



# Workshop manual

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# Foreword

## About the Workshop Manual

### General

Thank you for choosing Kalmar Industries as your machine supplier. We hope that we'll meet your expectations.

### Conditions

The instructions are based on the use of generally available standard tools. All lifting devices, for example, slings, straps, ratchet blocks, etc., must meet governing national standards and regulations for lifting devices.

Kalmar Industries will not accept any responsibility for modifications performed without permission from Kalmar Industries or if other lifting devices, tools or work methods are used other than those described in this manual.

### Storage

#### NOTE

*The Maintenance Manual should be accessible to the service personnel.*

### About the machine version

The information in this publication corresponds to the machine's design and appearance at the time of delivery from Kalmar Industries. Due to customizations, there may be variations and/or deviations.

Kalmar Industries reserves the right to modify specifications and equipment without prior notice. All information and data in this manual are valid at the time of publication.

### Copyright

#### Kalmar Industries AB

Duplication of the content in this manual, in whole or in part, is strictly prohibited without written permission from Kalmar Industries AB.

Duplication by any means such as copying, printing, etc., is prohibited.

## Reading instructions

### Warning information

Warnings inform on potential dangers which can, if the warnings are not heeded, result in personal injury or product damage.

#### **DANGER**

**Situation that may result in serious personal injury, possible death, if the instruction is not followed.**

#### **WARNING**

**Situation that may result in serious personal injury if the instruction is not followed.**

#### **CAUTION**

**Situation that may result in damage to the product if the instruction is not followed.**

### Important information

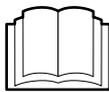
Important information marked with NOTE facilitates the work process, operation/handling or increases understanding of the information.

#### **NOTE**

*Information that is important without being safety related.*

### Read operator's manual

The symbol to the left is used in certain cases on the machine and refers to important information in the operator's manual.



Read the operator's manual

000262

### Read maintenance manual

The symbol to the left is used in certain cases on the machine and refers to important information in the maintenance manual.



Read the maintenance manual

001128

## Workshop manual contents

The Workshop manual contains information for corrective maintenance (component replacement) and is a supplement to the maintenance manual. Supplier documentation for engine, transmission, and drive axle belongs to the Workshop manual. In some cases, the Workshop manual refers to the supplier documentation to avoid doubled information. Methods for preventive maintenance and certain checks are found in the maintenance manual, no reference are made to these. Use the function groups to find the information in the maintenance manual.

The workshop manual is divided into the following sections.

A	Foreword	General information about the workshop manual's purpose, contents and reading instructions as well as survey for feedback of views and any inaccuracies.
B	Safety	Keep in mind for your safety.
C	Preventive maintenance	Reference to maintenance manual: Preventive maintenance.
0	Complete machine	<p>Technical description, comprehensive function descriptions and a description of the function of components included in the machine, divided into function groups.</p> <p>Under each sub-function there is a description of the components that are used for respective function. Therefore common components are described in several places, but generally under the first function that uses the component.</p> <p>Together with the general description there is a detailed description of that which is unique for that specific sub-function. For the next sub-function that uses the same component, only the unique for the new function is described.</p> <p>Work instructions for corrective maintenance (replacement of components).</p>
1	Engine	
2	Transmission	
3	Power transmission	
4	Brakes	
5	Steering	
6	Wheel suspension	
7	Load handling	
8	Control and monitoring system	
9	Frame, body, cab and accessories	
10	Common hydraulics	
11	Common electrical	
12	Common pneumatics	
D	Error codes	Error code information and instructions for reading error code information.
E	Diagrams	Wiring diagrams and hydraulic diagrams as well as list of electric components.
F	Technical data	Technical data, conversion tables, information for conversion of units.
G	Terminology and index	General terminology and abbreviations, explanations of terms and abbreviations that may appear in the sections, index register for headings in the manual.

## Function group structure

The information in the manual is divided in a structure of functions at different levels, based on the machine's design and use, called function groups.

The upper level (called main group) determines area, e.g., group 7 Load handling. The second level (called two-digit) determines function, e.g., 7.2 Lift and lower. The third and fourth levels are used to break down functions in smaller parts (components).

The function groups' structure for main group and two-digit group level are common for all machines from Kalmar Industries, e.g., 4.3 Servo brake system. Machine-unique adaptations of functions are done at the third and fourth group level, e.g., 4.3.9 Wheel brake and 4.3.9.1 Disc pack. This means that certain function groups (headings) will be left out in the documentation for certain machines since the machine is missing that specific function or component. In turn, this means that there may be skips in the function groups' numbering (e.g., the three-digit heading level 4.8.7 Oil cooler may be included for some machines, but is missing for others).

The function groups are intended to be used as search terms to find different types of information between different sections and manuals. The information in a function group is divided in smaller sections according to the type of content, e.g., description or change.

The maintenance manual and Workshop manual contain different information. The maintenance manual contains only the information needed for preventive maintenance and simpler troubleshooting. The Workshop manual contains more in-depth information and repair instructions.

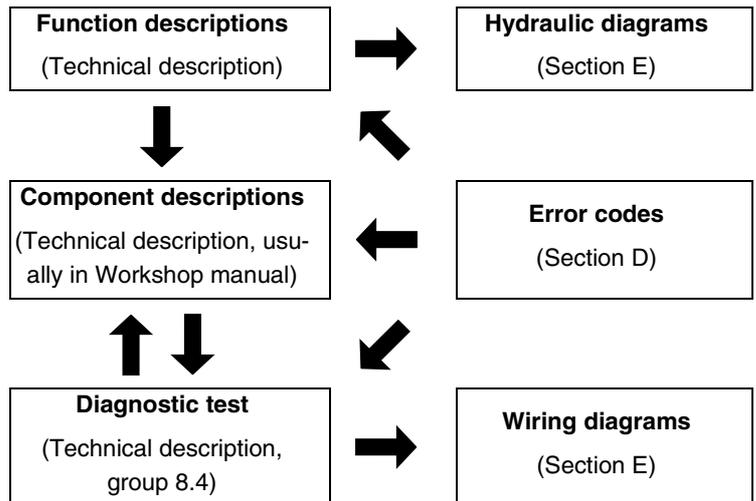
References between sections in the same manual are indicated with section and group number, e.g., see section 4 *Brakes*, group 4.3.9 *Wheel brake*". References within a section are indicated with page number, e.g., "see *Sensor fuel level, description page 24*".

References between Maintenance manual and Workshop manual are not given. If more information is desired for a function group, the primary recommendation is to search in the same function group in the other manual. For additional information about where different information types are found and which references are given, see *References between different information types page 7*.

## References between different information types

The Workshop manual and service manual are mainly divided into function groups, see *Workshop manual contents page 5*. Some parts are 'broken out' as separate parts to increase usability, e.g., "Technical data".

The basic rule of searching for information is to use function groups to find different types of information regarding the function or component in question. As a complement to this, there are references according to the below.



- From Function description to Component description, to enable fast finding of more information about the different components that create a function.
- From Function description to Hydraulic diagram, to enable fast finding of the right hydraulic diagram for the function in question.
- From Component description or Function description to Diagnostic test, to enable fast finding of the right diagnostic menu that can be used to check the component (only applies to electrical components).
- From Diagnostic test to Wiring diagrams. to enable fast finding of the right circuit diagram for further troubleshooting.
- From Diagnostic test to Component description or Function description. To enable fast finding of more information about the component's appearance and position when troubleshooting.
- From Error codes to Diagnostic test, to enable fast finding of the right diagnostic menu to troubleshoot component or function in question.
- From Error codes to Function description or Component description, to enable fast finding of more information about components or function.

## Product alternatives and optional equipment

The information in the manual is divided in modules. For product alternatives and optional equipment, handling of the modules differs depending on if it is the one or the other that is described, see below.

Special equipment is not described in the manual. When uncertain about the equipment with which the machine is provided, use the machine card to decide which information applies, see *Machine card page 9*.

### Product alternatives

Product alternatives are such options that exclude certain standard equipment (e.g., engine alternative).

Similar information for different product alternatives are described in separate sections following each other in the same function group. To show that there are different alternatives, the added text "Product alternative" is used in the heading, together with a simple description of which alternative is described, e.g., "(Product alternative Air conditioning ECC)". Further, alternatives that are optional equipment are marked with the symbol for optional equipment.

### Optional equipment

Optional equipment are options that can be added to the standard equipment to obtain additional or improved functions.

Information for optional equipment is described in separate sections with standard equipment as the starting point. The description of the optional equipment describes how the standard function is affected by the option as well as which components are added.



Symbol indicating optional equipment

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## Machine card

### NOTE

*If the machine has been modified after delivery the information on the machine card may be lacking or incorrect.*

The machine card indicates of which drawings the machine consists, in many cases these can be connected to options and product alternatives. For more information about handling of product alternatives and optional equipment, see *Product alternatives and optional equipment page 8*. The machine card is delivered with the parts catalogue.

The machine card is divided in the same functions groups as the parts catalogue, maintenance and Workshop manual. For practical reasons, the machine card uses only the first and second level in the function group register. The function groups are written in groups of four characters, e.g. group 0107 matches group 1.7 Cooling system in the manual.

For more information about how the machine card is used for ordering spare parts, see the parts catalogue's foreword.

If the information on the machine card does not help, contact Kalmar Industries AB.

### NOTE

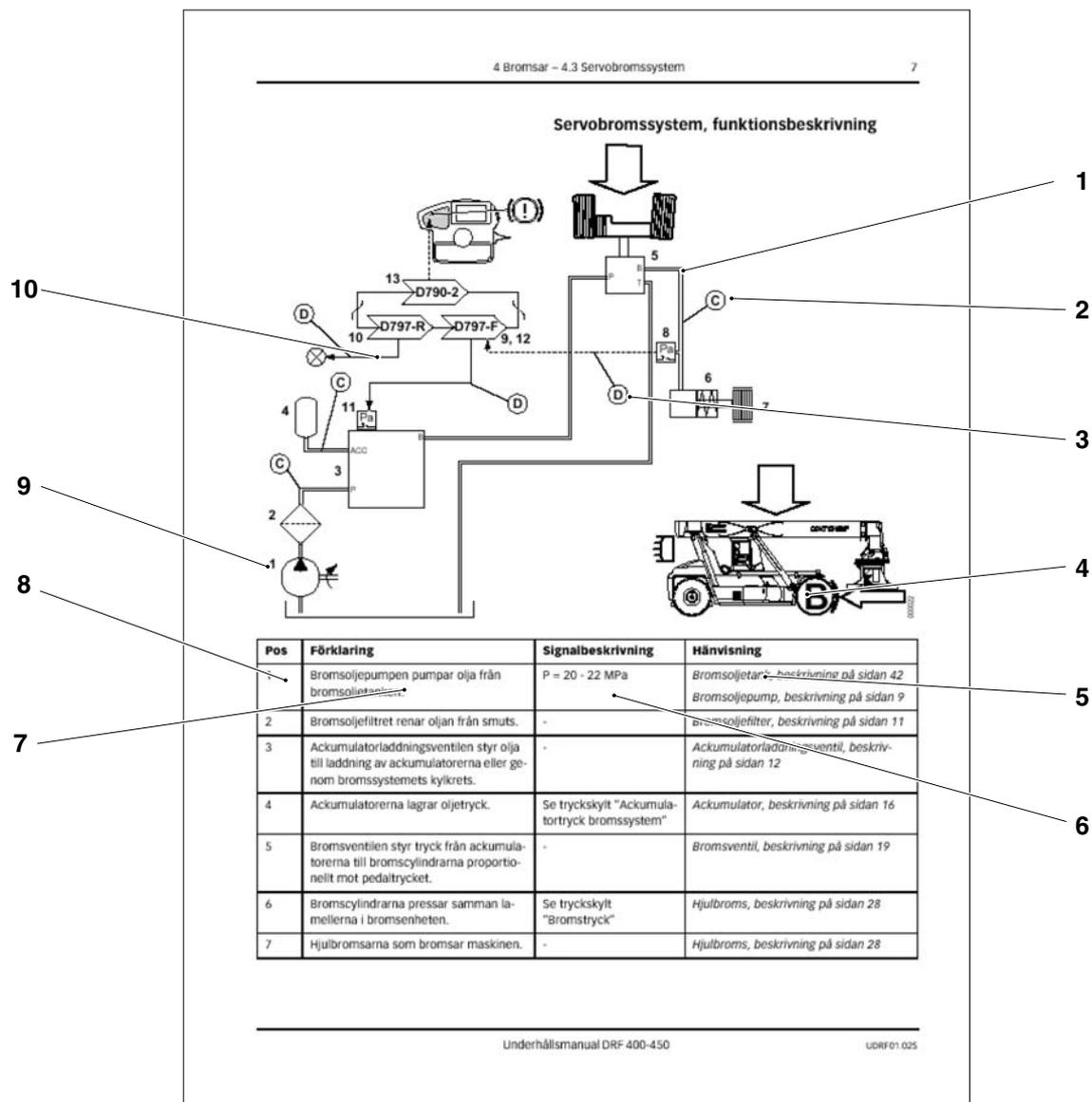
*All documents that accompany the machine are non-registered documents and there will be no notification of changes.*

## Function descriptions

Function descriptions are schematic overviews that describe how a function works as well as which components and signals work together.

Function descriptions describe the function in a logical flow from input signal to desired output signal. Most functions require that preset conditions are fulfilled for the function to be activated. In these cases, the conditions are listed above the illustration.

Function descriptions use symbols to illustrate components such as valves, sensors, etc.

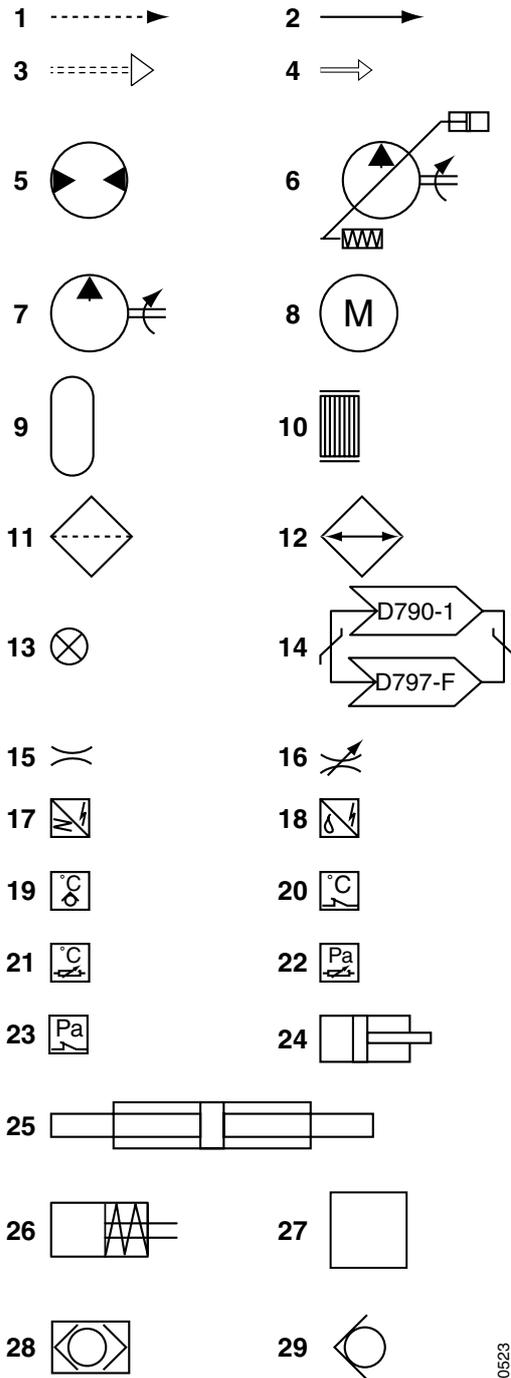


#### Example of function description

1. Hydraulic force (solid double line)
2. Flag pressure check connection (Check point), indicates that there is pressure check connection for checking pressure signal
3. Flag diagnostic test, indicates that signal can be checked with diagnostic test, see group "8.4 Diagnostics"
4. Illustration of function, (applied brake)
5. Reference to description of component
6. Signal description, reference value for signal out from component
7. Description of component's function
8. Position number, reference to position in illustration
9. Position number in illustration, reference to row in table
10. Electric power (solid single line)

**Symbol explanation function descriptions**

The following symbols are used in function descriptions, the symbols are based on standard symbols used in wiring and hydraulic diagrams.



1. Electric control signal
2. Electric force
3. Hydraulic control signal
4. Hydraulic force
5. Hydraulic motor
6. Hydraulic oil pump with variable displacement
7. Hydraulic oil pump with fixed displacement
8. Electric motor
9. Accumulator
10. Disc brake
11. Filter
12. Radiator
13. Bulb
14. Control and monitoring system, two control units with CAN bus
15. Restriction
16. Adjustable restriction
17. Inductive position sensor
18. Electrically controlled servo valve
19. Thermal by-pass valve
20. Temperature-controlled switch
21. Temperature sensor
22. Pressure sensor
23. Pressure-controlled switch
24. Hydraulic cylinder
25. Double-acting hydraulic cylinder
26. Spring brake cylinder
27. Valve block
28. Shuttle valve
29. Non-return valve

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## About the documentation

### Documentation sections

The documentation to the machine comprises the following sections:

#### Operator's manual

The Operator's manual is supplied with the machine in the cab.

#### Documentation kit

Maintenance manual and spare parts catalogue with machine card are supplied with the machine as a separate documentation kit.

#### Supplementary documentation

There are Supplementary documentation that can be ordered for the machine. in the form of a Workshop manual. The Workshop manual includes supplier documentation for engine, transmission and drive axle.

- Workshop manual.
- Supplier documentation for engine, transmission and drive axle.

#### Ordering of documentation

Extra issues and supplementary documentation can be ordered from Kalmar Industries' dealers.

### NOTE

*If possible, always indicate publication number when ordering.*

# Feedback

## Form for copying

Kalmar Industries' ambition is that you who work with maintenance of Kalmar machines shall have access to correct information.

Your feedback is important to be able to improve the information.

Copy this form, write down your views and send it to us. Thank you for your participation!

To:	<b>Kalmar Industries AB</b> <b>Product Support</b> <b>Torggatan 3</b> <b>SE-340 10 Lidhult</b> <b>SWEDEN</b> <b>Fax: +46 372 263 93</b>
From:	Company / Sender: .....  Telephone: .....  E-mail: .....  Date: ..... - ..... - .....
Manual information	Name / Publication number: .....  Section / page number: .....
Suggestions, views, remarks, etc.	..... ..... ..... ..... ..... .....



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# Safety

## General safety information

### Safety concerns everyone!

The safety information concerns everyone who works with the machine! Persons who do not follow the safety instructions given in this manual must make absolutely sure that the work is performed without risks of personal injury and without risk of damage to machine or machine property!

Remember to:

- follow the instructions in this manual
- be trained for the work in question
- follow local laws, safety rules and regulations
- use the correct equipment and tools for the job
- wear the correct clothes
- use common sense and work carefully. Do not take any risks!

Kalmar Industries has in this publication documented and warned for situations and risks that may occur in connection with using as well as service/repairs of the machine during normal circumstances.

That's why it's important that all who work with the machine, or repair/service the machine read and follow the information in Workshop manual and Operator's manual.

### A near-accident is a warning signal!

A near-accident is an unexpected event where neither persons, machine or property are injured or damaged. However, a near-accident indicates that there is an injury risk and actions must be taken to avoid the risk of injuries.

# Safety instructions

## General

Read, consider and follow the safety instructions below before starting to work in the machine:

- *Service position page 4*
- *Hydraulic and brake systems, depressurizing page 5*
- *Oils page 6*
- *Fuel system page 7*
- *Clothing etc. page 8*
- *Several mechanics on the same machine page 8*
- *Working under machine page 9*
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- *Solvents page 11*
- *Fire and explosion risks page 11*
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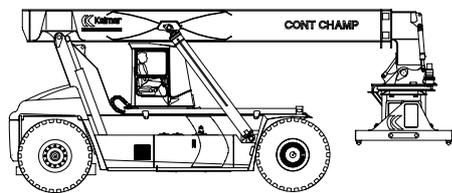
## Service position

### General

Service position is used for service, maintenance and other situations when the machine needs to be secured.

Service position means:

- Machine parked, that is, parking brake applied.
- Boom fully retracted and lowered to horizontal position.
- Engine off.
- Main electric power off (with battery disconnecter).



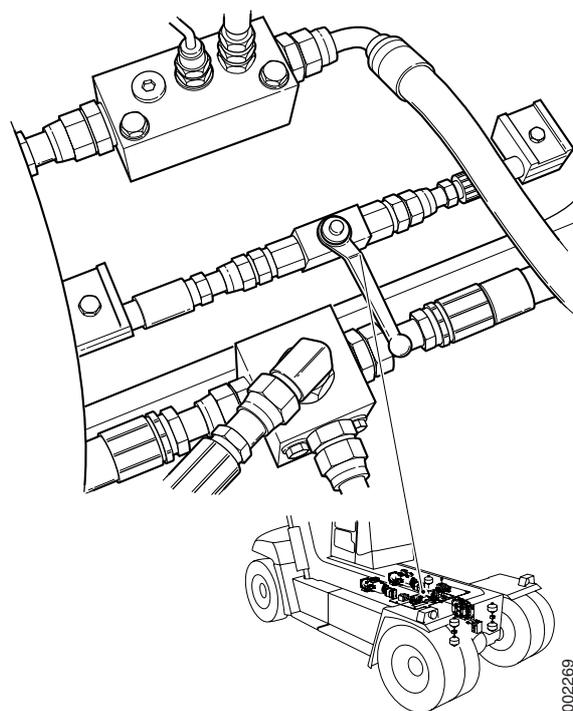
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Machine with fully retracted and lowered boom

## Hydraulic and brake systems, depressurizing

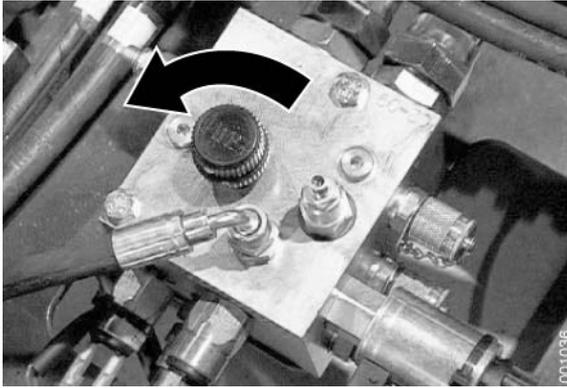


- 1 Machine in service position.
- 2 Depressurize the hydraulic system.  
Turn the start key to position I and activate extension out, a distinct hissing sound is heard if there is pressure in the hydraulic system. Activate lift, extension and sideshift several times.
- 3 Turn the start key to position 0 and turn off the main electric power.



- 4 Depressurize the attachment.  
Open the relief valve top lift.

The above illustration shows closed valve.



- 5 Depressurize the brake system by opening the drain valve on the accumulator charging valve.

## NOTE

*Keep the drain valve open as long as work is in progress.*

## Oils

The following safety instructions shall be followed for work when handling oils.



## WARNING

**Warm and pressurized oil.**

**Always depressurize hydraulic and brake systems completely before starting to work in the systems. Hydraulic and brake systems are pressurized and the oil may cause personal injuries.**

**Avoid skin contact with the oil, use protective gloves. Warm oil can cause burn injuries, rashes and irritation! The oil may also be corrosive to mucous membranes in, e.g., the eyes, skin and throat.**

## IMPORTANT

**Always clean the area around components and connections before they are loosened. Dirt in oil systems causes increased wear, resulting in subsequent material damages.**

**Always take action to avoid spills. In places where drain containers cannot be used, use a pump or hose for safe handling.**

**Always check that plugs seal tight before collection containers are moved.**

**Handle all oil as environmentally hazardous waste. Oils freely released cause damage to the environment and may also cause fires. Waste oils/fluids shall always be handled by an authorized company.**

## Fuel system

The following safety instructions shall be followed for work when handling fuel.



### DANGER

**Pay attention to the risk of fire when working on the fuel system.**

**Work on the fuel system shall be avoided when the engine is warm since fuel can spill on hot surfaces and may ignite.**



### WARNING

**Use protective gloves and protective goggles. If a component is to be disconnected, hold a rag over the connection as protection and to collect fuel. The engine's fuel system operates at very high pressure. The pressure is so high that the jet can injure the skin, resulting in severe injuries. Risk of personal injuries.**

**Avoid skin contact with fuel, use protective gloves. Fuel is corrosive to mucous membranes in, e.g., eyes, skin and throat.**



### CAUTION

**Always clean the area around components and connections before they are loosened. Dirt in the fuel may cause malfunctions and engine stop in undesirable situations as well as increase wear, resulting in subsequent material damages.**

## IMPORTANT

**Always take action to avoid spills. In places where drain containers cannot be used, use a pump or hose for safe handling.**

**Always check that plugs and connections seal tight before moving collection containers.**

**Handle the fuel as environmentally hazardous waste. Fuel freely released causes damage to the environment and may also cause fires. Fuel shall always be handled by an authorized company.**

### **Clothing etc.**

Clothes should be in good condition. Remove loosely hanging clothing (tie, scarf, etc.). Do not wear clothes with wide sleeves, wide trouser legs, etc.

Remove jewelry as it may conduct electricity and get caught in moving parts.

Long hair must be tied up securely, otherwise it may easily get caught in moving parts. Be careful when performing welding work or work requiring open flames since hair catches fire easily.

### **Several mechanics on the same machine**



## WARNING

**Be extra careful if several mechanics work on the same vehicle, so that unintentional movements do not injure another person. Communicate so that everyone knows where all are and what they are doing.**

### **Risks**

Work with wheels or axle suspension, mountings, etc. may result in components on the other side moving and causing damage/injury.

Movements performed from the operator's station, e.g., movement of lifting equipment, may cause severe personal injuries.

### Safety actions

- Make sure that the machine's lifting equipment is completely lowered or secured in another way.
- Move battery disconnecter to position zero, remove the key.
- Be aware of the risks when several persons work around the vehicle.
- Make your co-workers aware of what you're working with.
- Do not work with drive wheels on the machine's both sides at the same time.

### Working under machine

#### Working under cab

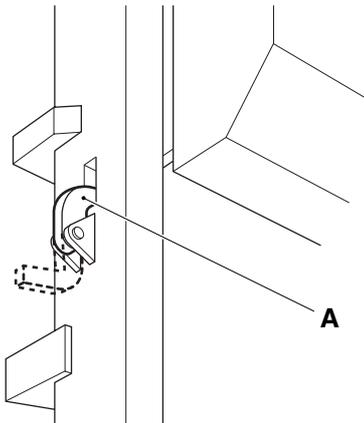
On machines with cab lift the machine shall be secured in raised position with the intended locks.

#### Working under chassis

A lifted/raised vehicle may under no circumstances be supported or lifted in parts that belong to the wheel suspension or steering. Always support under the frame or wheel axle.

#### Risks

Mechanical or hydraulic tools and lifting devices can fall over or accidentally be lowered due to malfunctions or incorrect use.



001977

Lock on lift frame for securing cab in raised position.

#### Safety actions

Use axle stands and supports that stand securely.

Lifting tools should be inspected and type approved for use.

### Lifting heavy components



## WARNING

**Careless handling of heavy components can lead to serious personal injury and material damage.**

**Use type approved lifting tools or other devices to move heavy components. Make sure that the device is stable and intact.**

#### Risks

Unsuitable lift slings, straps, etc. may break or slip.

The centre of gravity (balance point) of the component can change during the course of the work, and the component may then make unexpected movements which may cause severe personal injuries and material damage.

A component lifted with lifting equipment can start to turn if the equilibrium is upset.

A component lifted using an overhead crane may start to swing back and forth, which can cause severe crushing injuries or material damage.

### **Safety precautions**

**Lift using a lifting device.** Use lifting tools or equipment, especially when such equipment is available for specific work operations. See the workshop manual for methods.

#### **If lifting must be performed without lifting device:**

- Lift near the body.
- Keep your back vertical. Raise and lower with legs and arms, do not bend your back. Do not rotate your body while lifting. Ask for assistance in advance.
- Wear gloves. They're good protection against minor crushing injuries and cuts to fingers.
- Always use protective shoes.

### **Vibrations**

In case of long-term use of vibrating tools, for example, impact nut runners or grinders, injuries may be sustained as vibrations can be transmitted from tools to hands. Especially when fingers are cold.

### **Safety actions**

Use heavy gloves to protect against cold and somewhat against vibrations.

Switch between work duties to give the body time to rest.

Vary work position and grip so that the body is not stressed in only one position by the vibrations.

### **Noise**

Noise louder than 85 dB (A) that lasts for longer than 8 hours is considered harmful to hearing. (Limit values may vary between different countries.) High tones (high frequencies) are more damaging than low tones at the same sound level. Impact noise can also be hazardous, e.g. hammer blows.

### **Risks**

At noise levels higher than the limits hearing damage can occur. In more severe cases, hearing damage can become permanent.

### **Safety precautions**

Use hearing protection. Make sure that it is tested and protects against the noise level in question.

Limit noise with noise-absorbing dividers, for example, noise-absorbing materials in roof and on walls.

## Solvents

Fluids that (as opposed to water) dissolve grease, paint, lacquer, wax, oil, adhesive, rubber, etc. are called organic solvents. Examples: White (petroleum) spirits, gasoline, thinner, alcohols, diesel, xylene, trichloroethylene, toluene. Many solvents are flammable and constitute a fire hazard.

### Risks

Products containing solvents produce vapors that can cause dizziness, headaches and nausea. They may also irritate mucous membranes in the throat and respiratory tracts.

If the solvent comes into direct contact with the skin, this may cause drying and cracking. Risk for skin allergies increases. Solvents may also cause injury if they penetrate through the skin and are absorbed by the blood.

If the body is continuously exposed to solvents, the nervous system may be damaged. Symptoms include sleep disorders, depressions, nervousness, poor memory or general tiredness and fatigue. Continuous inhalation of gasoline and diesel fumes is suspected to cause cancer.

### Safety precautions

Avoid inhaling solvent fumes by providing good ventilation, or wearing a fresh-air mask or respiratory device with a suitable filter for the toxic gases.

Never leave a solvent container without tight-sealing lid.

Use solvents with low content of aromatic substances. This reduces the risk of injuries.

Avoid skin contact.

Use protective gloves.

Make sure that work clothes are solvent-resistant.

## Fire and explosion risks

Examples of explosion-prone substances are oils, petrol, diesel fuel, organic solvents (lacquer, plastic, cleaning agents), rustproofing agents, welding gas, gas for heating (acetylene), high concentration of dust particles of combustible materials. Rubber tyres are highly flammable and cause fires that spread explosively.

### Risks

Examples of causes of ignition include welding, cutting, smoking, sparks produced by grinding, inflammable materials coming into contact with hot machine parts, the generation of heat in rags saturated with oil or paint (linseed oil) and oxygen. Oxygen cylinders, lines and valves must be kept free from oil and grease.

Fumes from gasoline, for example, are heavier than air and can thus “run down” a sloping grade, or down into a grease pit, where welding flames, grinding sparks or a burning cigarette can cause an explosion. Evaporated gasoline has a very powerful explosive force.

**Special cases**

Diesel fuel oil with an additive of petrol has a reduced flash point. Explosion risk even at room temperature. The explosion risk due to warmed diesel fuel oil is greater than for gasoline.

When changing oil in the engine, hydraulic system and transmission, keep in mind that the oil may be hot and can cause burn injuries.

Welding on or near the machine. If diesel or other oils have leaked out and have been absorbed by rags, absorbing agent, paper or other porous material, glowing welding sparks can cause ignition and an explosive spread of fire.

When a battery is being charged, the battery electrolyte water is divided into oxygen and hydrogen gas. This mixture is very explosive. The risk of explosion is especially high when a booster battery or a rapid-charge unit is used, as these increase the risk of sparks.

The machines nowadays contain a lot of electronic equipment. During welding work, the control units must be disconnected and current turned off using the battery disconnect switch. Otherwise, strong welding currents can short-circuit the electronics, destroy expensive equipment, and may also cause an explosion or fire.

Welding work must never be carried out on painted surfaces (remove paint by blasting at least 10 cm around the welding or cutting point.) Use gloves, breathing protection and protective safety glasses. Also, welding work must never take place near plastic or rubber materials without first protecting them from the heat. Paints, plastics and rubber generate various substances when heated that may be hazardous to health. Be careful with machines that have been exposed to intense heat or a fire.

**Safety precautions**

Store hazardous substance in approved and sealed container.

Make sure that there is no ignition source near flammable or explosive substances.

Make sure that ventilation is adequate or there is an air extraction unit when handling flammable substances.

**Fluid or gas under pressure**

Lines with high pressure may be damaged during work and fluid or gas may jet out.

There may be high pressure in a line even if the pump has stopped, therefore gas or fluid may leak out when the connection for the hose is loosened.

A gas container that is subjected to external forces may explode, e.g., if it falls against a hard surface. Gas may jet out from damaged valves.

### Risks

Risk of damage/injuries in connection with work on:

- Hydraulic systems (e.g., working hydraulics and brake system).
- Fuel system.
- Tire change.
- Climate control unit (air conditioning).

### Safety actions

- Use protective goggles and protective gloves.
- Never work in a pressurized system.
- Never adjust a pressure limiting valve to a higher pressure than the manufacturer's recommendations.
- A hydraulic hose that swells at a connection shows that it is about to rupture. Change as soon as possible! Check the connections carefully.
- Use fluid when checking for leaks.
- Never blow clothes clean with compressed air.
- Discarded pressure accumulator shall first be depressurized and then punctured before it is discarded (to avoid risk of explosion). Carefully, drill a hole with 3 mm diameter after depressurizing.
- Never use your hands to check for any leaks. A fine jet from a hydraulic hose may have such high pressure that it easily cuts through, e.g., a hand and causes very severe injuries.

### Coolant

The coolant in the machine's cooling system consists of water, anti-corrosion compound and (when needed) anti-freeze fluid, for example, ethylene glycol.

Coolant must not be drained into the sewer system or directly onto the ground.

### Risks

The cooling system operates at high pressure when the engine is warm. Hot coolant can jet out and cause scalding in case of a leak or when the expansion tank cap (filler cap) is opened.

Ingesting ethylene glycol and anti-corrosion compound is dangerous and hazardous to health.

### Safety precautions

- Use protective gloves and safety glasses if there is a risk of splashing or spraying.
- Open the filler cap first, to release the excess pressure. Open carefully. Hot steam and coolant can stream out.
- If possible, avoid working on the cooling system when the coolant is hot.

## Refrigerant

Refrigerant is used in the machine's air conditioning system.

Work on the air conditioning system must be performed by accredited/authorised and trained personnel according to national legislation and local regulations.

### Risks

The air conditioning operates at high pressure. Escaping refrigerant can cause frostbite.

Refrigerant that is heated (e.g., when repairing leaking climate/AC system), generates gases that are very dangerous to inhale.

### Safety actions

- Use special instructions and equipment for refrigerant according to the manual when working on the air conditioning system. Special certification and authorization is often required of the person who may do the work. (Note national legislation and local regulations!)
- Use protective gloves and safety glasses if there's a risk of leaks.
- Make sure that heat-producing sources or objects are not close by (cigarette glow, welding flame).

## Air pollution

Air pollution is the impurities in the air around us and which are regarded as hazardous to health. Certain pollution is more prominent in certain environments.

The following health-hazardous air pollution is especially prominent in workshops:

- **Carbon monoxide (fumes)** is present in exhaust fumes. Odorless and therefore especially dangerous.
- **Nitrogen oxides (nitrous gases)** are present in exhaust fumes.
- **Welding smoke** especially hazardous to health when welding on oily surfaces, galvanized or lacquered materials.
- **Oil mist** for example, when applying anti-corrosion agent.
- **Grinding dust and gases** generated when grinding and heating plastics, lacquer, anti-corrosion agents, lubricants, paint, etc.
- **Isocyanates** are present in certain paints, fillers, adhesives and foam plastics used on machines.

### Risks

Sulfuric acid mist is corrosive and injures the respiratory tracts. (Generated when heating certain plastics and paints.)

Isocyanates can be released in the form of steam, dust (or may be present in aerosols) when cutting, grinding or welding. Can irritate mucous membranes producing symptoms similar to asthma and impairing lung function. Even brief exposure to high concentrations can give problems with persistent high sensitivity.

### **Safety precautions**

- Make sure of adequate ventilation with fresh air when welding, battery charging and other work when hazardous gases are generated.
- Use suitable gloves and breathing protection when there's a risk of oil mist. Make sure that protective gear is oil-resistant.
- Apply oil-resistant protective lotion to unprotected skin.
- Make sure that an eye-wash station is in the immediate vicinity when working with corrosive substances.
- Avoid unnecessary operation of the machine inside the workshop. Connect an air extractor to the exhaust pipe so that the exhaust fumes are removed from the workshop.

### **Tensioned springs**

Examples of tensioned springs:

1. Torque springs in pedals for example.
2. Return spring (cup springs) in parking brake cylinder.
3. Lock rings
4. Gas springs

### **Risks**

If a tensioned spring releases, it is shot out by the spring force and can also take adjoining parts with it.

Small springs can cause eye injuries.

Parking brake springs are tensioned with high force and can cause very severe accidents if they are accidentally released in an uncontrolled manner.

Gas springs and gas-charged shock absorbers are tensioned with high force and can cause very severe accidents if they are accidentally released in an uncontrolled manner.

### **Safety precautions**

- Use safety glasses.
- Lock rings should be of a suitable type and in good condition.
- Follow the instructions in this and other manual when performing maintenance and changing parts and components.
- Always use recommended tools.

### **Electric motors**

#### **Safety actions**

Always turn off the battery disconnecter when working on electric motors.

Always block the machine's wheels, make sure that the parking brake is activated and that the gear selector is in neutral position before starting any work on the machine.

## **Rotating components and tools**

Examples of rotating components and tools:

- Cooling fan
- Drive belts
- Propeller shafts
- Drills
- Grinders

### **Risks**

Rotating components, for example, fans or shafts, can cause severe injuries if touched.

Drills, lathes, grinders or other machines with rotating parts can cause severe accidents if clothes or hair get caught and are wound up in the machine.

### **Safety precautions**

- Do not use gloves when working with a drill.
- Remove loose, hanging clothing, scarf or tie.
- Never use clothing with wide sleeves or trouser legs.
- Make sure that clothing is intact and in good condition.
- Long hair should be gathered up in a hair-net or similar.
- Remove large or loose hanging jewelry from hands, arms and neck.

## Tyre system



### DANGER

**Tires shall be regarded as pressure reservoirs. If handled incorrectly, they constitute a fatal danger**

**Parts can be thrown with explosive force and may cause severe injuries.**

**Never repair damaged tires, rims or lock rings. Tire changes shall be performed by authorized personnel.**

### Risks

Dismantling of wheels: Tires, rims and lock rings may be ejected.

Inflating of wheels: Tires, rims or lock rings may be ejected.

### Safety actions

- Deflate the tire before starting to work on the wheel.
- Check that tires, rims and lock rings are not damaged. Never repair damaged rims or lock rings.
- Wheels shall be inflated on the machine or in a protective device, designed and dimensioned so that it can handle or dissipate a shock wave from a tire explosion as well as catch the ejected parts.
- Use protective screen and safety glasses.

## Lifting equipment

When working on the machine in general, and with the machine's lifting equipment in particular, extreme caution must be exercised regarding securing the boom and attachment.

Therefore, make it a habit to always have the boom fully lowered and completely retracted when working on the machine.

### Risks

Risk of crushing if the machine's lifting equipment is not lowered or secured.

Risk of crushing is very high when the hydraulic system is being depressurized, see *Hydraulic and brake systems, depressurizing page 5*.

### Safety actions

- Do not start work before the boom is lowered and completely retracted, if possible.

## Environment

### General

Our global environment is severely affected by the world's increasing industrialization. Nature, animals, and man are exposed daily to great risks in connection with handling of chemicals in different forms.

There are still no completely environment-friendly chemicals such as oils, and coolants on the market. That's why all who handle, perform service on, or repair machines use the necessary tools and methods needed to care for the environment in an environmentally correct manner.

By following the simple rules below you contribute to caring for our environment:

### Recycling

Well-thought out recycling of the machine is the cornerstone of ending its life cycle and being able to reuse materials in new products. According to calculations by Kalmar Industries, the machine can be recycled to more than 90% by weight.

### Environmentally hazardous waste

Components such as batteries, plastics, and other materials that may be considered as environmentally hazardous waste must be handled in an environmentally correct manner.

Discarded batteries contain substances that are hazardous to health and the environment, and these must be handled in an environmentally safe manner according to national regulations.

### Oils and fluids

Oils freely released into the environment cause environmental damage and may also cause fires. When emptying and draining oils or fuel, take actions to avoid unnecessary spills.

Waste oils and fluids shall always be handled and taken care of by an authorized company.

Watch for leaks of oils and other fluids. Take action to seal the leak immediately.

### Air conditioning unit

The refrigerant in the air conditioning unit for the cab contributes to the greenhouse effect and may not be intentionally released into the open air. Special training is required for all service work on the air conditioning unit. Many countries demand certification by a governing authority for such work.

### Work in a contaminated area

The machine shall be equipped for work within a contaminated area (environmental contamination or health-hazardous area) before work is started. Also, special local regulations apply to such handling and to service work on such a machine.

**Declarations**

The machine does not contain asbestos.

The machine contains lead in batteries and electric cabling. Some models have counterweights of cast lead.

If the machine is equipped with air conditioning, then refrigerant of the type R134a is used, in an amount between 1-3 kg.



# Preventive maintenance

## The information is found in the Maintenance manual

The information is found in the Maintenance manual.

For information on how to order Maintenance manual, see tab *A Foreword*.



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# Complete machine

## Complete machine, description

Kalmar DRF 400–450 is a “Reachstacker” for container handling. The machine has a lift capacity of 40–45 tons depending on version.

The power source is a six cylinder four-stroke direct-injected diesel engine.

The transmission is hydromechanical with gear wheels constantly meshed. It has four forward gears and four reverse gears. Engine power is transferred using a torque converter.

The power transmission consists of one propeller shaft and rigid drive axle with hub reduction. Drive takes place on the front wheels.

The service brake is of wet disc type, built together with drive wheel hubs. The parking brake is of dry disc type and acts on the drive axle input shaft.

Steering takes place on the rear wheels with a double-acting hydraulic cylinder. The steering axle is oscillation-mounted in the frame.

The wheels are mounted on the hubs with clamps. The drive axle has twin wheels, the steering axle single wheels.

Load handling are components and functions for handling loads. Loads are lifted with an attachment located on a liftable telescopic boom. Load handling is divided into the functions lift and lower, extension, sideshift, spreading, rotation, tilt, levelling and load carrying.

- Lift and lower is the function to lift and lower the boom.
- Extension is the function to push out and retract the boom.
- Sideshift is to move the attachment sideways in relation to the machine.
- Spreading is to adjust the width between the attachment's lifting points.
- Rotation is to rotate the load in relation to the machine.
- Tilt is to angle the load in the machine's longitudinal direction.
- Levelling is to angle the load in the machine's side direction.
- Load carrying is to hold the load.

The control and monitoring systems are functions for warning the operator of dangerous situations and machine malfunctions. The control and monitoring system has diagnostic resources that simplify troubleshooting.

The frame supports the machine. The engine, transmission, drive axle and steering axle are mounted in the frame. On the frame's sides there are tanks for fuel, hydraulic oils and oil for brake system. The cab is positioned centrally and can be moved fore-aft. As an option, there is a side-mounted cab with a cab lift/lower function.

## Troubleshooting, general work instructions

When troubleshooting, it's important that the work is structured and logical. The point of the troubleshooting described in the maintenance manual is to exclude components as error source so that the real error source can be pin-pointed. A proposal for structured work method is described below.

When troubleshooting, it's important to understand how the machine functions, certain malfunctions can be pin-pointed directly using function descriptions. In the sections 0–12 there are descriptions of the machine's different functions.

### Troubleshooting procedure

- 1 Check that there is battery voltage available.
  - Battery disconnect switch, must be in position 1.
  - Battery voltage, should be 22–30 V.
  - Fuses, check that they are intact.
- 2 Check that all oil and fluid levels are normal.
  - Fuel
  - Engine oil
  - Transmission oil
  - Oil for brake system
  - Hydraulic oil
  - Coolant
  - Washer fluid
- 3 Check if there are error codes.
- 4 If there are error codes, use the error code lists as a guide. See *Troubleshooting with error code, example page 5*.

In the error code lists there are recommended actions for every error code. Error code lists are found in section *D Error codes*.
- 5 If there is no error code, or problem remains, use the function description for function in question in section 0–12.

In the function description there's information about which components are involved in the function and how these components work together. In certain cases, there's information about which conditions apply to enable activation of the function. Measuring points are marked with flags (C for pressure check connections, D for diagnostic menu).

---

## Troubleshooting without an error code, example

- 1 Choose suitable section 0–12 to find the function and sub-function that have caused the symptom.
- 2 Read function description for the function in question to get an overall understanding of which components are affected and how these interact
- 3 Use the function description and check the signals for the function in question to find where in the function chain that signal or reaction is incorrect.
- 4 The fault is probably between the two units where the signal is failing. Start by checking the component that should send the signal.
- 5 If the component that is to send the signal seems to be correct, check transmission of the signal (electric wiring or hydraulic hoses).  
For electric cabling, see *Troubleshooting cable harness page 7*.  
For hydraulic hoses, see *Troubleshooting hydraulic hoses page 8*.
- 6 If the leads or hoses between the components seem in order, then check the component that receives the signal.

## Troubleshooting with error code, example

Error codes are strong indicators of malfunctions detected by the control system. Many error codes are connected to electrical malfunctions but there are also error codes that interpret associations between one or several signals that indicate a non-electrical malfunction. It's important to not draw conclusions too fast based on an error code.

- 1 Read out error code from the display, e.g., error code 34.
- 2 Use the error code lists and search information about the error code, see "Example of error code information in error code list" below.  
Error code lists are found in section *D Error codes*.  
For detailed instruction on reading out error code, see tab *D Error codes*.
- 3 Follow instructions in field "Action".
- 4 Use diagnostic menus and circuit diagrams to determine if the input signal to the control unit is correct, see section *8 Control system*, group *8.4 Diagnostics* as well as section *E Diagrams*.
- 5 Use the function group to find more information if needed.  
In section 0–12 there is function description, the function's included components and their position as well as, in certain cases, work instructions for how components are checked, cleaned or adjusted.

- 6 If possible eliminate component fault by testing the component individually.

Electric components can sometimes be checked with resistance measurements using a multimeter.

Hydraulic components are often checked by measuring pressure (then described in the function group and indicated in the section *C Preventive maintenance*). Sometimes valves can be activated mechanically to determine if the malfunction is electric or hydraulic.

- 7 If the component's measuring values are correct, continue by troubleshooting electric cabling and hydraulic hoses.

For electric cabling, see *Troubleshooting cable harness page 7*.

For hydraulic hoses, see *Troubleshooting hydraulic hoses page 8*.

- 8 If the cable is not defective then connect the lead to the control unit.

## NOTE

*The main electric power shall be turned off with the battery disconnecter!*

- 9 Disconnect the cable harness from the component in question.  
 10 Turn on the main electric power with the battery disconnecter.  
 11 Turn the ignition key to the operating position.  
 12 Check that voltage reaches the component.

Table 1. Example of error code information in error code list

Code	Description	Limit	Action	Con- tion and component	Diag- nostic menu	Function group
34	Signal error from switch parking brake, indicates released and applied at same time or nothing at all.	Parking brake cannot be re-leased.	Use diagnostic menu to check cable be-tween control unit and component.  Check component.	D791-1/K8:5 - S107, K8:13 - S107	HYD, menu 5	4.1.2 Parking brake control

---

## Troubleshooting cable harness

### NOTE

*Perform troubleshooting for all cables in the same way to avoid damage to control units, components or measuring equipment.*

- 1 Study the circuit diagram in question, check where the suspected cable is connected and if, and if so where, it is spliced.
- 2 Turn off the main electric power with the battery disconnecter.
- 3 Unplug the connector at the control unit or component in question.
- 4 Check if there is open circuit.

### NOTE

*Some components cannot be checked without power supply to the component. In such an event, proceed to point 5.*

- a. Measure resistance between connections for the component in the connector at the control unit or component.
  - b. The resistance must correspond with the component. Otherwise there may be an open circuit or short circuit in cable harness and/or component.
- 5 Check if there is short circuit to frame:
    - a. Unplug the connector both at the control unit and component in question.
    - b. Measure the resistance of one lead at a time. Measure between the lead and a frame-connected part of the machine.
    - c. The multimeter should show endless resistance.

## Troubleshooting hydraulic hoses



### WARNING

**Oil under high pressure!**

**Personal injury!**

**Always depressurize hydraulic and brake systems before starting to work on the systems.**

- 1 Depressurize the hydraulic and brake systems, see tab *B Safety*.
- 2 Study the relevant hydraulic diagram, check between whichever components the suspect hose is connected and correspondingly where it is spliced.
- 3 Locate the hose on the machine.  
Start at one component and follow the hose to the next component.
- 4 Inspect the entire hose and splicing points with respect to chafing damage, pinching damage and leaks.  
Change damaged hoses. When removing a hydraulic hose, change of O-ring is always recommended on the hoses that have these (ORFS).

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# 1 Engine

## Engine, general

### Engine alternative

The machine can be equipped with one of the following engine alternatives:

- Volvo TWD1240VE (step II according to directive 97/68/EG)
- Volvo TAD1250VE (step III according to directive 97/68/EG)
- Cummins QSM11 (step III according to directive 97/68/EG)

In case there are differences between the engine alternatives, this is written in brackets after headings or under figures to clarify that which is shown.

Volvo-engines have many similarities. Descriptions and instructions that are the same for both engine alternatives are designated "(engine alternative Volvo)". If a description or instruction only applies to one engine alternative, then the whole engine designation is written out, e.g., "(engine alternative Volvo TAD1250VE)"

### Supplier documentation

The Workshop manual only describes components and work descriptions that concern installation in the machine. For descriptions and instructions for the engine's components and systems, refer to supplier documentation.

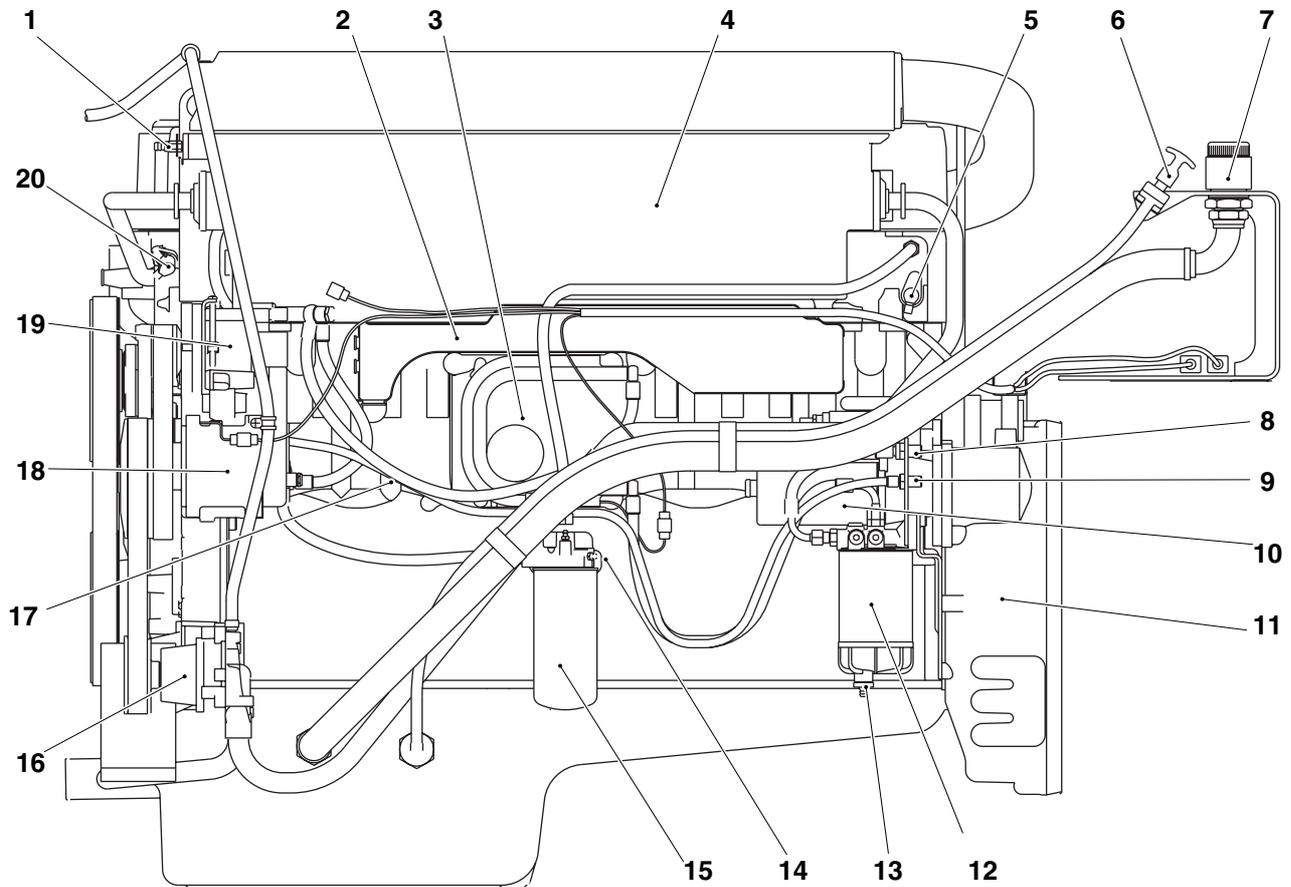
References to supplier documentation are only used in exceptional cases. If information about a component is missing, use the supplier documentation.



Pos	Explanation	Signal description	Reference
5	The ignition sends a voltage signal to Control unit KIT (D790-2) when the start key is turned to the start position.	U = 24 V	<i>Ignition, description page 20</i> D5: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.4 <i>ENGINE</i> , menu 4
6	Control unit KIT (D790-2) sends start signal on the CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.11 <i>Control unit KIT</i>
7	Control unit engine (D794) feeds voltage to starter motor.	U = 24 V	<i>Starter motor, description (engine alternative Volvo) page 34</i> D7: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.5 <i>ENGINE</i> , menu 5
8	Starter motor rotates engine	-	<i>Starter motor, description (engine alternative Volvo) page 34</i> D7: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.6.5 <i>ENGINE</i> , menu 5
9	The engine's sensors send signals to Control unit engine (D794) which controls the injectors so that the engine starts.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.10 <i>Control unit engine</i>
10	The accelerator pedal sends a voltage signal proportional to the depression to Control unit cab (D790-1).	U = 0.5–4.5 V Lower voltage than 0.5 V and higher voltage than 4.5 V used to detect malfunction in cable harnesses and controls.	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i> D10: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.6.1 <i>ENGINE</i> , menu 1
11	Control unit cab (D790-1) sends a message with the engine speed request on the CAN bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
12	Control unit engine (D794) increases the engine speed.	-	Tab 11 <i>Common electric</i> , group 11.5.3.10 <i>Control unit engine</i>
13	Make-contact (closing switch) coolant level sends a voltage signal to Control unit engine (D794) if the coolant level in the expansion tank is low.	U = 24 V	<i>Cooling system, description page 25</i>

<b>Pos</b>	<b>Explanation</b>	<b>Signal description</b>	<b>Reference</b>
14	Control unit engine (D794) sends engine data and warning messages on the CAN bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.10 <i>Control unit engine</i> D14: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.6.6 <i>ENGINE</i> , menu 6 and 8.4.6.7 <i>ENGINE</i> , menu 7
15	Control unit KID (D795) shows engine data via display images.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>
16	Sensor fuel level (B757) sends a voltage signal proportional to the fuel level in the tank to Control unit frame rear (D797-R).	U = 0.5–4.5 V Lower voltage than 0.5 V and higher voltage than 4.5 V used to detect malfunction in cable harnesses and controls.	<i>Sensor fuel level</i> , description page 22 D16: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.3.7 <i>CAB</i> , menu 7
17	Control unit frame rear (D797-R) sends fuel level on the CAN-bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i>
18	Control unit KID (D795) shows fuel level in operating menu for engine.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>
19	Sensor output shaft, (B758) sends pulses at a frequency proportional to the speed of the output shaft to Control unit transmission (D793).	-	D19: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.6 <i>TRANSM</i> , menu 6
20	Control unit transmission (D793) sends speed on the CAN-bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.9 <i>Control unit transmission</i>
21	Control unit KID (D795) shows the machine's speed.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>
22	If the rpm on the output shaft is so high that it matches the limit for the machine's speed limitation, then Control unit cab (D790-1) sends reduce engine rpm on the CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
23	Control unit engine (D794) limits engine speed.	-	Tab 11 <i>Common electric</i> , group 11.5.3.10 <i>Control unit engine</i>

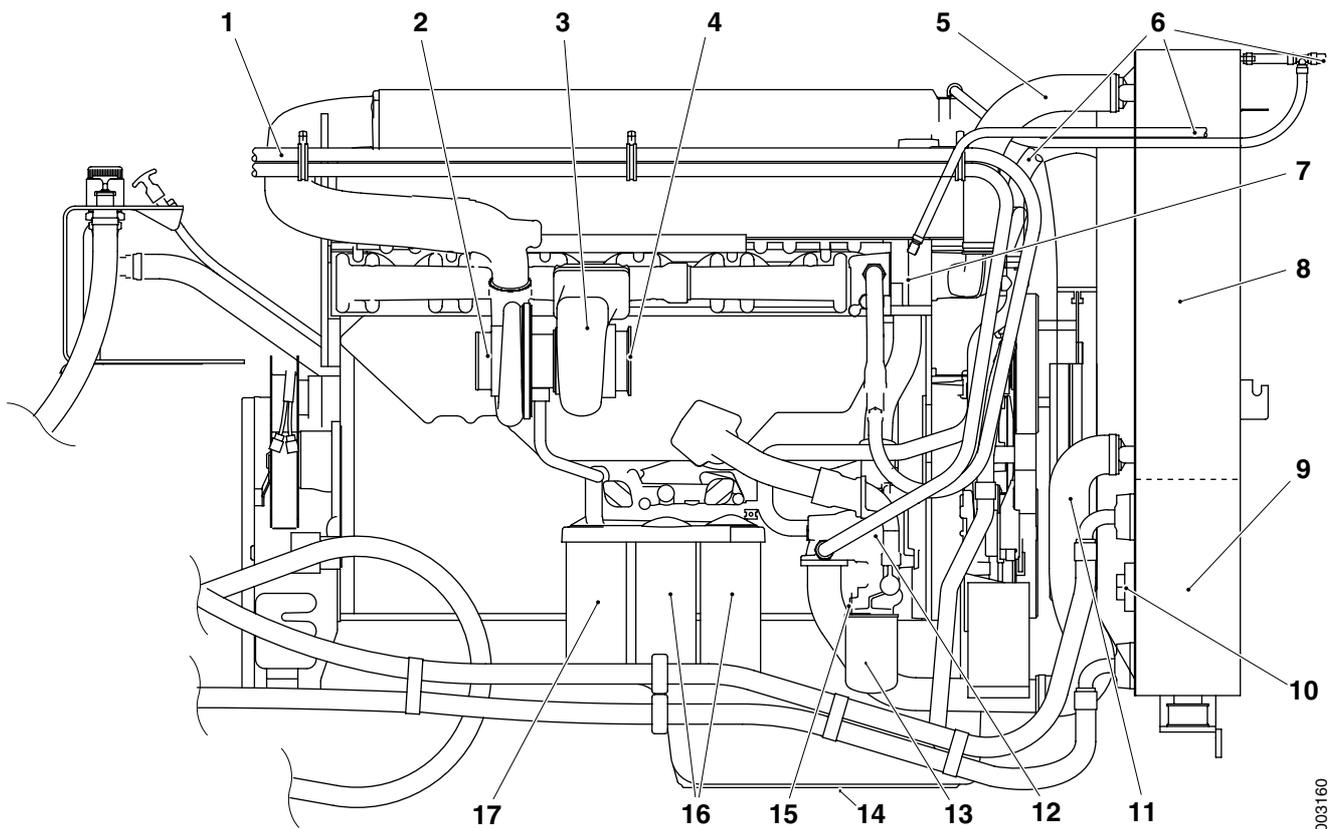
## Engine alternative Volvo TWD1240VE, component position



Engine alternative Volvo TWD1240VE, right side (in machine's travel direction)

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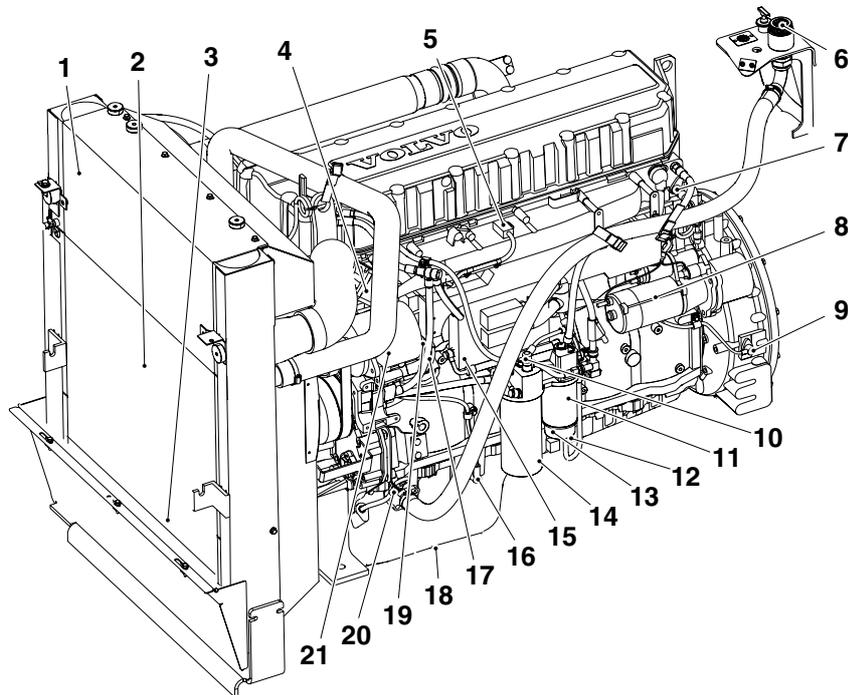
- |   |   |
|---|---|
| 1. Breather nipple cooling system                   | 11. Sensor engine speed   |
| 2. Sensor boost pressure and charge-air temperature | 12. Fuel pre-filter   |
| 3. Control unit engine (D794)                       | 13. Draining condensation water fuel pre-filter and sensor wa-<br>ter in fuel |
| 4. Intercooler                                      | 14. Make-contact fuel pressure  |
| 5. Sensor coolant temperature                       | 15. Fuel filter   |
| 6. Oil dipstick                                     | 16. Extra coolant pump  |
| 7. Filling point engine oil                         | 17. Sensor oil pressure and oil temperature                                   |
| 8. Fuel connection (inlet)                          | 18. Compressor climate control unit (air conditioning)                        |
| 9. Fuel connection (return)                         | 19. Alternator  |
| 10. Starter motor                                   | 20. Sensor camshaft rpm   |



Engine alternative Volvo TWD1240VE, left side (in machine's travel direction)

- |                                 |  |
|---------------------------------|--|
| 1. Connection cab heat          | 9. Transmission oil cooler             |
| 2. Connection air cleaner       | 10. Thermostat transmission oil cooler |
| 3. Turbocharger                 | 11. Connection radiator inlet          |
| 4. Connection exhaust system    | 12. Coolant pump                       |
| 5. Connection radiator (outlet) | 13. Coolant filter                     |
| 6. Connection expansion tank    | 14. Drain plug engine oil              |
| 7. Thermostat                   | 15. Shut-off valve, coolant            |
| 8. Radiator                     | 16. Oil filter (full-flow)             |
|                                 | 17. Oil filter (by-pass)               |

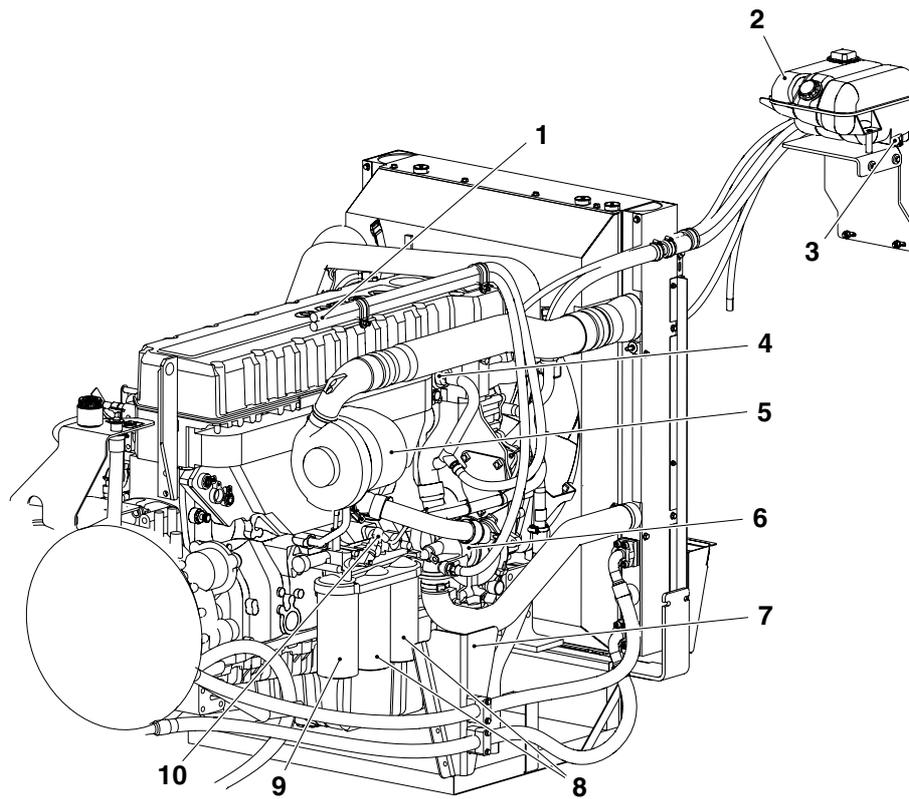
## Engine alternative Volvo TAD1250VE, component position



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*Engine alternative Volvo TAD1250VE, left side (in machine's travel direction)*

- |     |  |     |   |
|-----|--|-----|---|
| 1.  | Intercooler                                      | 12. | Water trap                              |
| 2.  | Radiator   | 13. | Sensor water in fuel                    |
| 3.  | Transmission oil cooler                          | 14. | Fuel filter                             |
| 4.  | Preheating coil                                  | 15. | Control unit engine (D794)              |
| 5.  | Sensor boost pressure and charge-air temperature | 16. | Sensor oil level                        |
| 6.  | Filling point engine oil                         | 17. | Sensor crankcase pressure               |
| 7.  | Sensor coolant temperature                       | 18. | Drain plug engine oil                   |
| 8.  | Starter motor                                    | 19. | Sensor oil pressure and oil temperature |
| 9.  | Sensor engine speed                              | 20. | Dipstick                                |
| 10. | Make-contact fuel pressure                       | 21. | Alternator                              |
| 11. | Fuel pre-filter                                  |     |   |



006400

*Engine alternative Volvo TAD1250VE, left side (in machine's travel direction)*

- |    |                      |     |                                    |
|----|----------------------|-----|------------------------------------|
| 1. | Connection cab heat  | 6.  | Coolant pump                       |
| 2. | Expansion tank       | 7.  | Coolant filter (behind bracket)    |
| 3. | Sensor coolant level | 8.  | Oil filter (full-flow)             |
| 4. | Thermostat           | 9.  | Oil filter (by-pass)               |
| 5. | Turbocharger         | 10. | Sensor oil pressure piston cooling |

## Engine and gearbox, separation (Volvo engine)

### Separation

- 1 Machine in service position, see tab *B Safety*.
- 2 Disconnect required hoses and cables before separating engine and transmission.

### NOTE

*Drain and collect liquids before detaching hoses.*

- 3 Attach hoisting equipment to the engine.



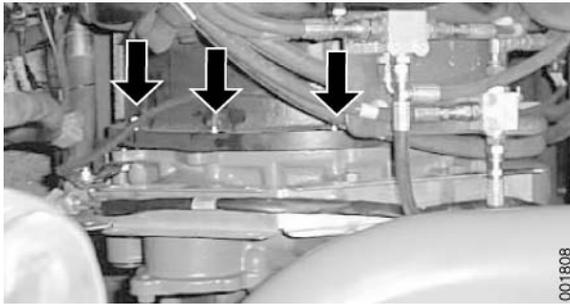
- 4 Use a jack to secure the gearbox.



- 5 Remove the plugs ahead of the flywheel.  
The outer hole is used for turning the engine over.
- 6 Remove the flex plate's attaching bolt. Rotate the engine until the flex plate's bolts are visible in the inner hole. The flex plate has eight attaching points that have to be loosened.
- 7 Take up the slack in the hoisting equipment.

### NOTE

*Do not raise the engine or gearbox.*



- 8 Remove the screws between engine and gearbox.
- 9 Remove the engine or gearbox brackets and separate engine and gearbox.

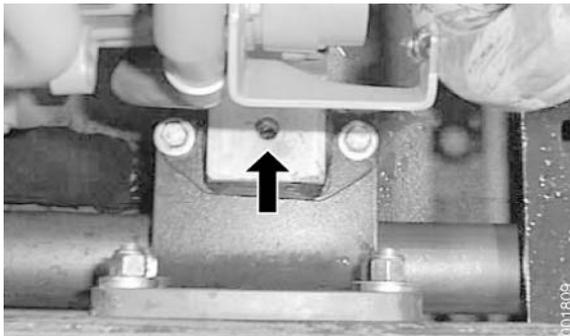
### Assembly

- 10 Check that the holes for attaching the flex plate to the flywheel are lined up directly opposite with the flex plate's attaching nuts. The flexible plate has eight attachment points that must be connected to the flywheel on the engine.

- 11 Fit the engine or gearbox brackets.

Tighten to a torque of **168 Nm**.

- 12 Connect the engine to the gearbox.

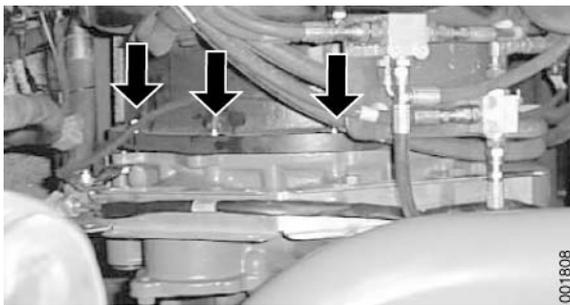


- 13 Install the bolts between the engine and transmission. Torque-tighten with **40 Nm**.

- 14 Install the flex plate's bolts. Torque-tighten with **40 Nm**.

### NOTE

*The engine must be loosened from the engine mounts and separated from the transmission to remove a dropped bolt. Secure the bolt in the socket when installing.*



- 15 Fit the plugs ahead of the flywheel.

- 16 Remove the hoisting equipment from the engine.

- 17 Remove the jack from underneath the gearbox.

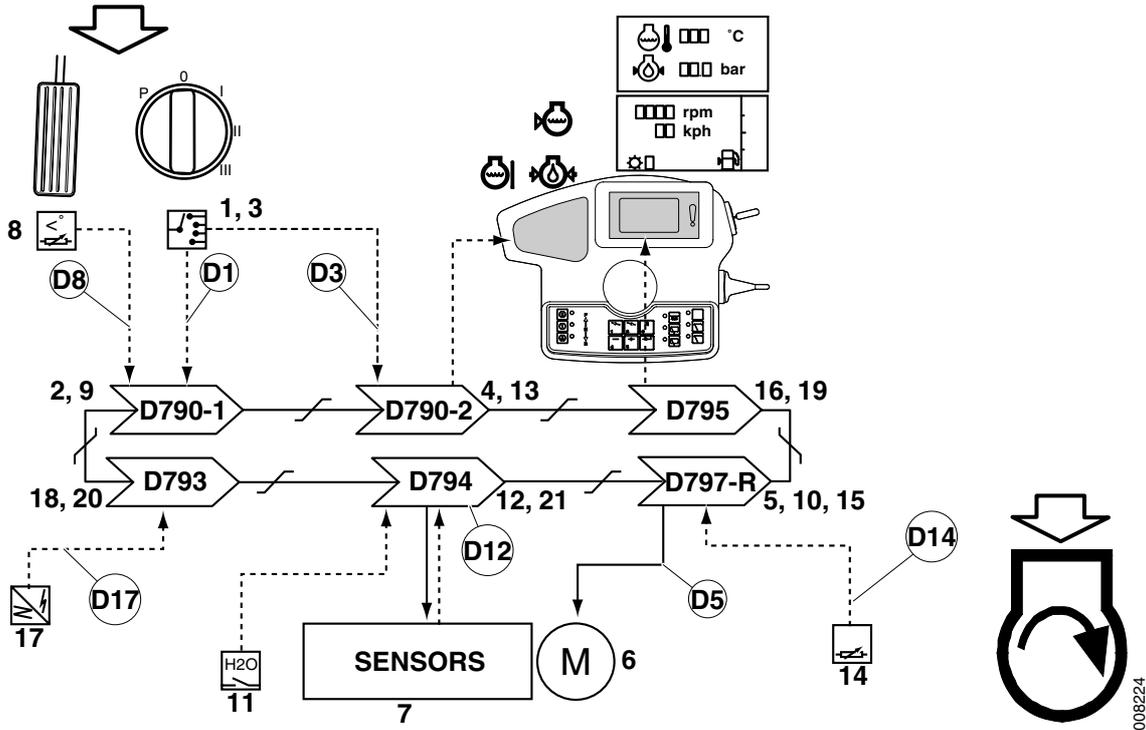
- 18 Connect the required hoses and cables for the engine and transmission. Check and fill fluids as needed.

- 19 Bleed air from the engine's fuel system before start.



## Engine alternative Cummins QSM11, function description

Condition	Reference value	Reference
Engine heater	Disconnected (when cable is in start lock-out is activated)	<i>Engine heater, description page 32</i>

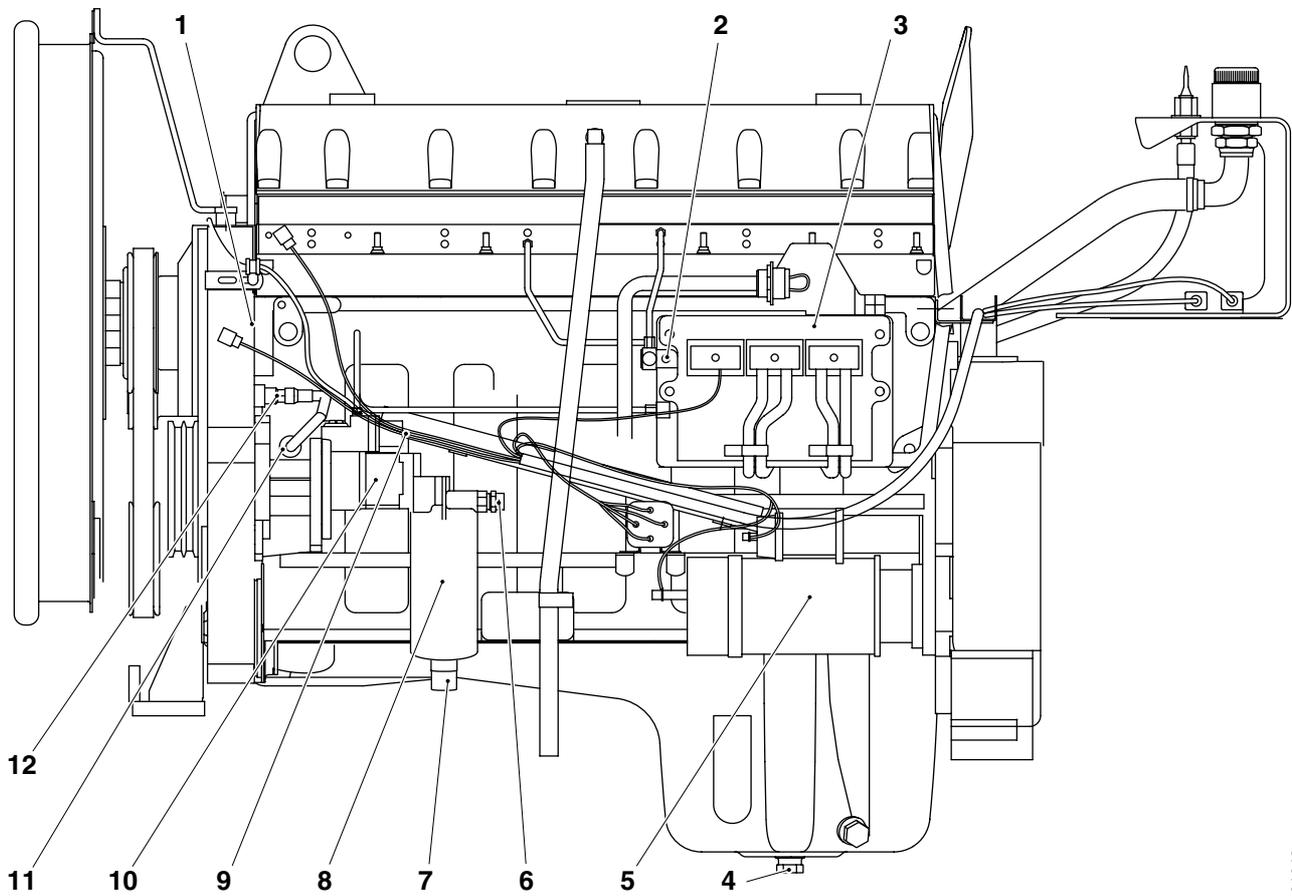


Pos	Explanation	Signal description	Reference
1	The ignition sends a voltage signal to Control unit cab (D790-1) when the start key is turned to the position 1.	U = 24 V	<i>Ignition, description page 20</i> D1: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.4 <i>CAN/POWER</i> , menu 4 and 8.4.6.4 <i>ENGINE</i> , menu 4
2	Control unit cab (D790-1) sends ignition as start message on the CAN-bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
3	The ignition sends a voltage signal to Control unit KIT (D790-2) when the start key is turned to the start position.	U = 24 V	<i>Ignition, description page 20</i> D2: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.4 <i>ENGINE</i> , menu 4
4	Control unit KIT (D790-2) sends start signal on the CAN-bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.11 <i>Control unit KIT</i>

Pos	Explanation	Signal description	Reference
5	Control unit frame rear (D797-R) feeds voltage to starter motor.	U = 24 V	<i>Starter motor, description (engine alternative Cummins QSM11) page 34</i> D5: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.5 <i>ENGINE</i> , menu 5
6	Starter motor rotates engine	-	<i>Starter motor, description (engine alternative Cummins QSM11) page 34</i>
7	The engine's sensors send signals to Control unit engine (D794) which controls the injectors so that the engine starts.	-	Tab 11 <i>Common electric</i> , group 11.5.3.10 <i>Control unit engine</i>
8	The throttle pedal sends a voltage signal proportional to the depression to Control unit cab (D790-1).	U = 0.5–4.5 V Lower voltage than 0.5 V and higher voltage than 4.5 V used to detect malfunction in cable harnesses and controls.	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i> D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.1 <i>ENGINE</i> , menu 1
9	Control unit cab (D790-1) sends a message with the engine speed request on the CAN-bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
10	Control unit engine (D794) controls the engine rpm.	-	Tab 11 <i>Common electric</i> , group 11.5.3.10 <i>Control unit engine</i>
11	Make-contact (closing switch) coolant level sends a voltage signal to Control unit engine (D794) if the coolant level in the expansion tank is low.	U = 24 V	<i>Cooling system, description page 25</i>
12	Control unit engine (D794) sends engine data and warning messages on the CAN-bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.10 <i>Control unit engine</i> D12: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.6 <i>ENGINE</i> , menu 6 and 8.4.6.7 <i>ENGINE</i> , menu 7
13	Control unit KID (D795) shows engine data via display images.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>
14	Sensor fuel level (B757) sends a voltage signal proportional to the fuel level in the tank to Control unit frame rear (D797-R).	U = 0.5–4.5 V Lower voltage than 0.5 V and higher voltage than 4.5 V used to detect malfunction in cable harnesses and controls.	<i>Sensor fuel level, description page 22</i> D14: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.3.7 <i>CAB</i> , menu 7
15	Control unit frame rear (D797-R) sends fuel level on the CAN-bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i>
16	Control unit KID (D795) shows fuel level in operating menu for engine.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>

<b>Pos</b>	<b>Explanation</b>	<b>Signal description</b>	<b>Reference</b>
17	Sensor rpm output shaft (B758) sends pulses at a frequency proportional to the speed of the output shaft to Control unit transmission (D793).	-	D17: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.6 <i>TRANSM</i> , menu 6
18	Control unit transmission (D793) sends speed information on the CAN-bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.9 <i>Control unit transmission</i>
19	Control unit KID (D795) shows the machine's speed.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>
20	If the speed matches the limit for the machine's speed limitation, then Control unit cab (D790-1) sends reduce engine rpm on the CAN-bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
21	Control unit engine (D794) restricts engine rpm.	-	Tab 11 <i>Common electric</i> , group 11.5.3.10 <i>Control unit engine</i>

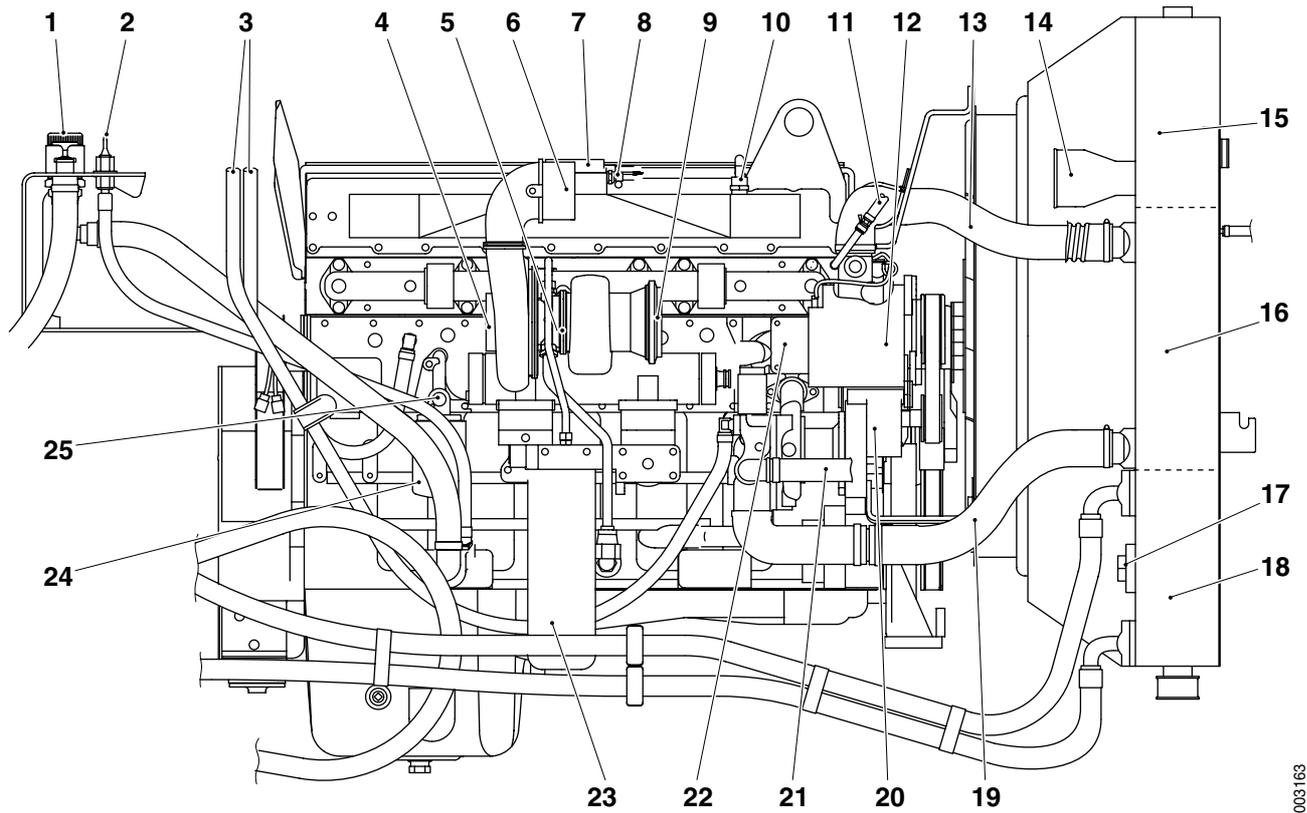
## Engine alternative Cummins QSM11, component position



001643

Engine alternative Cummins, right side (in machine's travel direction)

- |   |  |
|---|--|
| 1. Position for compressor climate control unit | 7. Drain point condensation water fuel filter and sensor water in fuel |
| 2. Fuel connection (outlet)                     | 8. Fuel filter   |
| 3. Control unit engine (D794)                   | 9. Sensor fuel pressure  |
| 4. Drain plug engine oil                        | 10. Fuel pump  |
| 5. Starter motor                                | 11. Sensor oil pressure and oil temperature                            |
| 6. Fuel connection (inlet)                      | 12. Sensor crankshaft position   |



*Engine alternative Cummins, left side (in machine's travel direction)*

- |   |                                  |
|---|----------------------------------|
| 1. Filling point engine oil                                   | 13. Connection radiator (outlet) |
| 2. Oil dipstick   | 14. Inlet intercooler            |
| 3. Connection cab heat  | 15. Intercooler                  |
| 4. Connection air cleaner                                     | 16. Radiator                     |
| 5. Turbocharger   | 17. Thermostat                   |
| 6. Connection intercooler (outlet)                            | 18. Transmission oil cooler      |
| 7. Connection intercooler (inlet)                             | 19. Connection radiator (inlet)  |
| 8. Sensor inlet temperature                                   | 20. Coolant pump                 |
| 9. Connection exhaust system                                  | 21. Connection expansion tank    |
| 10. Sensor boost pressure                                     | 22. Thermostat housing           |
| 11. Connection expansion tank                                 | 23. Oil filter                   |
| 12. Alternator (sensor coolant temperature behind alternator) | 24. Coolant filter               |
|   | 25. Shut-off valve, coolant      |

003163

## Engine and transmission, separating (engine alternative Cummins QSM11)

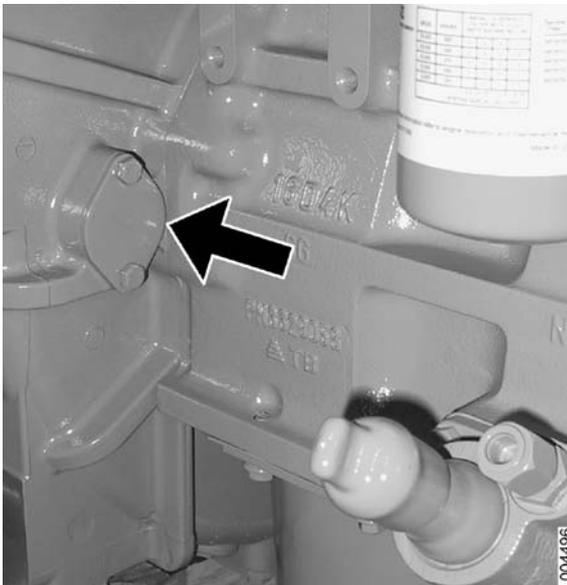
### Separation

- 1 Machine in service position, see tab *B Safety*.
- 2 Attach hoisting equipment to the engine.
- 3 Disconnect required hoses and cables before separating engine and transmission.

### NOTE

*Drain and collect liquids before detaching hoses.*

- 4 Use a jack to secure the gearbox.



- 5 Remove the cover washer.



- 6 Rotate the engine for each bolt in the flex plate that has to be removed.
- 7 Remove the bolts for the flex plate through the hole under the cover washer.
- 8 Take up the slack in the hoisting equipment.

## NOTE

*Do not raise the engine.*

- 9 Remove the screws between engine and gearbox.
- 10 Remove the engine and transmission mounts.
- 11 Withdraw the engine rearwards to separate it from the gearbox.

## Assembly

- 12 Rotate the engine so that the holes in the flywheel are lined up directly opposite with the flex plate's attachment points.  
The flexible plate has eight attachment points that must be connected to the flywheel on the engine.
- 13 Install the bolts by the engine mount. Torque-tighten with **168 Nm**.
- 14 Connect the engine to the gearbox.
- 15 Install the bolts between engine and transmission. Torque-tighten with **52 Nm**.
- 16 Install the flex plate's bolts. Torque-tighten with **40 Nm**.

## NOTE

*The engine must be loosened from the engine mounts and separated from the transmission to remove a dropped bolt. Secure the bolt in the socket when installing.*

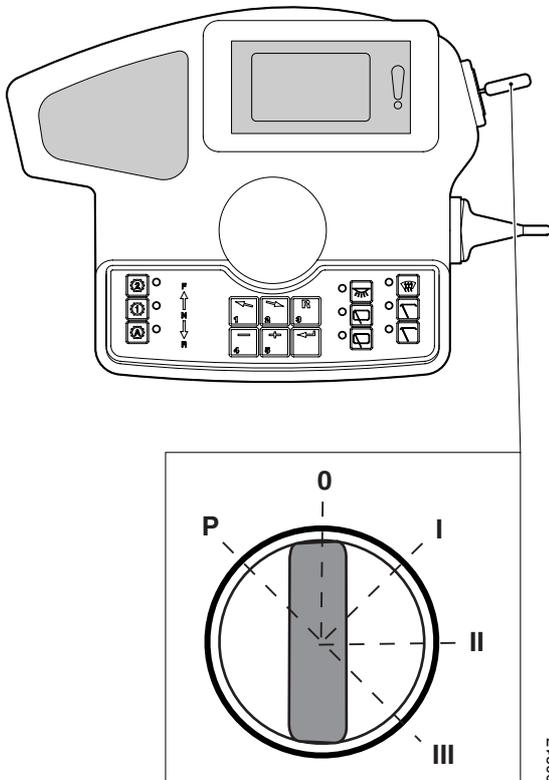
- 17 Fit the plug in front of the flywheel.
- 18 Remove the hoisting equipment from the engine.
- 19 Remove the jack from underneath the gearbox.
- 20 Connect the required hoses and cables for the engine and transmission. Check and fill fluids as needed.



## 1.1 Controls and instrumentation

### 1.1.1 Ignition

#### Ignition, description



P No function.

0 Stop position. Everything is off, key can be removed.

I Operating position.

Voltage to all electrical functions. Control units for engine and transmission are now ready for start.

The signal can be checked from the diagnostic menu, see section 8 Control and monitoring system, group 8.4.1.4 CAN/POWER, menu 4.

II Preheating position.

In preheating position, the engine's inlet air is preheated with a preheating coil to a suitable temperature. Indicator light for preheating is activated during preheating.

The signal can be checked from the diagnostic menu, see section 8 Control and monitoring system, group 8.4.6.4 ENGINE, menu 4.

III Start position.

Engagement of starter motor for engine start.

#### NOTE

*The machine is equipped with an electric restart interlock, which prevents engagement of the starter motor when the engine is rotating.*

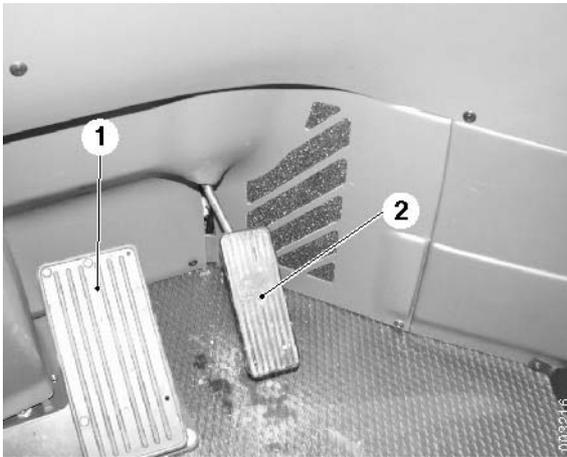
*Condition for starter motor to engage is that transmission is in neutral position and that the engine isn't already running.*

The signal can be checked from the diagnostic menu, see section 8 Control and monitoring system, group 8.4.6.4 ENGINE, menu 4.

000317

## 1.1.2 Accelerator

### Throttle pedal, change



1. Brake pedal
2. Throttle pedal

- 1 Machine in service position, see tab *B Safety*.
- 2 Pull one edge of the cover away to facilitate access to the throttle pedal.
- 3 Unplug the cable from the connector.
- 4 Unscrew the connector from the throttle pedal.
- 5 Change the throttle pedal.
- 6 Fit in the reverse order.
- 7 Calibrate the throttle pedal, see tab *8 Control system*, group *8.5.2.3 Calibrate DRIVE-TRAIN*.

### Throttle pedal, calibration

See tab *8 Control system*, group *8.5.2.3 Calibrate DRIVE-TRAIN*.

## 1.2 Fuel system

### Fuel system, description

The fuel system distributes fuel to the cylinders and so controls engine output power and rpm.

When the engine starts, the fuel pump sucks fuel from the tank through the fuel filter and feeds it to the unit injectors under pressure. The unit injectors inject the atomized fuel into the engine combustion chambers.

### 1.2.1 Fuel tank

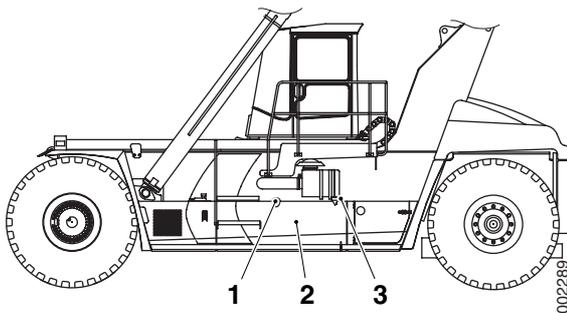
#### Fuel tank, description

The fuel tank is located on the left-hand side of the machine behind the brake fluid reservoir.

### 1.2.2 Sensor fuel level

#### Sensor fuel level, description

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.3.7 *CAB*, menu 7.



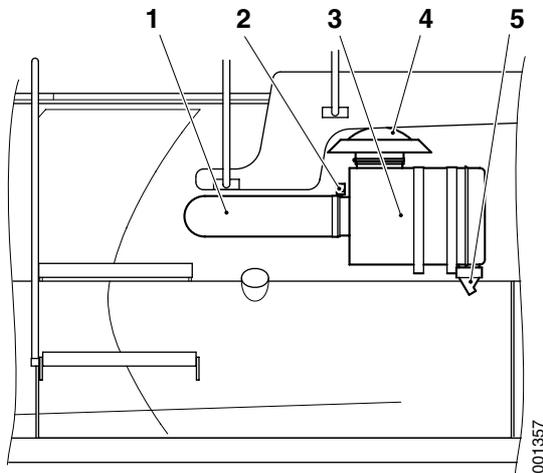
1. Filling point, fuel
2. Fuel tank
3. Sensor, fuel level (behind air filter)

## 1.6 Air intake and exhaust outlet

### 1.6.1 Air cleaning system

#### Air cleaning system, description

Combustion in the engine requires air. The free passage of fresh air and exhaust gases is essential for the engine to work efficiently.



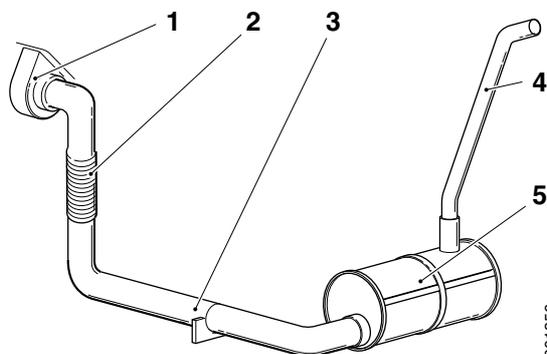
Air cleaning system, overview

1. Intake hose
2. Filter indication
3. Air cleaner
4. Intake
5. Dust reservoir

### 1.6.3 Exhaust system

#### Exhaust system, description

The exhaust system is mounted to the chassis. A heat shield is mounted between the engine and the exhaust system to protect cable harnesses, etc. A flex hose between the turbo and muffler absorbs engine movements. On the outside of the machine, there is a heat shield located over the exhaust system.



Exhaust system, overview

1. Turbocharger
2. Flex hose
3. Exhaust pipe
4. End pipe
5. Muffler

#### **WARNING**

**Hot exhaust system!**

**Risk of burn injuries!**

**Never touch the turbo or muffler when the machine is running or just after it has been turned off!**

## 1.6.4 Intercooler

### Intercooler, description

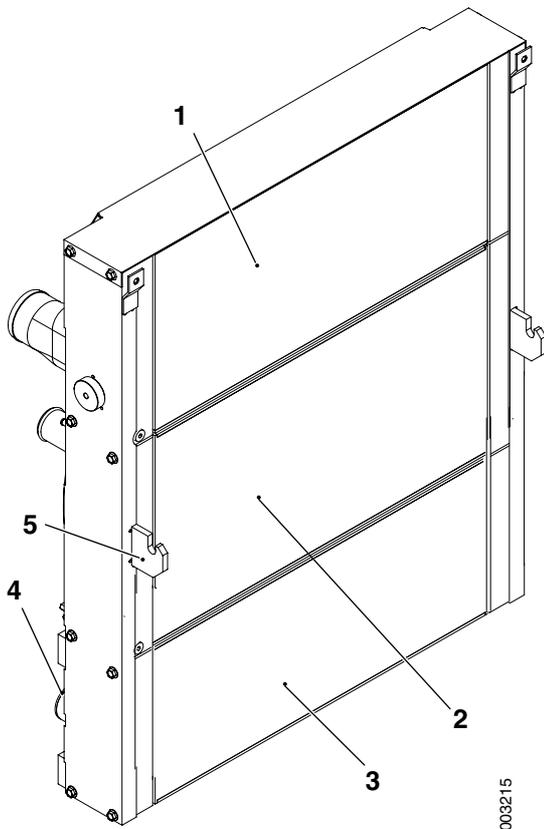
#### Engine alternative Volvo TAD1250VE and Cummins QSM11

The charge-air is cooled by an air-air intercooler in the upper part of the cooler unit.

#### Engine alternative Volvo TWD1240VE

The charge-air is cooled by a liquid-air intercooler on the engine, see supplier documentation engine.

See also *Cooling system, description page 25.*



Cooler unit engine alternative Volvo TAD1250VE and Cummins QSM11

1. Intercooler
2. Radiator engine
3. Cooler transmission oil
4. Thermostat transmission oil
5. Mounting condenser (for AC)

---

## 1.7 Cooling system

### Cooling system, description

The engine is water-cooled and has passages through which the coolant from the radiator flows round a closed system.

Main parts of the cooling system:

- Coolant pump
- Expansion tank
- Thermostat
- Cooling fan
- Radiator
- Engine oil cooler
- Intercooler
- Coolant filter

How the engine cooling system works:

1. Coolant is circulated through the cylinder head, engine block and oil cooler by the coolant pump. On engine alternative Volvo TWD1240VE the coolant is pumped through the intercooler by a separate coolant pump.
2. The thermostat directs the heated coolant back to the coolant pump or through the radiator.
3. When the coolant is colder than the thermostat opening temperature it is pumped back to the engine.  
  
When the coolant is warmer than the thermostat opening temperature it is pumped through the radiator and then back to the coolant pump.
4. The expansion tank allows the coolant to expand without escaping from the engine.

## 1.7.4 Radiator and expansion tank

### Radiator and expansion tank, description

**Radiator** for the engine is located in a cooler unit which is placed behind the engine.

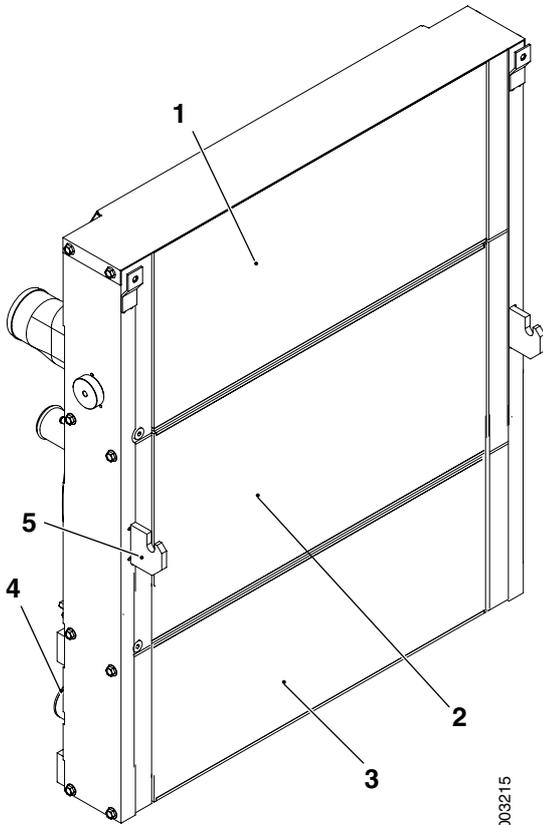
The purpose of the cooler assembly is to cool:

- Engine coolant
- The transmission oil (cooled in the lower part of the cooler unit), see also tab 2 *Transmission*, group 2.6.3 *Oil cooler*.
- The charge-air (engine alternative Volvo TAD1250VE and Cummins QSM11) is cooled in the upper part of the cooler unit, see also *Intercooler*, description page 24.

Engine alternative Volvo TWD1240VE has a liquid-air intercooler mounted directly on the engine.

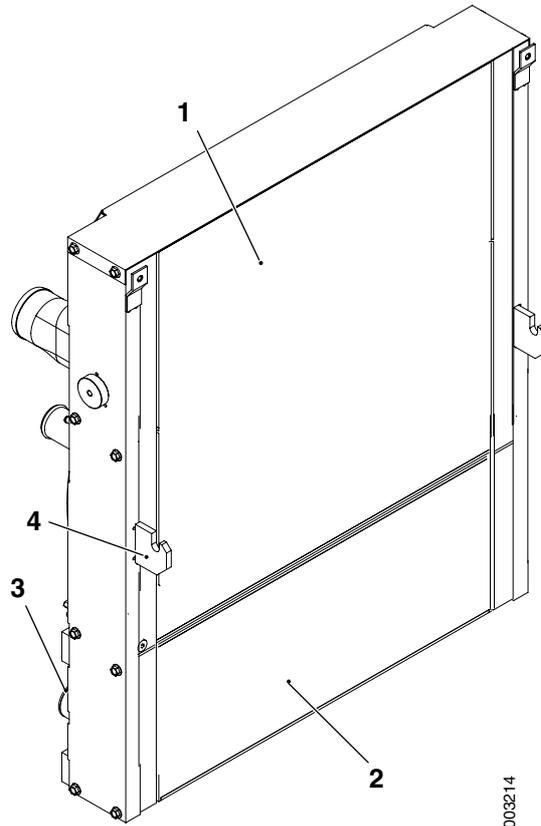
See also *Cooling system*, description page 25.

For more information, see *supplier documentation engine*.



Cooler unit engine alternative Volvo TAD1250VE and Cummins QSM11

1. Intercooler
2. Radiator engine
3. Cooler transmission oil
4. Thermostat transmission oil
5. Mounting condenser (for AC)



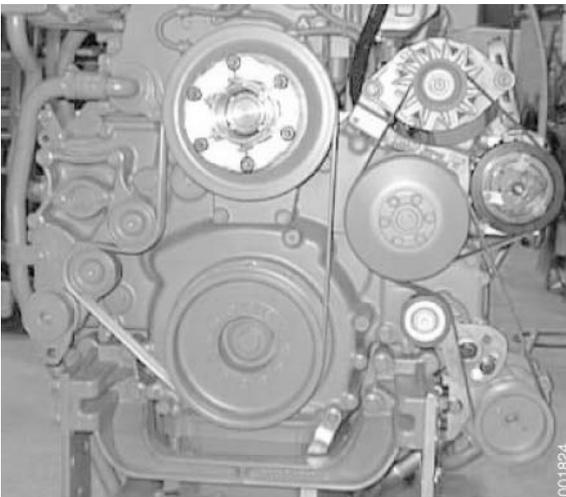
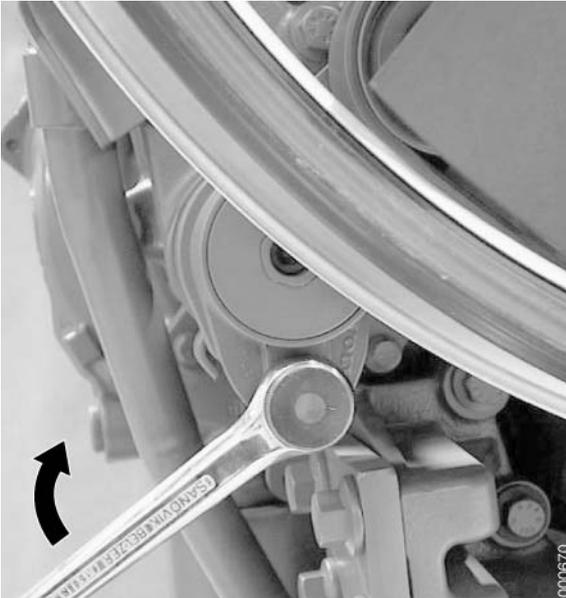
Cooler unit engine alternative Volvo TWD1240VE

1. Radiator engine
2. Cooler transmission oil
3. Thermostat transmission oil
4. Mounting condenser (for AC)

## 1.7.5 Cooling fan

### Fan belt, change (Volvo engine)

- 1 Move the cab into its foremost position.
- 2 Machine in service position, see section tab *B Safety*.
- 3 Remove the cover plates over the engine and radiator.
- 4 Release the tension of the fan belt, and release the fan belt from the belt pulley on the belt tensioner.
- 5 Remove the fan belt.

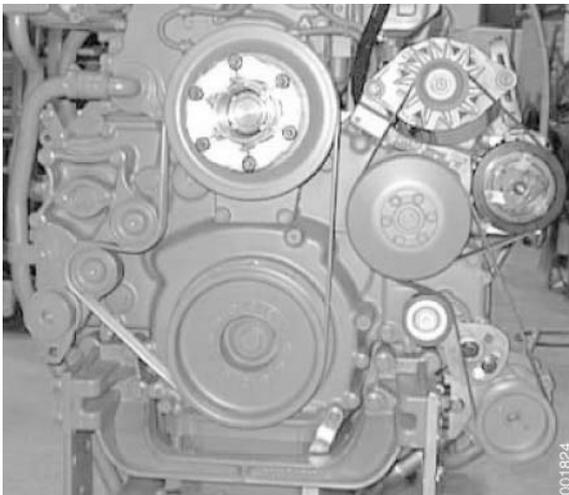
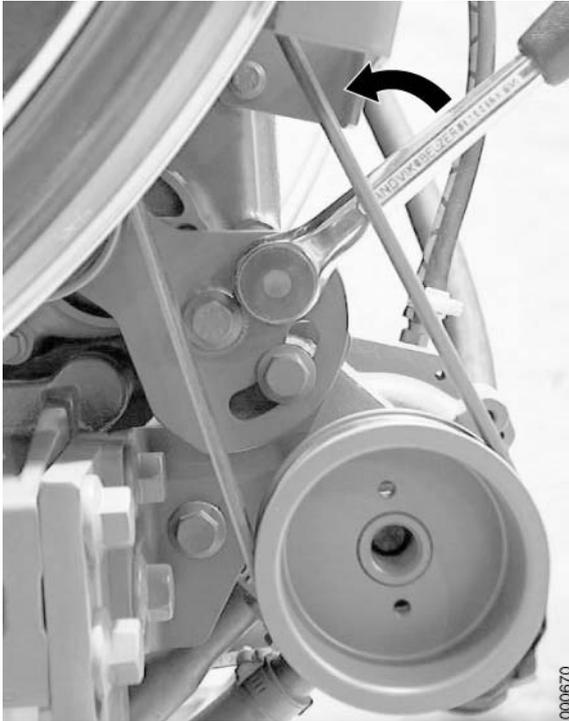


The illustration shows the engine without radiator fan.

- 6 Install the new fan belt as shown.

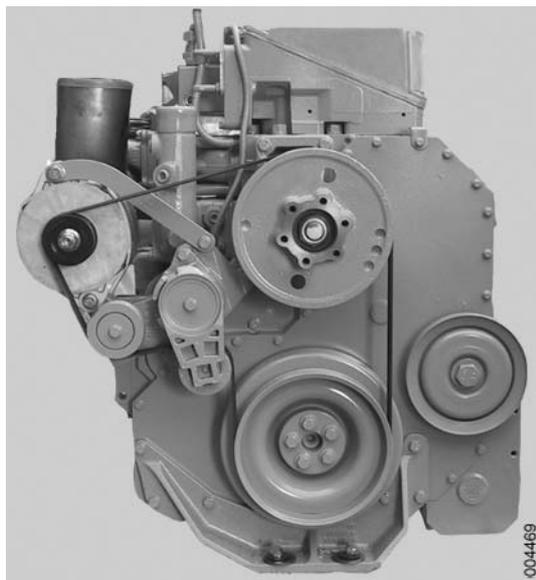
**Drive belt extra water pump, changing (engine alternative Volvo TWD1240VE)**

- 1 Move the cab into its foremost position.
- 2 Machine in service position, see tab *B Safety*.
- 3 Remove the cover plates over the engine and radiator.
- 4 Release the tension of the fan belt.
- 5 Remove the drive belt.



The illustration shows the engine without radiator fan.

- 6 Install the new drive belt as shown.



### Fan belt, change (Cummins engine)

- 1 Move the cab into its foremost position.
- 2 Machine in service position, see tab *B Safety*.
- 3 Remove the cover plates over the engine and radiator.
- 4 Remove the belt tensioner.
- 5 Remove the fan belt.
- 6 Fit a new fan belt.
- 7 Use the belt tensioner to tension the fan belt.

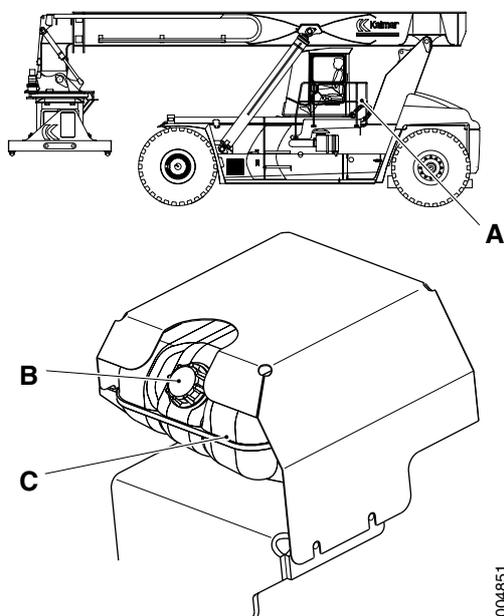
## 1.7.7 Coolant

### Coolant, changing (engine alternative Volvo)

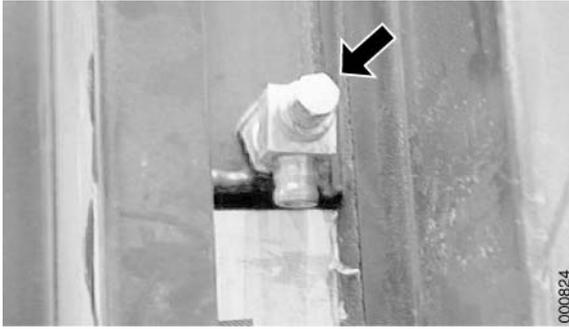
#### NOTE

*Read the safety instructions for coolant before working, see tab B Safety.*

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the cap on the expansion tank.
- 3 Place a container under the radiator and engine. (Cooling system capacity is approx. 40 litres.)

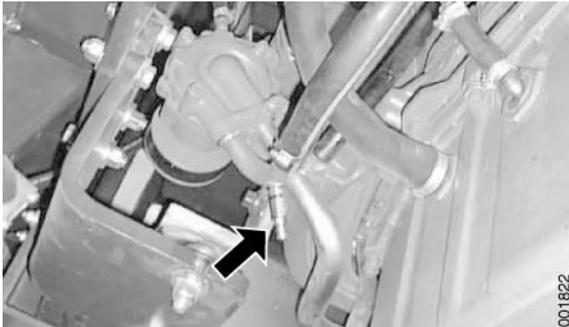


- A. Position expansion tank  
 B. Filling point  
 C. Level marking



4 Drain the cooling system.

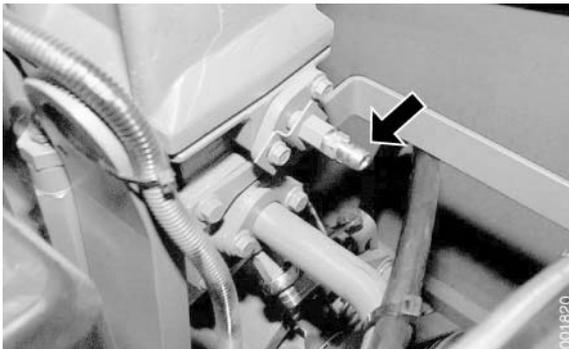
Open the drain on the lower section of the radiator. Collect the coolant in the container.



5 Open the drain cock on the engine.

6 When all the coolant has run out, close the drain cocks.

7 Fill new coolant through the expansion tank.



8 Open the air bleeder nipple to release air and speed up filling. Close the air bleeder nipple when clean coolant without air bubbles runs out.

9 Turn on the main electrical power and start the engine.

10 Turn heating to max. in the cab.

11 Warm up the engine until the thermostat opens and coolant is pumped round the whole system.

12 Check the level in the expansion tank, fill if necessary.

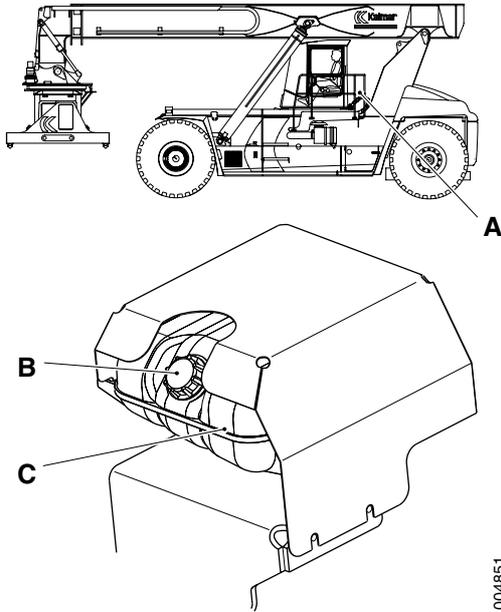
13 Check the coolant level again after 10 working hours.

## Coolant, changing (engine alternative Cummins QSM11)

### NOTE

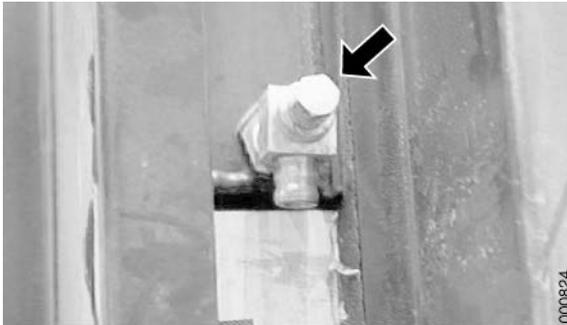
*Read the safety instructions for coolant before working, see tab B Safety*

- 1 Machine in service position, see tab B Safety.
- 2 Remove the cap on the expansion tank.
- 3 Place a container under the radiator and engine. (Cooling system capacity is approx. 40 litres.)



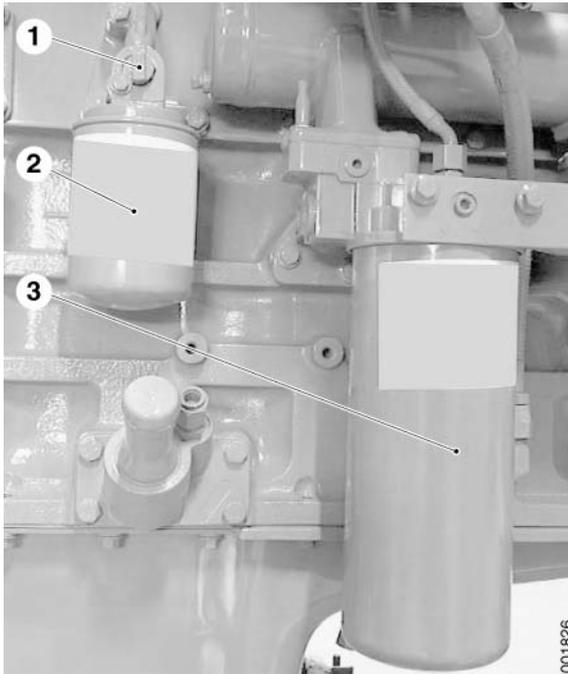
004851

- A. Position expansion tank  
B. Filling point  
C. Level marking



000824

- 4 Drain the cooling system.  
Open the drain on the lower section of the radiator. Collect the coolant in the container.



1. Shut-off valve coolant
2. Coolant filter
3. Oil filter

- 5 Open the drain cock on the engine.
- 6 When all the coolant has run out, close the drain cocks.
- 7 Fill new coolant through the expansion tank.
- 8 Turn on the main electrical power and start the engine.
- 9 Turn heating to max. in the cab.
- 10 Warm up the engine until the thermostat opens and coolant is pumped round the whole system.
- 11 Check the level in the expansion tank, fill if necessary.
- 12 Check the coolant level again after 10 working hours.

## 1.7.10 Plug-in heater

### Engine heater, description



See *supplier documentation engine*.

Available as an option in conjunction with the engine heater is a start-inhibiting function. It is activated when the heater is in operation.

## **1.9 Control system engine**

### **1.9.1 Control unit engine**

#### **Control unit, general**

See tab *11 Common electric*, group *11.5.3.10 Control unit engine* and *supplier documentation engine*.

## 1.11 Start/stopp

### 1.11.1 Start motor

#### **Starter motor, description (engine alternative Volvo)**

The starter motor rotates the engine until fuel combustion begins and the engine starts.

The starter motor is supplied with voltage directly from the start batteries, a relay on the starter motor (solenoid) is activated by control unit engine (D794).

For more information, see *supplier documentation engine*.

#### **Starter motor, description (engine alternative Cummins QSM11)**

The starter motor rotates the engine until fuel combustion begins and the engine starts.

The starter motor is supplied with current directly from the starter batteries. A relay on the starter motor (solenoid) is activated by Control unit frame rear (D797-R).

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.6.5 *ENGINE*, menu 5.

For more information, see *supplier documentation engine*.

### 1.11.2 Stop device

#### **Stop device, description**

The engines have unit injectors that stop delivering fuel when the voltage is cut off, which means that the engine stops.

The engine can only be stopped by turning off the ignition.

#### **NOTE**

*The battery disconnecter may not be used for emergency stop!*

For more information, see *supplier documentation engine*.



Automatic motor shutoff after a certain adjustable time is available as an option.

---

## Table of Contents 2 Transmission

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---

# 2 Transmission

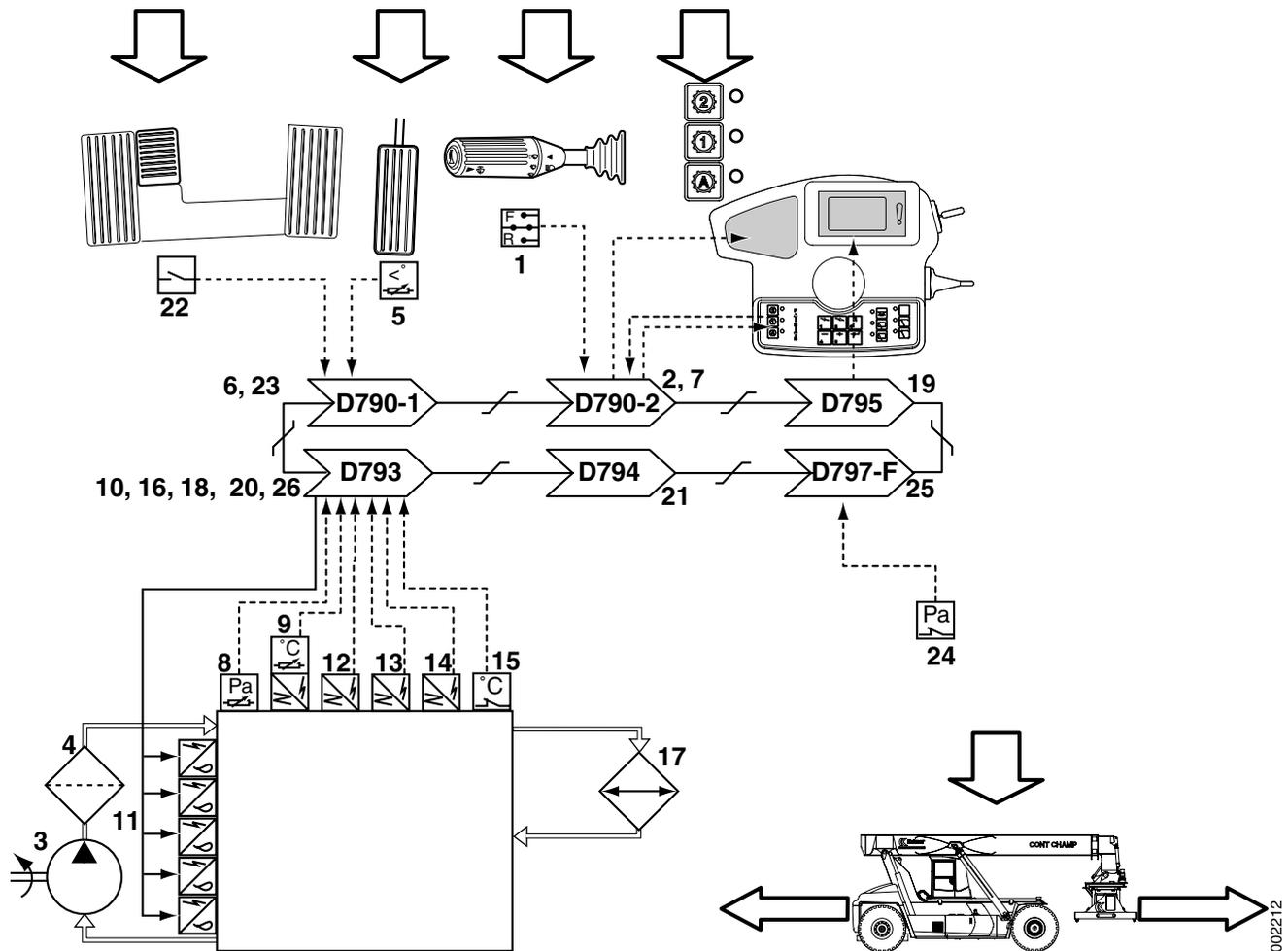
## Transmission, general

### Supplier documentation

The Workshop manual only describes components and work descriptions that concern installation in the machine. For descriptions of and instructions for the transmission's components and systems, refer to the supplier documentation.

References to supplier documentation are only used in exceptional cases. If information about a component is missing, use the supplier documentation.

## Transmission, function description

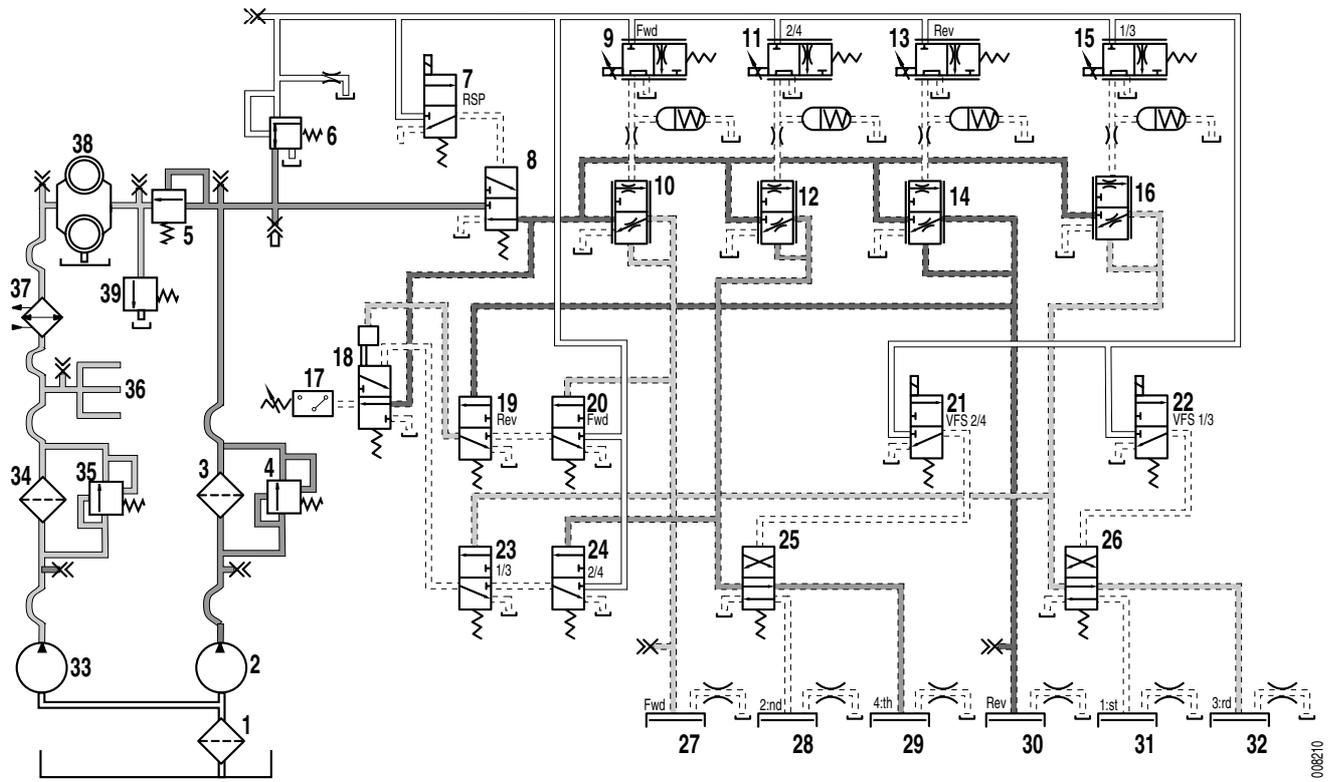


Pos	Explanation	Signal description	Reference
1	The gear selector sends voltage signal to Control unit KIT (D790-2).	Forward, Conn. F: U = 24 V Reverse, Conn. R: U = 24 V	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i> D1: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.2, <i>TRANSM</i> , menu 2
2	Control unit KIT (D790-2) sends selected direction of travel (forward or back) on the CAN bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.11 <i>Control unit KIT</i>
3	The transmission's oil pump pumps oil when the engine is running.	-	-
4	The transmission's oil filter cleans the oil from impurities.	-	-
5	The accelerator pedal sends a signal to Control unit cab (D790-1).	U = 0.5-4.5 V	Tab 1 <i>Engine</i> , group 1.1.2 <i>Accelerator</i> D5: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.1 <i>ENGINE</i> , menu 1

<b>Pos</b>	<b>Explanation</b>	<b>Signal description</b>	<b>Reference</b>
6	Control unit cab (D790-1) sends required throttle application on the CAN bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
7	Control unit KIT (D790-2) sends selected shifting program on the CAN bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.11 <i>Control unit KIT</i>
8	Sensor oil pressure sends voltage signal proportional to oil pressure to Control unit transmission (D793).	Checked by Control unit transmission, error shown with error code.	D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.10 <i>TRANSM</i> , menu 10
9	Sensor engine speed and oil temperature (B758/766) sends pulse signal with frequency proportional to engine speed and voltage signal proportional to transmission oil temperature to Control unit transmission (D793).	Checked by Control unit transmission, error shown with error code.	D9: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.6 <i>TRANSM</i> , menu 6 and 8.4.7.10 <i>TRANSM</i> , menu 10
10	Control unit transmission (D793) supplies voltage to valve block transmission control to obtain required function.	Checked by Control unit transmission, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.9 <i>Control unit transmission</i>
11	Solenoid valves for travel direction and gear position in valve block transmission control activate gears in the transmission and the engine's power is transmitted to the transmission's output shaft.	Checked by Control unit transmission, error shown with error code.	-
12	Sensor rpm turbine (B751) sends pulse signal with frequency proportional to turbine's rpm to Control unit transmission (D793).	Checked by Control unit transmission, error shown with error code.	D12: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.6 <i>TRANS</i> , menu 6
13	Sensor rpm drum (B752) sends pulse signal with frequency proportional to drum's rpm to Control unit transmission (D793).	Checked by Control unit transmission, error shown with error code.	D13: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.6 <i>TRANSM</i> , menu 6
14	Sensor rpm output shaft (B758) sends pulse signal with frequency proportional to output shaft's rpm to Control unit transmission (D793).	Checked by Control unit transmission, error shown with error code.	D14: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.6 <i>TRANSM</i> , menu 6
15	Temperature monitor torque converter (S221) sends voltage signal to Control unit transmission (D793) if oil temperature in torque converter becomes too high.	Checked by Control unit transmission, error shown with error code.	D15: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.10 <i>TRANSM</i> , menu 10
16	Control unit transmission (D793) controls gearshifting according to selected shifting program.	Checked by Control unit transmission, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.9 <i>Control unit transmission</i>

Pos	Explanation	Signal description	Reference
17	The oil cooler cools the transmission oil. A thermostat senses the oil's temperature and directs the oil back to the transmission if the oil is cold.	-	<i>Oil cooler, description page 22</i>
18	Control unit transmission (D793) sends temperature and rpm information on the CAN bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.9 <i>Control unit transmission</i>
19	Control unit KID (D795) shows transmission information in operating menus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>
20	If the signal from sensor output shaft (B758) indicates that the machine's speed exceeds the speed limitation, then Control unit transmission (D793) sends a signal for reduced engine speed on the CAN-bus.	-	D20: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.6 <i>TRANSM</i> , menu 6
21	Control unit engine (D794) reduces engine speed.	-	Tab 11 <i>Common electric</i> , group 11.5.3.10 <i>Control unit engine</i>
22	If the declutch pedal (S220-1) is pressed down it sends a voltage signal to Control unit cab (D790-1).	U = 24 V	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i> D22: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.1 <i>TRANSM</i> , menu 1
23	Control unit cab (D790-1) sends disengage drive on the CAN bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
24	Break contact (opening switch) declutch (S220-2) sends a voltage signal to Control unit frame front (D797-F) if brake pressure is high enough to allow disengagement of drive.	Brake pressure above 0.2 MPa: Conn 1, U = 24 V Conn 2, U = 24 V Brake pressure below 0.2 MPa: Conn 1, U = 24 V Conn 2, U = 0 V	<i>Breaking contact disengagement (declutch), description page 23</i> D24: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.1 <i>TRANSM</i> , menu 1
25	Control unit frame front (D797-F) sends disengagement approved on the CAN bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i>
26	Control unit transmission (D793) supplies voltage to valve block transmission control so that drive is disengaged.	Checked by Control unit transmission, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.9 <i>Control unit transmission</i>

## Shifting transmission, function description

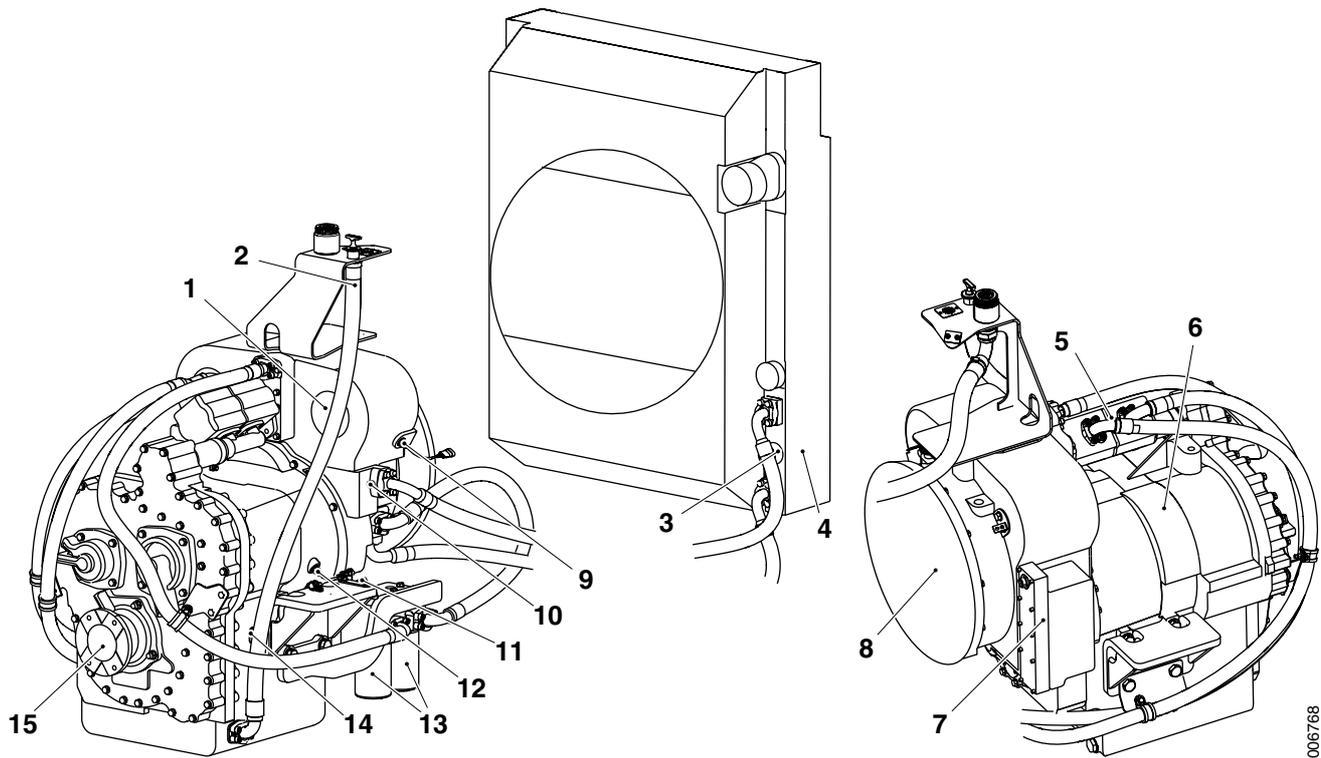


Pos	Explanation	Signal description	Reference
1.	Bottom strainer oil sump, separates particles from the oil before the pumps.	-	-
2.	The transmission's oil pump 1 feeds the transmission with control pressure for control of the transmission.	100.5 l/min at 1973 rpm	-
3.	The oil filter cleans the oil.	-	-
4.	The by-pass valve in the filter bracket leads the oil past the filter if resistance through the filter becomes too high.	Opening pressure: 410-450 kPa	-
5.	The pressure governor releases pressure to the torque converter if the pressure becomes too high.	Opening pressure: 2200 kPa	-
6.	The pressure reducer reduces the feed pressure to servo pressure.	1200 kPa	-
7.	Solenoid valve neutral position (RSP) (Y6066) controls Valve slide neutral position.	-	Diagnostic menu, see section 8 <i>Control and monitoring system,</i> group 8.4.7.7 <i>TRANSM, menu 7</i>
8.	Valve slide neutral position opens or closes to allow control pressure to the transmission.	-	-

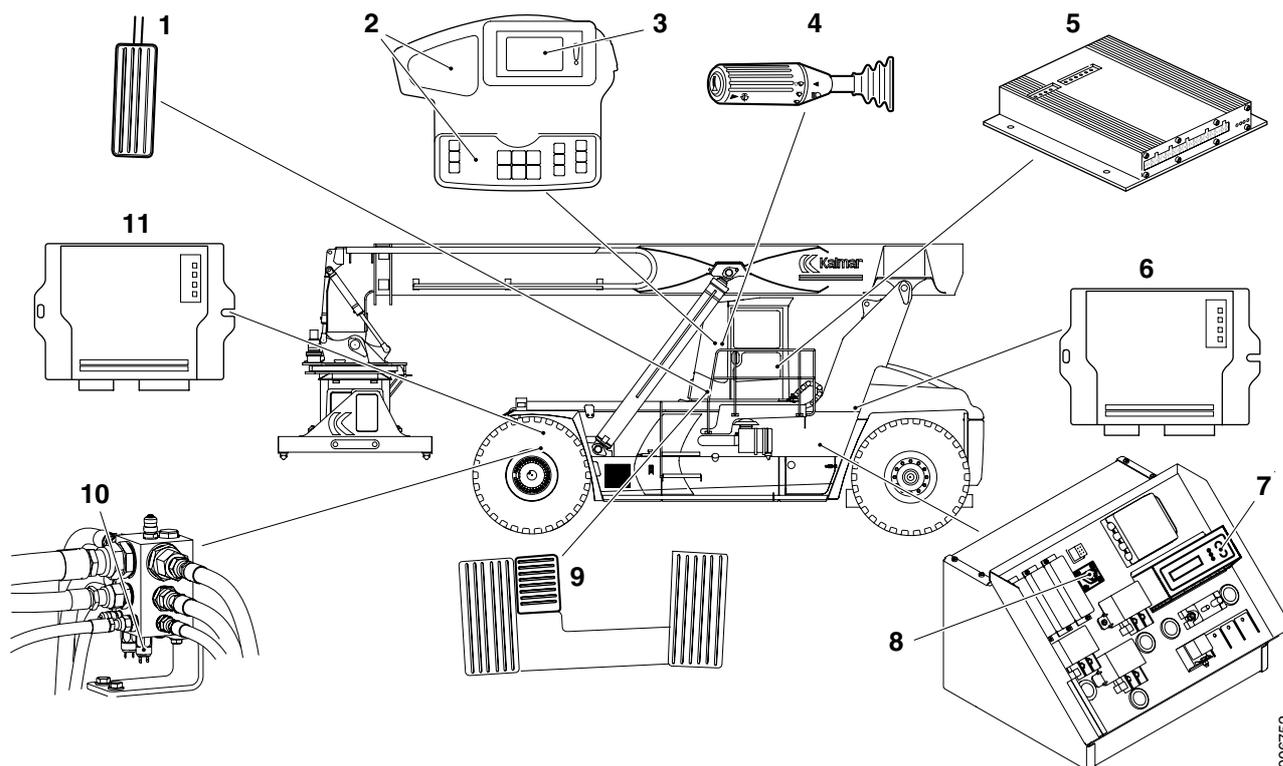
Pos	Explanation	Signal description	Reference
9.	Solenoid valve drive forward (Y630) controls Pressure booster drive forward.	0-600 kPa	Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.7.8 <i>TRANSM</i> , menu 8 and 8.4.7.9 <i>TRANSM</i> , menu 9
10.	Pressure booster forward increases the pressure and pressurizes Drive clutch forward.	0-2000 kPa	-
11.	Solenoid valve gear 2/4 (Y6069) controls Pressure booster gear 2/4.	0-600 kPa	Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.7.8 <i>TRANSM</i> , menu 8 and 8.4.7.9 <i>TRANSM</i> , menu 9
12.	Pressure booster gear 2/4 increases the pressure and feeds Valve slide gear selection 2/4.	0-2000 kPa	-
13.	Solenoid valve drive reverse controls Pressure booster drive reverse.	0-600 kPa	Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.7.8 <i>TRANSM</i> , menu 8 and 8.4.7.9 <i>TRANSM</i> , menu 9
14.	Pressure booster reverse increases the pressure and pressurizes Drive clutch reverse.	0-2000 kPa	-
15.	Solenoid valve 1/3 (Y6067) controls Pressure booster gear 1/3.	0-600 kPa	Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.7.8 <i>TRANSM</i> , menu 8 and 8.4.7.9 <i>TRANSM</i> , menu 9
16.	Pressure booster gear 1/3 increases the pressure and feeds Valve slide gear selection 1/3 as well as .	0-2000 kPa	-
17.	Contact drive sends signal to the control unit to verify that drive clutches for travel direction and gear selection are activated when solenoid valve neutral position (RSP) (Y6066) is activated.	-	
18.	Control valve drive compares pressure signals from drive clutches for travel direction and gear selection, and sends pressure signal on to Contact drive.	-	-
19.	Valve slide control drive reverse opens when Drive clutch reverse is pressurized and leads pressure signal to Control valve drive.	0-2000 kPa	
20.	Valve slide control drive forward opens when Drive clutch forward is pressurized and leads pressure signal to Control valve drive.	0-2000 kPa	-
21.	Solenoid valve VFS 2/4 (Y6074) controls servo pressure to Valve slide gear selection 2/4.	1200 kPa	Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.7.7 <i>TRANSM</i> , menu 7
22.	Solenoid valve VFS 1/3 (Y6075) controls servo pressure to Valve slide gear selection 1/3.	1200 kPa	Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.7.7 <i>TRANSM</i> , menu 7

Pos	Explanation	Signal description	Reference
23.	Valve slide control gear 1/3 opens when Valve slide gear selection 1/3 is pressurized and leads pressure signal to Control valve drive.	0-2000 kPa	-
24.	Valve slide control gear 2/4 opens when Valve slide gear selection 2/4 is pressurized and leads pressure signal to Control valve drive.	0-2000 kPa	-
25.	Valve slide gear selection 2/4 pressurizes Drive clutch gear 2 or Drive clutch gear 4.	0-2000 kPa	-
26.	Valve slide gear selection 1/3 pressurizes Drive clutch gear 1 or Drive clutch gear 3.	0-2000 kPa	-
27.	Drive clutch forward locks transmission in forward drive when the clutch is pressurized.	-	-
28.	Drive clutch 2nd gear locks transmission in 2nd gear when the clutch is pressurized.	-	-
29.	Drive clutch 4th gear locks transmission in 4th gear when the clutch is pressurized.	-	-
30.	Drive clutch reverse locks transmission in reverse drive when the clutch is pressurized.	-	-
31.	Drive clutch 1st gear locks transmission in 1st gear when the clutch is pressurized.	-	-
32.	Drive clutch 3rd gear locks transmission in 3rd gear when the clutch is pressurized.	-	-
33.	The transmission's oil pump pumps the oil through the cooler and supplies the torque converter with oil pressure for driving the machine.	85.1 l/min at 1973 rpm	-
34.	The oil filter cleans the oil.	-	-
35.	The by-pass valve in the filter bracket leads the oil past the filter if resistance through the filter becomes too high.	-	-
36.	The oil is distributed to different lubrication points in the transmission.	-	-
37.	The transmission oil cooler cools the oil.	-	-
38.	The torque converter transmits the engine's power to the transmission.	-	-
39.	The safety valve leads the oil back to the sump if the pressure in the torque converter becomes too high.	Opening pressure: 900 kPa	-

## Transmission, component position



- |    |   |     |   |
|----|---|-----|---|
| 1. | Power take-off                                      | 9.  | Sensor engine speed and oil temperature (B758/766)<br>(from cooler to sump) |
| 2. | Oil dipstick and filling point for transmission oil | 10. | Temperature monitor torque converter (S221)                                 |
| 3. | Thermostat  | 11. | Sensor turbine speed (B751)   |
| 4. | Transmission oil cooler                             | 12. | Sensor drum speed (B752)  |
| 5. | Oil pumps transmission                              | 13. | Oil filter transmission   |
| 6. | Transmission  | 14. | Sensor output shaft speed (B758)  |
| 7. | Valve block transmission control                    | 15. | Output shaft  |
| 8. | Torque converter                                    |     |   |



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- |                                     |                                       |
|-------------------------------------|---------------------------------------|
| 1. Accelerator pedal (B690)         | 7. Control unit transmission (D793)   |
| 2. Control unit KIT (D790-2)        | 8. Diagnostic socket transmission     |
| 3. Control unit KID (D795)          | 9. Declutch pedal (S220-1)            |
| 4. Multi-function lever (S162)      | 10. Make-contact declutch (S220-2)    |
| 5. Control unit cab (D790-1)        | 11. Control unit frame front (D797-F) |
| 6. Control unit frame rear (D797-R) |                                       |

## Engine and gearbox, separation

Engine alternative Volvo: see section 1 *Engine, group 1 Engine and gearbox, separation (engine alternative Volvo)*.

Engine alternative Cummins: see section 1 *Engine, group 1 Engine and gearbox, separation (engine alternative Cummins)*.

## 2.1 Controls and instrumentation

### 2.1.1 Gear and multi-function lever

#### Gear and multi-function lever, description

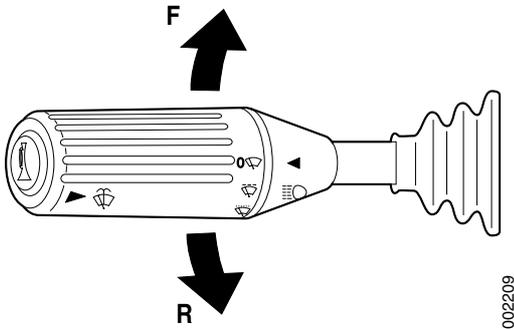
Travel direction is selected with the gear and multi-function lever.

Selection of travel direction:

- F – Forward
- N – Neutral
- R – Reverse

The switch is supplied with voltage by and sends signals to Control unit KIT (D790-2).

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.7.2 *TRANSM*, menu 2.

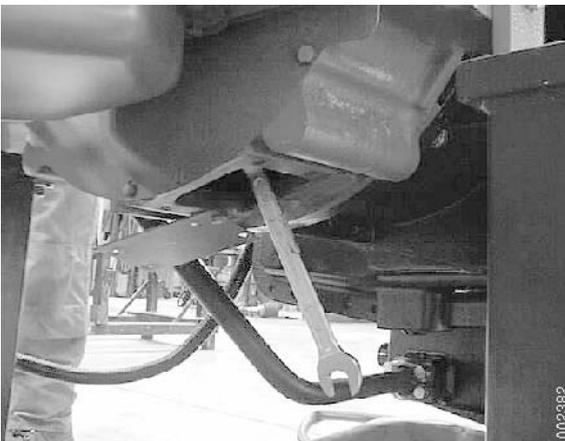
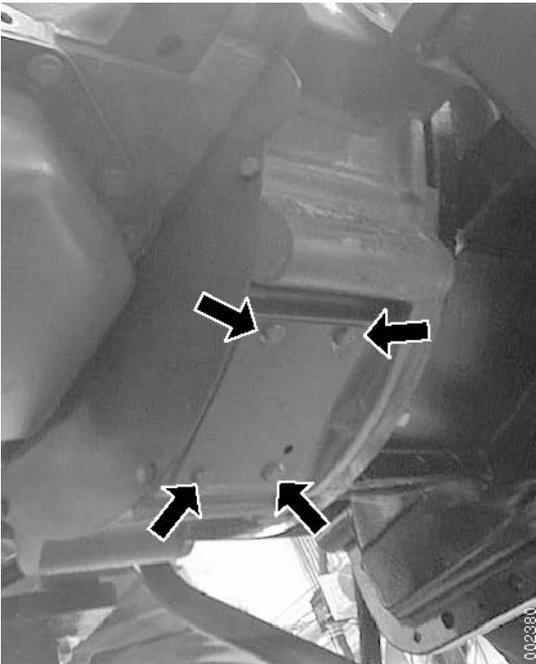


## 2.2 Torque converter/clutch system

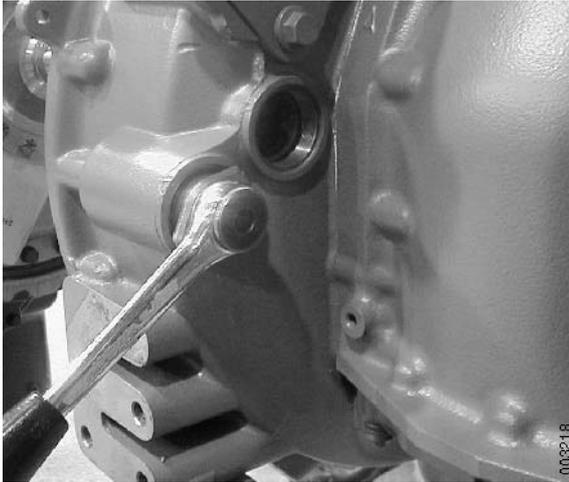
### 2.2.1 Flex plates

#### Flex plates, changing (engine alternative Volvo)

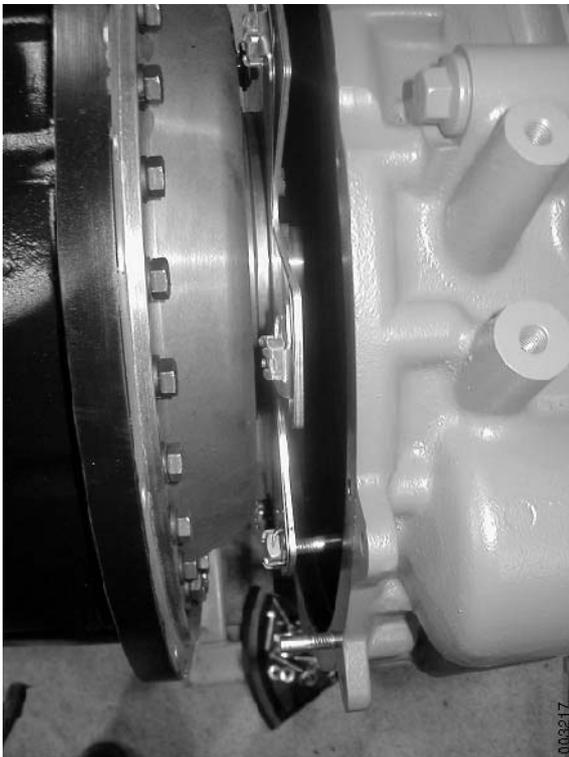
- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the flywheel cover plate.



- 3 Remove the bolts for the flex plate.



- 4 Rotate the engine for each bolt for the flex plate that is to be removed.
- 5 Attach the transmission to an overhead crane.
- 6 Remove the bolts holding together the transmission and engine.



- 7 Carefully separate the transmission and engine.

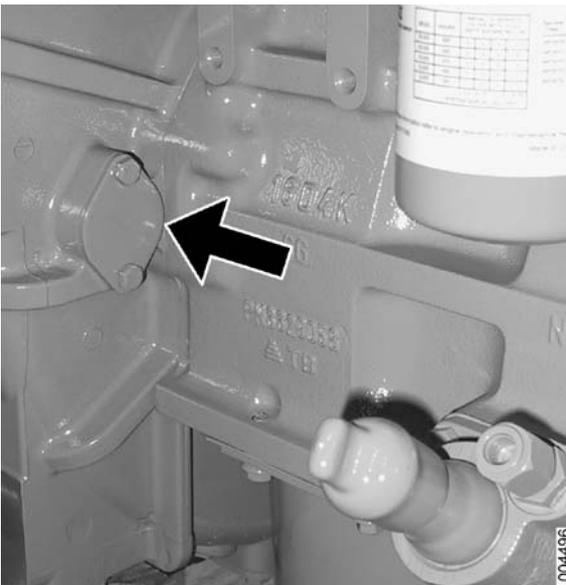


Attachment of flex plate.

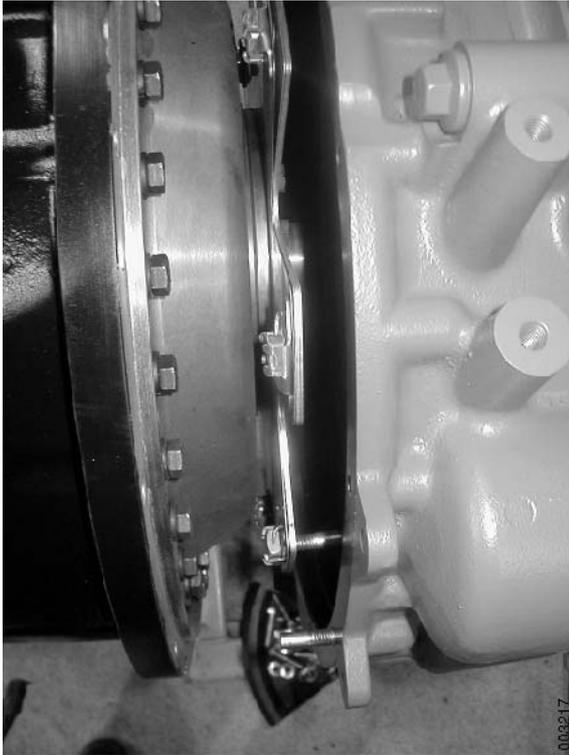
- 8 Remove the bolts holding the flex plate to the transmission.
- 9 Change the flex plate.
- 10 Fit in the reverse order. Tighten the retaining bolts to **40 Nm**.
- 11 Before the machine is put into operation, the transmission must be calibrated, see *Transmission, calibrating page 23*.

### Flex plates, changing (engine alternative Cummins QSM11)

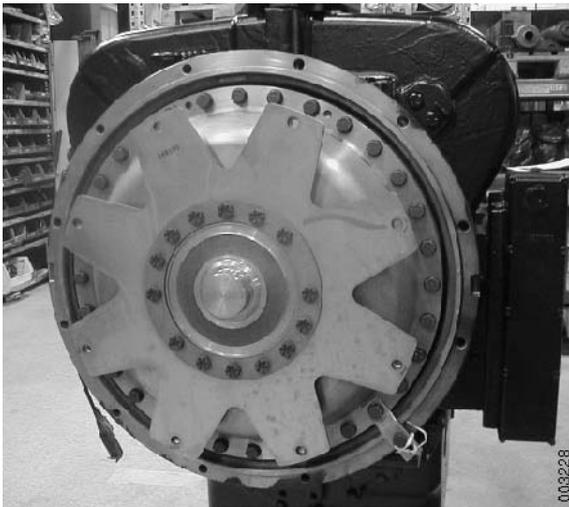
- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the cover plate.
- 3 Remove the bolts for the flex plate.



- 4 Rotate the engine for each bolt for the flex plate that is to be removed.
- 5 Attach the transmission to an overhead crane.
- 6 Remove the bolts holding together the transmission and engine.



7 Carefully separate the transmission and engine.



Attachment of flex plate.

8 Remove the bolts holding the flex plate to the transmission.

9 Change the flex plate.

10 Fit in the reverse order. Tighten the retaining bolts to **40 Nm**.

11 Before the machine is put into operation, the transmission must be calibrated, see *Transmission, calibrating* page 23.

## 2.6 Lubrication

### Lubrication system, description

The transmission lubricating system has the following function:

- Lubricate gear wheel and bearings
- Apply the clutches in the gearbox
- Cool down the torque converter and gearbox
- Clean the oil of any impurities with two oil filters.

During operation of the engine, the oil pump draws oil from the gearbox oil pan through a strainer, and it then pumps it through two oil filters to a control valve.

The control valve supplies oil at the correct pressure to the transmission valve housing to activate the clutch plates for FORWARD or REVERSE and gear 1, 2, 3, or 4. The clutch plates require just a small amount of the oil flow supplied by the pump. The remainder of the oil is pumped through the torque converter circuit to the oil cooler and returns to the transmission for lubrication.

See also *supplier documentation transmission*.

### Oil and oil filter, changing

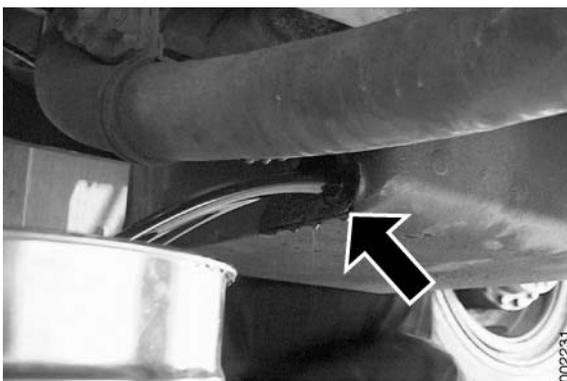
#### NOTE

*Read the safety instructions for oil before working, see tab B Safety.*

#### NOTE

*The transmission must not be overfilled!*

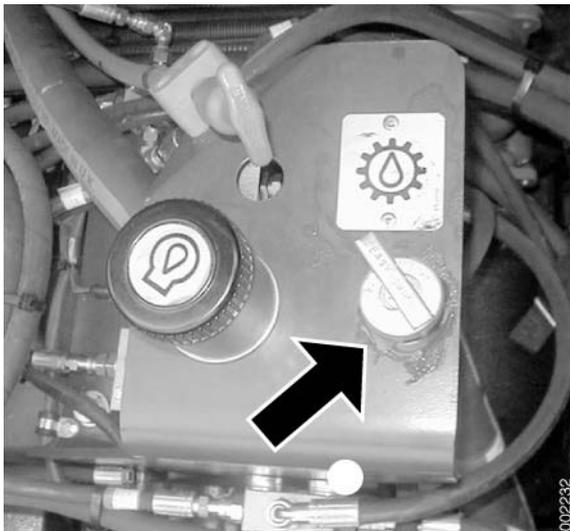
- 1 Operate and warm up the transmission oil.
- 2 Machine in service position, see tab B Safety.
- 3 Remove the drain plug for transmission oil and let the oil drain into the receptacle.



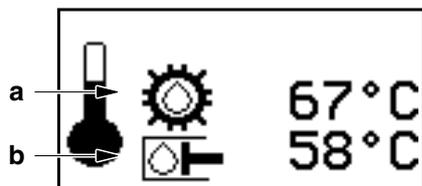
Draining transmission oil



Oil filter transmission



Oil dipstick and filling point transmission oil



Operating menu oil temperature

a. Transmission oil temperature

b. Hydraulic oil temperature

- 4 Change oil filters.

Lubricate the O-ring on the new oil filters with transmission oil. Tighten to contact and then another two-thirds turn.

- 5 When the transmission oil has drained, fit the drain plug.

Make sure that the washer for the oil plug is included.

- 6 Remove the transmission dipstick and fill new transmission oil through the dipstick's hole to the marking for low level on the dipstick.

For volume and quality, see tab *F Technical data*.

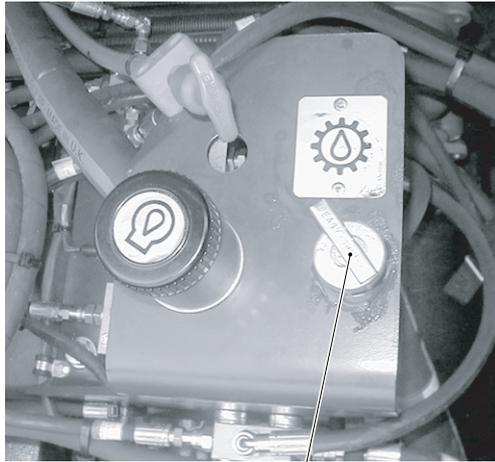
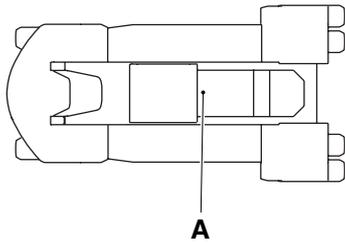
- 7 Start the engine and let the engine run at idle for at least two minutes.

- 8 Check that the drain plug for transmission oil seals tight.

- 9 Check the transmission oil level with the engine running at idle and top up to the marking for low level.

- 10 Warm up the transmission so that the oil temperature is 60-65 °C on the display. Use operating menu oil temperature to check the transmission oil temperature.

- 11 Check the oil level and top up to the MAX marking for oil level.



**B**

- A. Position of oil filling point and level check  
 B. Oil filling point and oil dipstick

## Oil level, checking

### NOTE

*Read the safety instructions for oil before working, see tab B Safety.*

The transmission's oil filler pipe and dipstick (position B) are located under the service hatch in front of the cab.

- 1 Check the oil level with the engine at idle, transmission in neutral position and at operating temperature (approx. 60-65 °C in the display). The dipstick has two markings, MAX and MIN, the oil level should be at MAX.

Wipe off the dipstick before checking.

### NOTE

*The dipstick is long. Use gloves.*

- 2 Fill transmission oil (position B) as needed (for volume and quality, see tab F Technical data).

Fill – wait awhile – check on the dipstick.

### NOTE

*Work carefully when filling transmission oil to prevent other fluids or particles from contaminating the oil, which means risk of transmission damage.*

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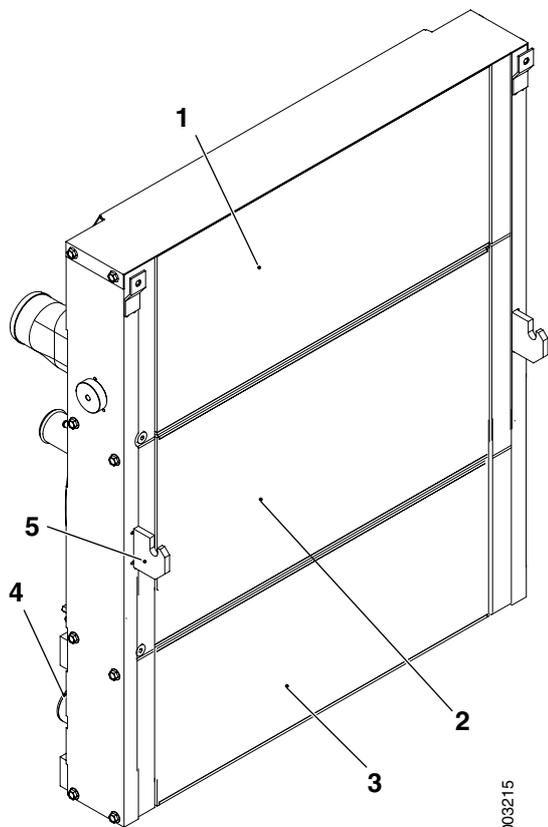
## 2.6.3 Oil cooler

### Oil cooler, description

The transmission oil is cooled in the lower section of the cooler assembly.

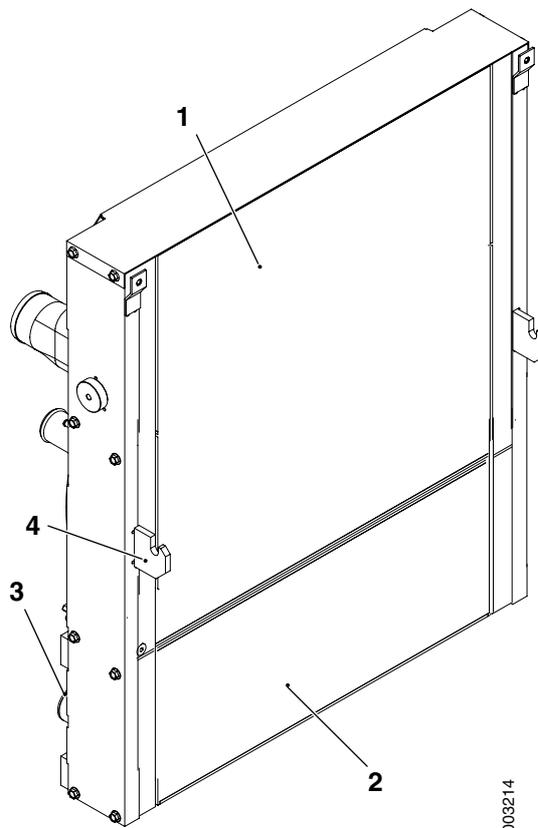
A temperature controlled bypass valve, which only acts on the cooling circuit for transmission oil, is located in a pipe at the lower edge of the radiator (on engine side). The valve closes when oil starts to reach operating temperature. In this way the oil reaches operating temperature more quickly.

For more detailed information see *supplier documentation transmission*.



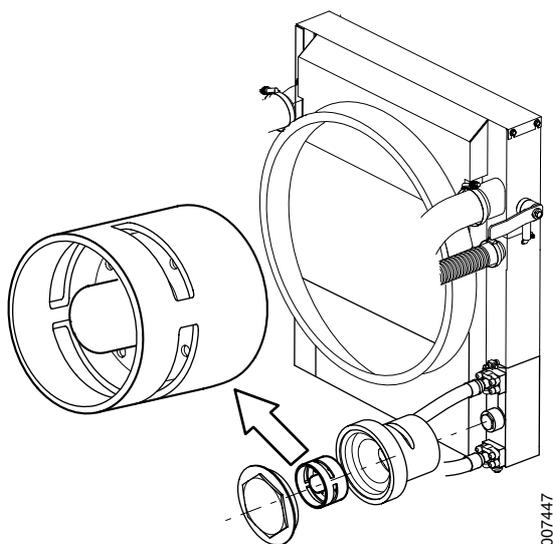
Radiator core, engine alternative, Cummins

1. Charge air cooler
2. Radiator, engine
3. Cooler, transmission oil
4. Thermostat, transmission oil
5. Mounting, condenser (to AC)



Radiator core, engine alternative Volvo

1. Radiator, engine
2. Cooler, transmission oil
3. Thermostat, transmission oil
4. Mounting, condenser (to AC)



## Thermostat transmission oil cooler, changing

### NOTE

Read the safety instructions for oil before working, see tab B Safety.

- 1 Machine in service position, see tab B Safety.
- 2 Drain the transmission of oil, see *Oil and oil filter, changing page 17*.
- 3 Loosen the cover plug and remove the thermostat.
- 4 Check the O-ring and the spring in the bottom, change as needed.
- 5 Install the new thermostat, and the cover plug.

### IMPORTANT

**It is very important that the thermostat is used with the temperature bulb facing out as shown.**

- 6 Fill transmission oil, see *Oil and oil filter, changing page 17*.
- 7 Start the engine and check for leaks.
- 8 Check the oil level in the transmission, see *Oil level, checking page 19*.

## **2.7 Cooling**

### **2.7.3 Oil cooler**

#### **Oil cooler, description**

*See Oil cooler, description page 20.*

## 2.8 Control system transmission

### Transmission, calibrating

See tab 8 *Control system*, group 8.5.2.3 *Calibrate DRIVE-TRAIN*.

#### 2.8.1 Control unit transmission

##### Control unit, transmission, general

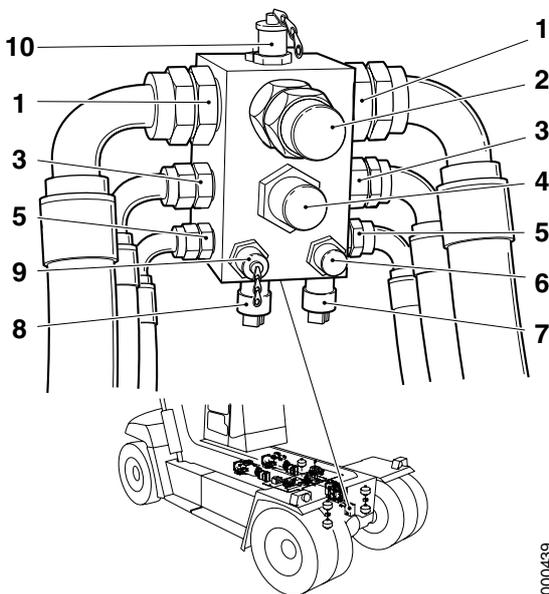
See section 11 *Common electric*, group 11.5.3.9 *Control unit, transmission* and *supplier documentation transmission*.

#### 2.8.2 Breaking contact declutch

##### Breaking contact disengagement (declutch), description

The break contact for disengagement senses if the wheel brakes are pressurised. The break contact is located on the distribution block for the brake system, above the drive axle's differential.

The sensor can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.7.1 *TRANSM*, menu 1.



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1. Connection brake cooling, return from wheel brake
2. Connection brake cooling, return to radiator and tank
3. Connection brake cooling, to wheel brake
4. Connection brake cooling, from accumulator charging valve
5. Connection brake cylinder, to wheel brake
6. Connection brake pressure, from brake valve
7. Make-contact, declutch (S220)
8. Make-contact, wheel brake (S216)
9. Test outlet, brake pressure
10. Test outlet, back-pressure brake cooling

#### 2.8.3 Cable harness transmission

##### Cable harness transmission, description

See section E *Diagrams*.



---

## Table of Contents 3 Driveline/axle

<b>3</b>	<b>Driveline/axle</b> .....	<b>3</b>
3.2	Propeller shaft .....	3
3.3	Drive axle .....	4



## 3 Driveline/axle

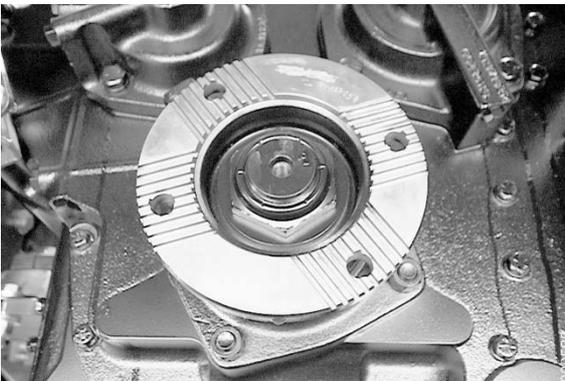
### 3.2 Propeller shaft

#### Universal drive shaft, description

The universal drive shaft transfers the engine power from the transmission to the drive axle. The universal drive shaft has two joints which mean that the engine and drive axle can move in relation to each other.

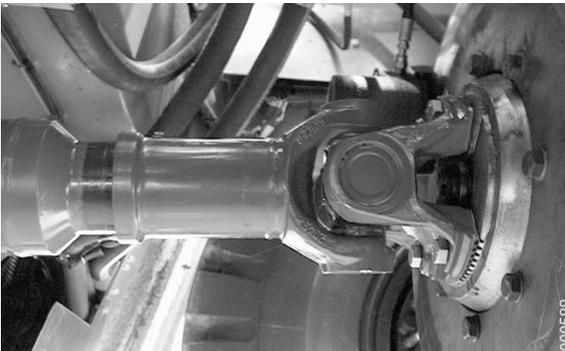
#### Universal drive shaft, replacement

- 1 Machine in service position, see section *B Safety*.
- 2 Clean the contact surfaces (cross-toothed) on the drive axle and gearbox.



- 3 Fit the universal drive shaft in position with the coupling upward.
- 4 Fit the universal drive shaft attaching bolts.

Tightening torque **200 Nm**. Retighten the attaching bolts after 50 hours operating time.



## 3.3 Drive axle

### Drive axle, general

#### Supplier documentation

The Workshop manual only describes components and work descriptions that concern installation in the machine. For descriptions and instructions for the drive axle's components and systems, refer to supplier documentation.

References to supplier documentation are only used in exceptional cases. If information about a component is missing, use the supplier documentation.

### Drive axle, changing

#### DANGER

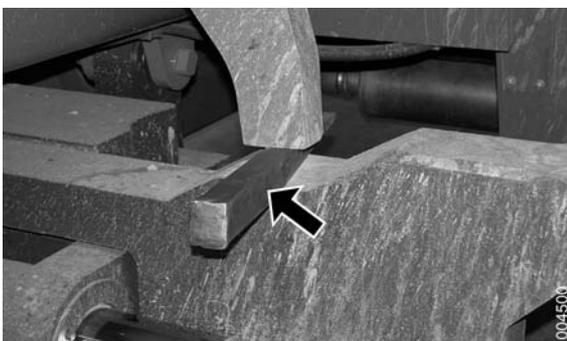
**Drive axle and machine are very heavy.**

**Risk of crushing!**

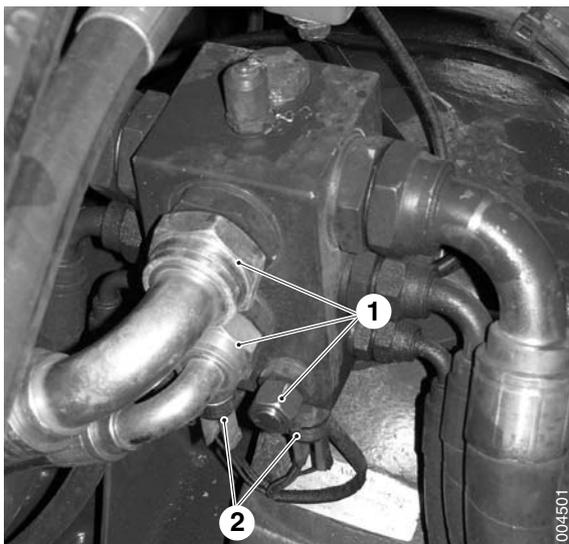
**It is forbidden to enter under a machine that is raised with a jack or similar. For machine weight, see section *F Technical data***



- 1 Park the machine with blocks behind the steering wheels.
- 2 Depressurize the brake and hydraulic systems, see tab *B Safety*.
- 3 Turn the start key to position 0, and turn off the main electric power.



- 4 Install wedges between the steering axle and frame.



- 5 Disconnect hydraulic hoses (position 1) and cabling (position 2) from the distribution block.

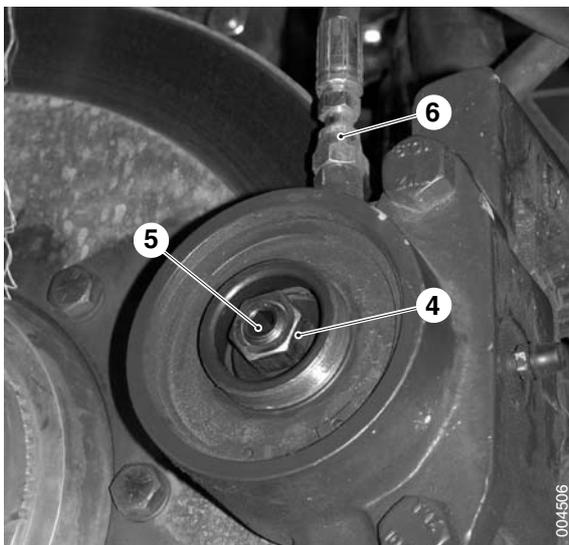
### NOTE

*Plug all connections immediately to protect the hydraulic system from impurities.*



- 6 Remove the casing (position 3) on the parking brake.

3. Casing parking brake



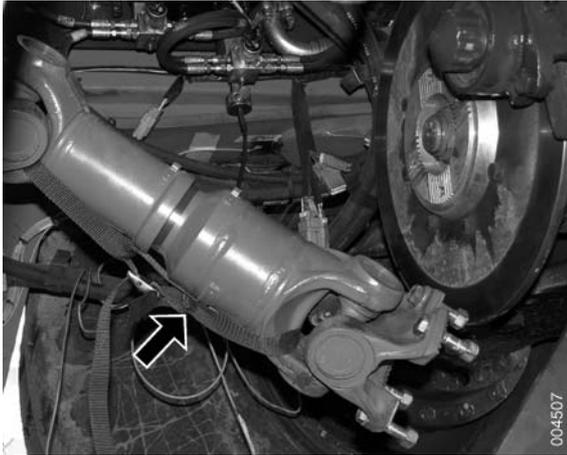
- 7 Loosen the lock nut (position 4) and screw in the screw (position 5), this compresses the brake spring. Screw until the brake pads release from the brake disc. Reinstall the casing on the parking brake (position 3).

- 8 Disconnect the hydraulic hose (position 6) from the parking brake.

### NOTE

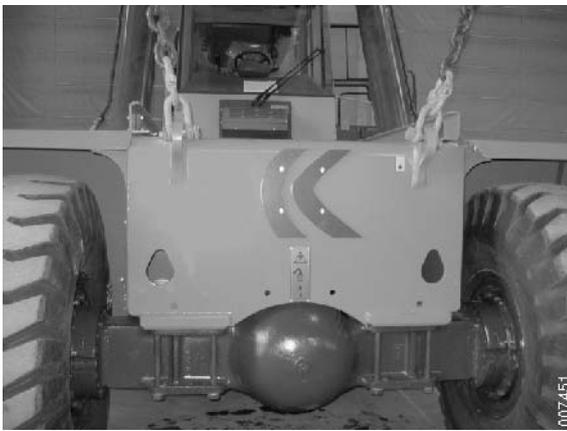
*Plug all connections immediately to protect the hydraulic system from impurities.*

4. Lock nut  
5. Release screw  
6. Hydraulic hose parking brake



Securing propeller shaft.

- 9 Disconnect the propeller shaft from the drive axle. Secure the propeller shaft, otherwise there is a risk that it will be pulled apart.



Lifting machine

- 10 Lift the machine so that the wheels are off the ground.
- 11 Remove the drive wheels from the drive axle.
- 12 Support the drive axle under the hubs.

### CAUTION

The drive axle may start to roll.

**Risk of crushing!**

**Make sure that the drive axle cannot make any uncontrolled movements.**

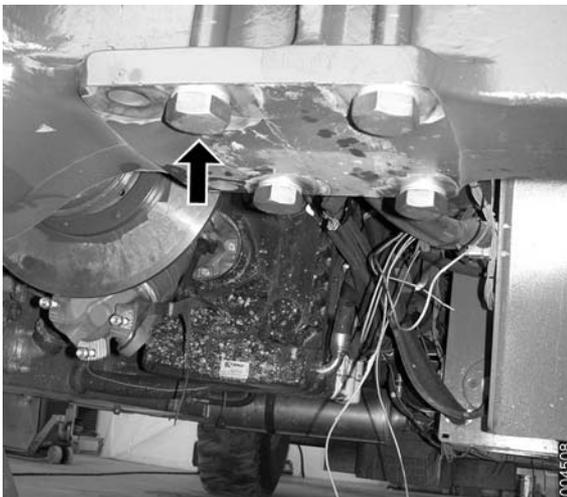
- 13 Remove the bolts that secure the drive axle in the frame.
- 14 Lift away the drive axle.

### CAUTION

The drive axle may start to roll.

**Risk of crushing!**

**Make sure that the drive axle cannot make any uncontrolled movements.**



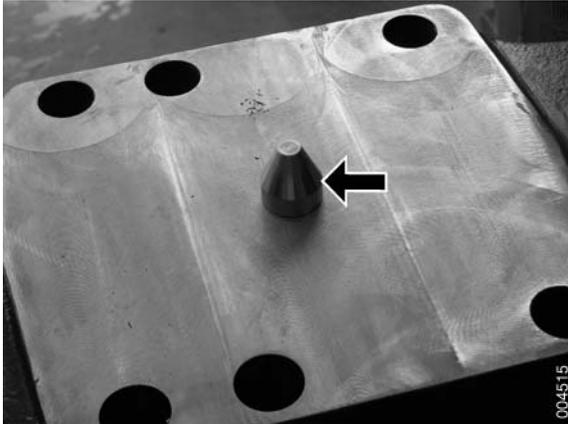
Attaching bolts drive axle

- 15 Transfer parts from the old drive axle to the new.

### NOTE

*Plug all connections immediately to protect the hydraulic system from impurities.*

- 16 Clean the contact surfaces on the drive axle and frame. Also clean the bolts' contact surface on the drive axle's underside.



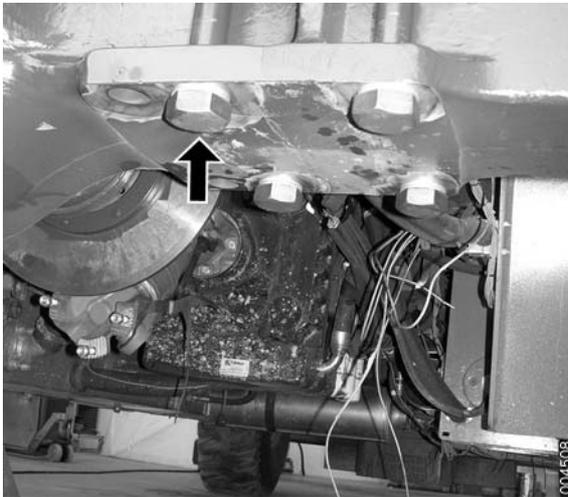
- 17 Remove the nuts for attaching the drive axle, blow clean and re-install the nuts.
- 18 Move guide pins from old to new axle.
- 19 Lift the drive axle into place under the frame.

## CAUTION

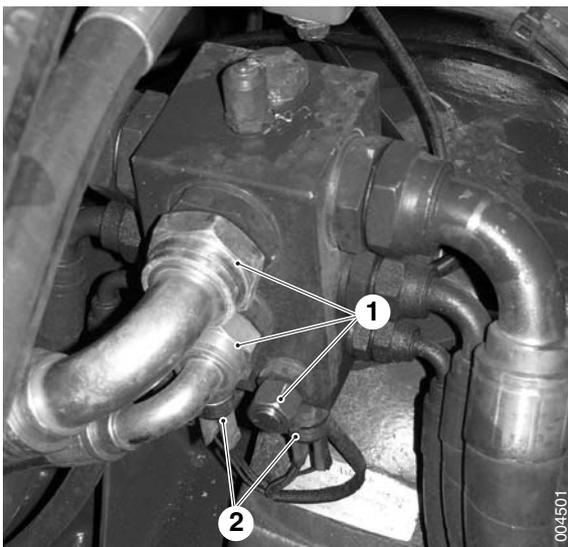
**The drive axle may start to roll.**

**Risk of crushing!**

**Make sure that the drive axle cannot make any uncontrolled movements.**



- 20 Lower the frame against the drive axle. Check that the guide pins fit in the frame.
- 21 Install the new bolts that secure the drive axle in the frame. Torque-tighten with **2350 Nm**.
- 22 Install the drive wheels on the new axle.
- 23 Rustproof the bolts with suitable paint.



- 24 Connect hydraulic hoses (position 1) and cabling (position 2) to the distribution block.
- 25 Connect the hydraulic hose to the parking brake, adjust the parking brake.
- 26 Connect the propeller shaft to the drive axle, torque-tighten the bolts with **200 Nm**. (Check-tighten the bolts after 50 operating hours).
- 27 Check oil level in the drive axle.
- 28 Start the machine and bleed the brakes, see tab *4 Brakes*, group *4.3.9 Wheel brakes*.
- 29 Check for leaks.



## Table of Contents 4 Brakes

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4.8.13	Pipes and hoses .....	43
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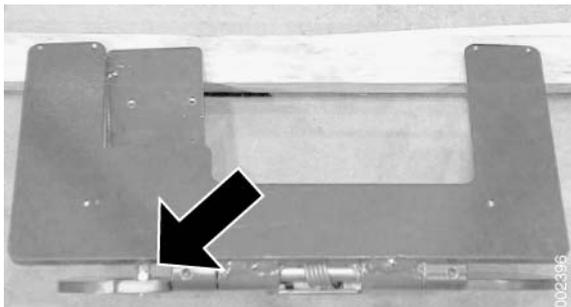
## 4 Brakes

### 4.1 Controls and instrumentation

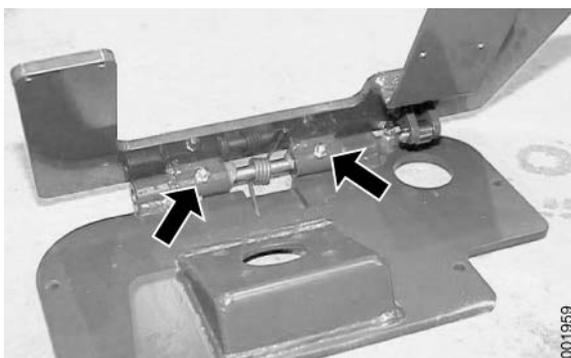
#### 4.1.1 Brake pedal

##### Brake pedal, checking and adjusting

- 1 Clean the floor around the brake pedal and check that nothing blocks movement of the brake pedal.
- 2 Check that the brake pedal really springs back and that the clearance between the brake pedal and brake valve is 1–1.5 mm. If needed, adjust the brake pedal's stop bolt so that the clearance is correct.
- 3 Check that the pedal's travel is smooth.



Set screw for adjusting clearance between brake pedal and brake valve. (Illustration shows loose brake pedal.)



Lubrication points, brake pedal. (Illustration shows loose brake pedal.)

- 4 Grease the pedal hinges with universal grease "EP2".
- 5 Check that the rubber on the brake pedal is complete and that the tread pattern is not worn. Change as needed.
- 6 Check the brake valve, see *Brake valve, checking page 18*.

##### Brake pedal, replacement

### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

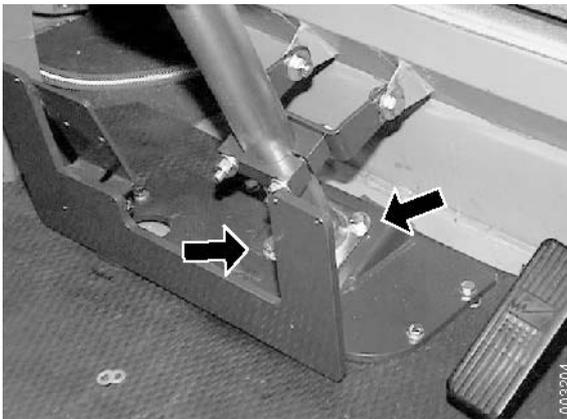
- 1 Turn off the engine and the main electrical power.
- 2 Depressurize the brake and hydraulic systems, see tab B Safety.
- 3 Detach the brake valve from the brake pedal.  
Secure the brake valve on the cab's underside and remove the brake valve attaching bolt.



- 4 Remove the panel around the steering wheel shaft.

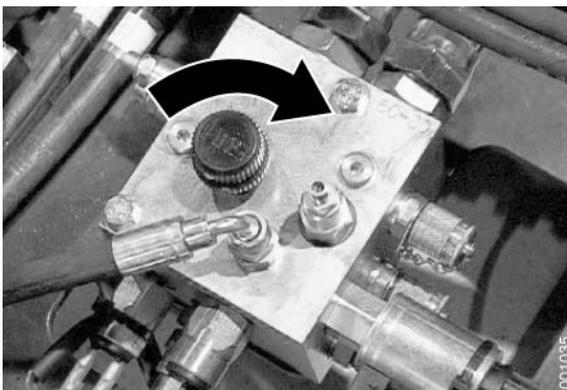
## NOTE

*There is a variant available with adjustable steering wheel shaft.*



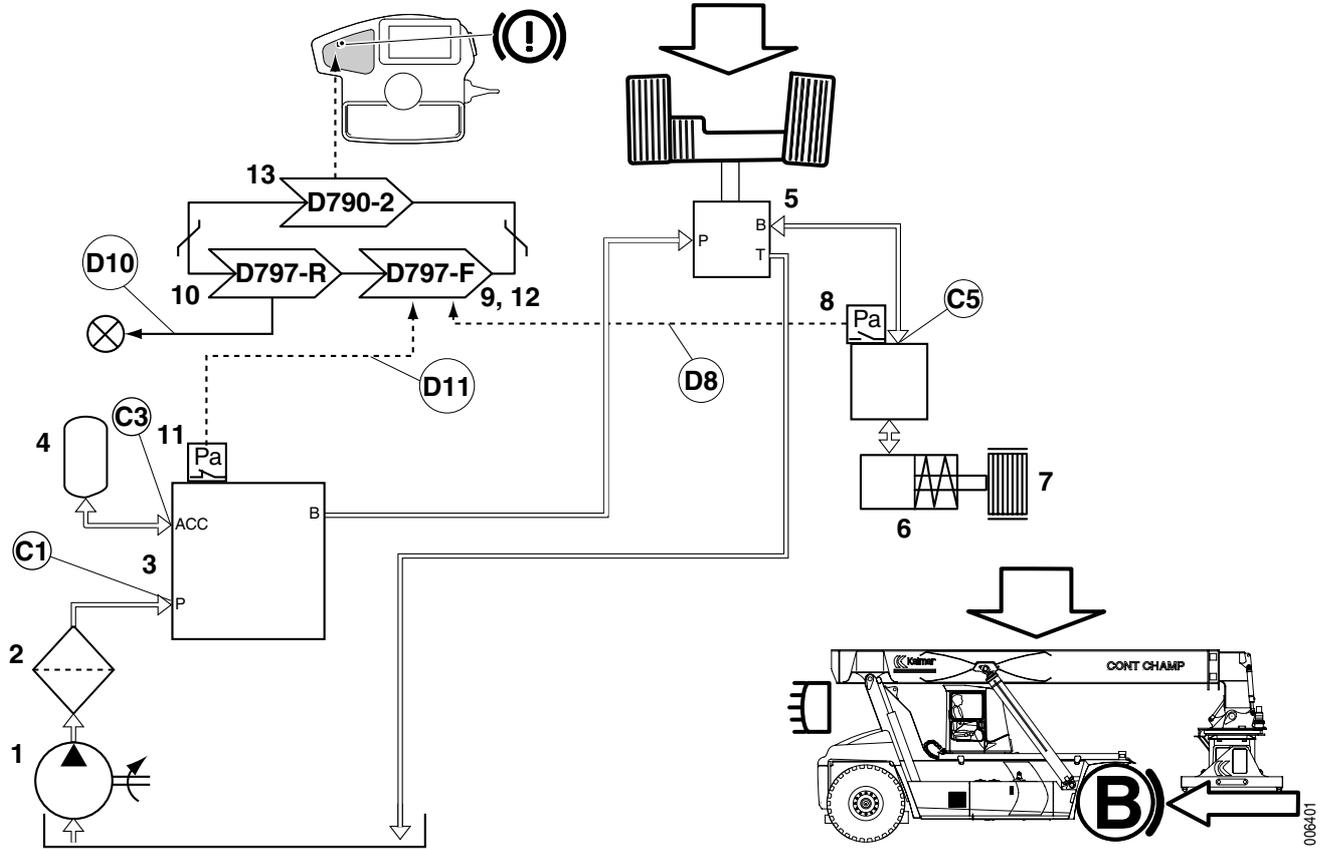
Mounting of steering wheel shaft and steering valve in pedal bracket.

- 5 Detach the steering valve from the pedal bracket.  
Secure the steering valve on the cab's underside. Remove the steering valve's attaching bolts. Pull down the valve slightly so that the steering axle releases from the steering valve.
- 6 Detach the steering wheel shaft from the brake pedal.  
Undo the bolts and pull the steering wheel shaft up slightly so that the brake pedal can be removed.
- 7 Detach the clutch pedal from the brake pedal.
- 8 Remove the brake pedal.  
Remove the brake pedal's attaching bolt and lift away the brake pedal.
- 9 Transfer the pedal rubber to the new pedal.
- 10 Fit the new brake pedal.  
Fit the pedal and fit the pedal's attaching bolts.
- 11 Connect the steering valve to the brake pedal.
- 12 Connect the brake valve to the brake pedal.
- 13 Fit the clutch pedal to the brake pedal.
- 14 Close the drain valve on the accumulator charging valve.
- 15 Grease and adjust the brake pedal, see *Brake pedal, checking and adjusting* page 3.



### 4.3 Service brake system

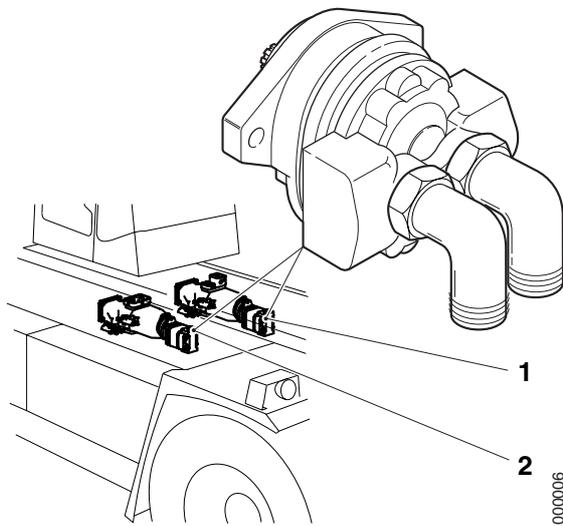
#### Power-assisted brake system, function description



Pos	Explanation	Signal description	Reference
1	The brake oil pump pumps oil from the brake tank.	$P = 20.5 \pm 1.0 \text{ MPa}$	<i>Brake oil tank, description page 36</i> <i>Brake oil pump, description page 7</i>
2	The brake oil filter cleans the oil.	-	<i>Brake oil filter, description page 42</i>
3	The accumulator charging valve directs oil to charging of accumulators or through the brake system's cooling circuit.	-	<i>Accumulator charging valve, description page 11</i>
4	The accumulators store oil pressure.	See pressure plate, Accumulator pressure brake system, on left-hand frame beam.	<i>Accumulator, description page 14</i>
5	The brake valve directs pressure from the accumulators to the brake cylinders proportional to pressing of the pedal.	-	<i>Brake valve, description page 18</i>
6	The brake cylinders compress the discs in the brake unit.	See pressure plate, Brake pressure, on left-hand frame beam.	<i>Wheel brake, description page 25</i>

Pos	Explanation	Signal description	Reference
7	The wheel brakes brake the machine.	-	<i>Wheel brake, description page 25</i>
8	Make-contact brake lights (S216) close the circuit when the brake cylinders are pressurised.	Brake pressure above 0.2 MPa: Conn 1, U = 24 V Conn 2, U = 24 V Brake pressure below 0.2 MPa: Conn 1, U = 24 V Conn 2, U = 0 V	<i>Make-contact brake lights, description page 23</i>  D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.5.4 <i>HYD</i> , menu 4
9	Control unit frame front (D797-F) sends brake light request on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i>
10	Brake lights are activated by Control unit frame rear (D797-R).	U = 24 V	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.6.4 <i>Brake lights</i>  D10: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.2.11 <i>LIGHTS</i> , menu 11
11	Breaking contact brake oil pressure (S204) opens the circuit if the pressure in the accumulators is low.	Brake pressure above 11.5 MPa: Conn 1, U = 24 V Conn 2, U = 24 V Brake pressure below 11.5 MPa: Conn 1, U = 24 V Conn 2, U = 0 V	<i>Break-contact (opening switch) brake pressure, description page 22</i>  D11: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.5.4 <i>HYD</i> , menu 4
12	Control unit frame front (D797-F) sends warning about low brake pressure on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i>
13	Control unit KIT (D790-2) activates Warning light brake pressure.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.11 <i>Control unit KIT</i>

Hydraulic diagram basic machine



1. Brake oil pump
2. Pump cooling and filtering, working hydraulics

### 4.3.1 Brake oil pump

#### Brake oil pump, description

The brake system has one gear pump with fixed displacement. The brake oil pump is located furthest forward on the left-hand main pump. The pump generates hydraulic force which is stored in an accumulator for braking force to servo brake and parking brake and also oil flow used for cleaning and cooling. Reconnection between power generation and flow is handled by the accumulator charging valve, see *Accumulator charging valve, description page 11*.

The brake oil pump is driven by the main pump shaft from the gearbox power take-off. The speed of the brake pump is directly dependent on engine speed. Pump flow increases with engine speed and varies with the speed of the input shaft.

#### NOTE

*It is very important that the clearance between gear wheels and housing is correct. Insufficient clearance causes wear damage. Too much clearance reduces the output of the pump.*

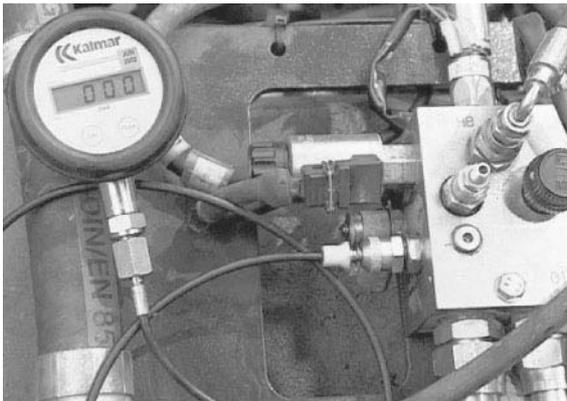
#### Brake oil pump, checking

#### NOTE

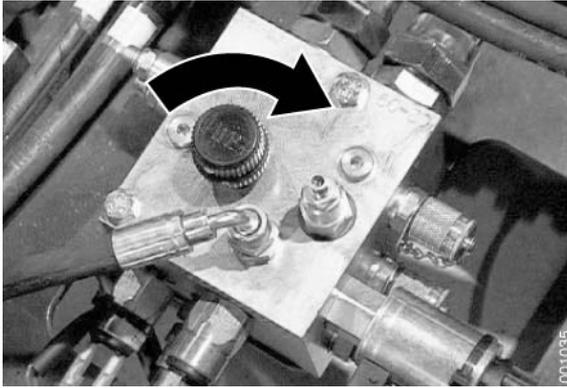
*Read the safety instructions for oil before work, see tab B Safety.*

#### Checking pump pressure

- 1 Operate and warm up the machine so that the oil in the brake system reaches operating temperature, at least 50 °C.
- 2 Machine in service position, see tab B Safety
- 3 Depressurize the brake and hydraulic systems, see tab B Safety.
- 4 Connect a pressure gauge (0–25 MPa) to the test outlet for pump pressure on the accumulator charging valve.
- 5 Start the engine and let it idle.



Pressure check connection pump pressure



Close the accumulator charging valve

- 6 Close the drain valve on the accumulator charging valve and check the pump pressure during charging.

During charging, the pressure shall increase to **20,5±1,0 MPa** before the accumulator charging valve switches to cooling. When the accumulator charging valve switches to cooling, the pressure drops.

- 7 Check the pressure during cooling.

During cooling the pressure should be **max. 1.0–1.5 MPa** at max. engine rpm.

- 8 Turn off the engine.

- 9 Depressurize the brake and hydraulic systems, see tab *B Safety*.

- 10 Remove the pressure gauge and fit the protective cap on the test outlet.

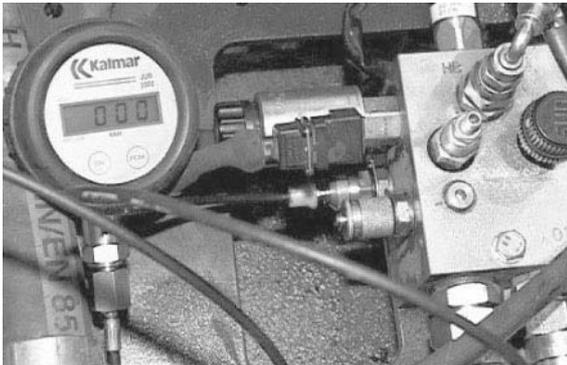
- 11 Close the drain valve on the accumulator charging valve.

### Checking accumulator charging

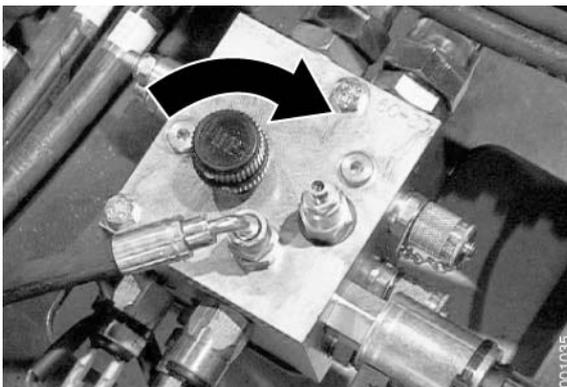
- 12 Depressurize the brake and hydraulic systems, see tab *B Safety*.

- 13 Connect a pressure gauge (0–25 MPa) to the measuring outlet for accumulator pressure on the accumulator charging valve.

- 14 Start the engine and let it idle.



Pressure check connection accumulator pressure



Close the accumulator charging valve

- 15 Close the drain valve on the accumulator charging valve.

- 16 Check that the pressure increases slowly to **20.5±1.0 MPa**.

- 17 Brake repeatedly and check at which pressure the accumulator charging valve switches to charging.

The valve shall switch to charging at **15.5±0.5 MPa**.

- 18 Depressurize the brake and hydraulic systems, see tab *B Safety*.

- 19 Remove the pressure gauge and fit the protective cap on the test outlet.

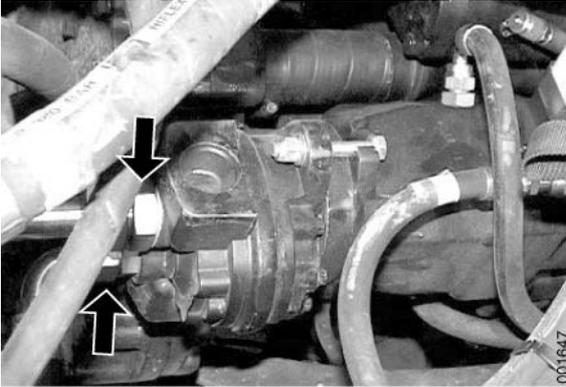
- 20 Close the drain valve on the accumulator charging valve.

## Brake oil pump, replacement

### NOTE

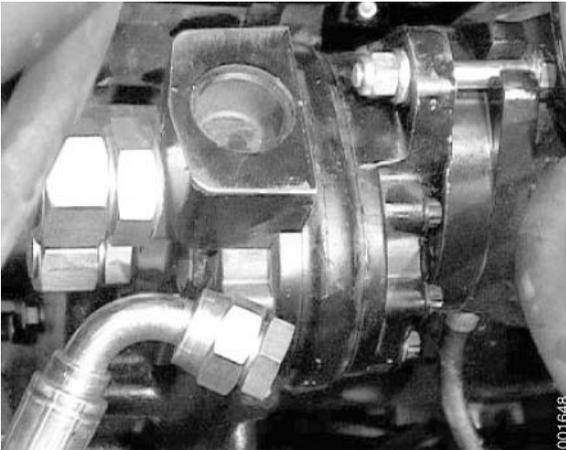
*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the brake and hydraulic systems, see tab B Safety.
- 3 Mark up and detach the hydraulic hoses from the pump.



### NOTE

*Plug all connections immediately to protect the brake system from impurities.*



- 4 Remove the attaching bolts, pull the pump out backwards and lift it away.
- 5 Transfer the connection adapters to the new pump.



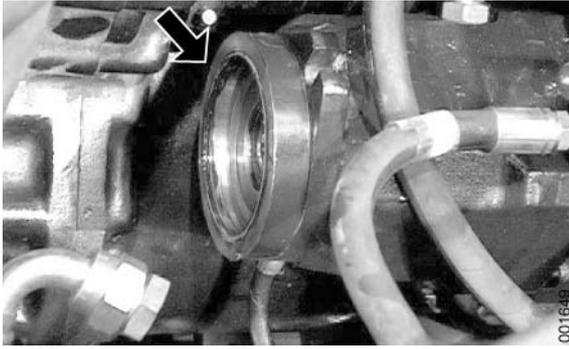
- 6 Remove the spacer ring from the brake pump or the hydraulic oil pump.

*Clean the O-rings' contact surfaces on the spacer ring.*

- 7 Check the O-rings, change as needed. Install the O-rings on the spacer ring. Apply sealant silicone on the sealing surface facing the brake pump, see tab F Technical data.

### NOTE

*Use silicone only on the side facing the the brake pump.*



- 8 Fit the spacer ring to the main pump.

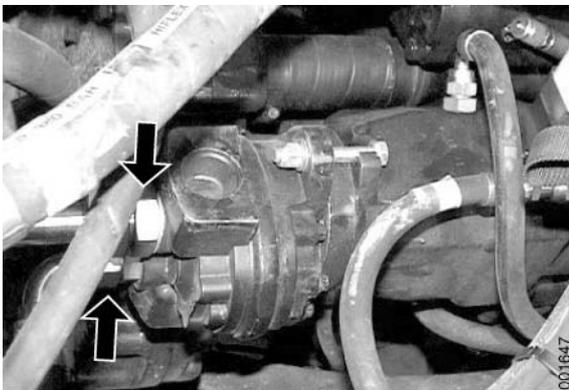


- 9 Apply sealant silicone on the brake pump's sealing surface facing the spacer ring, see tab *F Technical data*.

- 10 Fit the brake pump to the main pump.

Place the pump and check that the gear wheel engages in the shaft and that the spacer ring is straight against the brake pump.

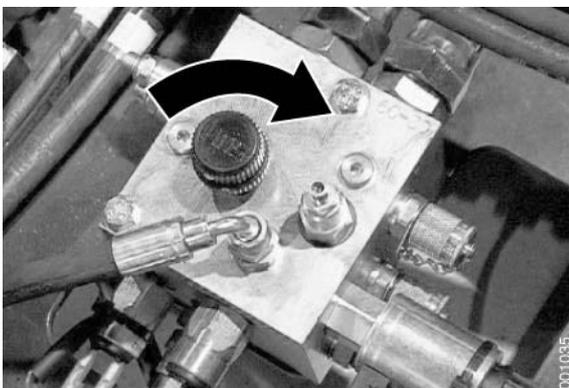
Fit the pump's attaching bolts.



- 11 Connect the hydraulic hoses to the brake pump.

## NOTE

*Check that the O-rings are intact and are fitted correctly.*



- 12 Close the drain valve on the accumulator charging valve.

- 13 Turn on the main electrical power and start the engine.

- 14 Check that the hose connections and the seal between hydraulic oil pump and brake pump are sealed tightly.

Check the feed pressure from the brake pump, see *Brake oil pump, checking page 7*.

- 15 Check the oil level in the brake system, fill as necessary.

## NOTE

*If the pump is replaced due to breakdown then change the oil and filter in the brake system as well.*

### 4.3.2 Brake oil filter

#### Brake oil filter, general

See *Brake oil filter, description page 42*.

### 4.3.3 Accumulator charging valve

#### Accumulator charging valve, description

The accumulator charging valve distributes oil from the brake oil pump between pressure storage and cooling of the wheel brakes. The accumulator charging valve is located on the beam in front of the transmission in the engine compartment.

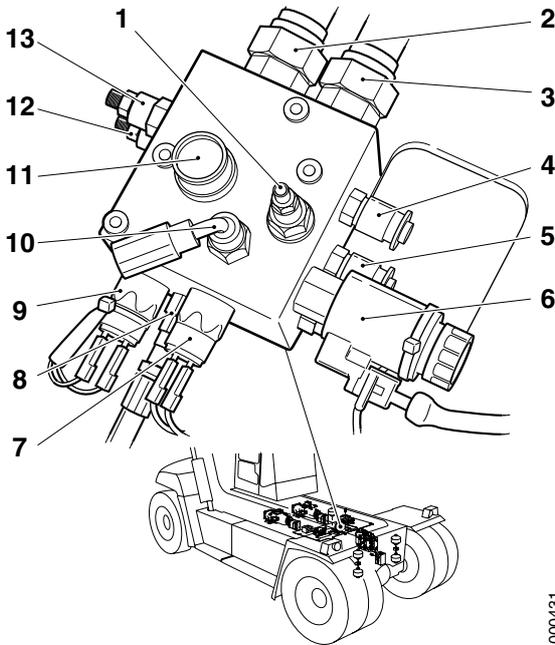
The accumulator charging valve stores pressure by means of controlling the oil to the accumulators. The wheel brakes are cooled by means of oil directed to the drive axle cooling circuit and then on to the brake system cooler.

The accumulator charging valve prioritises charging of the accumulators above cooling. A restriction of the charging means that a small quantity of oil also flows to cooling during accumulator charging. At idling speed the flow from the pump is so small that all oil flows to pressure storage.

The drain valve (position 11) is used to drain the pressure in the accumulators to the tank. The valve opens a connection between the accumulators and the wheel brake's cooling circuit. The oil is drained through the wheel brake to the tank.

There is a measuring outlet for measuring accumulator pressure (position 5) and pump pressure (position 4) on the accumulator charging valve. The pressures are individual to each machine and are on the pressure plate on the left-hand frame beam, see section *10 Common hydraulics*. On the accumulator charging valve, there is also a solenoid valve, parking brake (position 6), make-contact brake oil pressure (position 9) and make-contact parking brake (position 7).

- *Solenoid valve parking brake, description page 30*
- *Make-contact brake lights, description page 23*
- *Break-contact parking brake, description page 34*



1. Safety valve
2. Connection from pump (P)
3. Connection wheel brake (T)
4. Measuring outlet, pump pressure (P)
5. Measuring outlet, accumulator pressure (M)
6. Solenoid valve, parking brake (Y642)
7. Make-contact, parking brake (GHB) (S260)
8. Connection accumulators (ACC)
9. Make-contact, brake oil pressure (LB) (S204)
10. Connection parking brake caliper (HB)
11. Drain valve
12. Main valve charging
13. Pressure limiting valve

000431

## Accumulator charging, checking and adjustment

### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

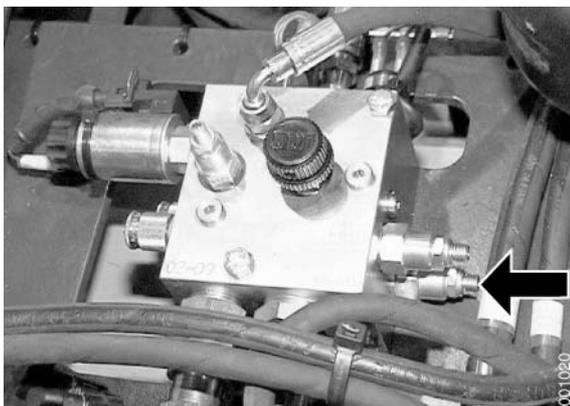
- 1 Machine in service position, see tab B Safety.
- 2 Check accumulator charging, see *Brake oil pump, checking page 7*.
- 3 If necessary, adjust the accumulator charging pressure on the pressure limiting slide.

Undo the lock nut and adjust the pressure by turning the adjusting screw.

**Clockwise:** reduce pressure.

**Counter-clockwise:** increase pressure.

- 4 Open the drain valve on the accumulator charging valve so that the accumulators are drained and the valve switches to charging. Close the valves and check the max. pressure again.
- 5 Repeat steps 3 and 4 until the pressure is correct.



Adjusting screw accumulator charging pressure

## Accumulator charging valve, replacement

### NOTE

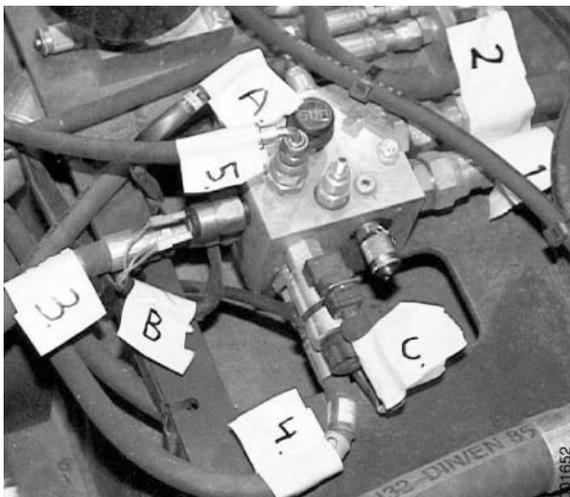
*Read the safety instructions for oil before work, see tab B Safety.*

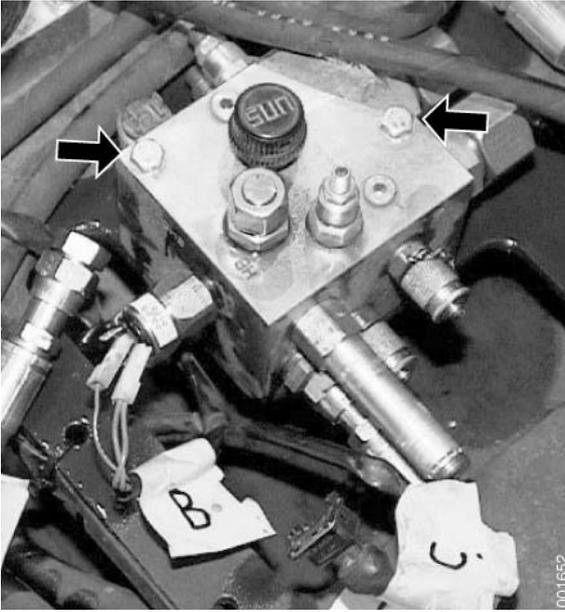
- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the brake and hydraulic systems, see tab B Safety.
- 3 Mark up hydraulic hoses and electric cables.
- 4 Detach the wiring from the accumulator charging valve.
- 5 Detach and plug all hydraulic hoses from the accumulator charging valve.

Remove the parking brake valve (C) for easier access.

### NOTE

*Plug all connections immediately to protect the brake system from impurities.*





- 6 Remove the accumulator charging valve.
- 7 Transfer the connection adapters and sensors to the new accumulator charging valve.
- 8 Fit the new valve.

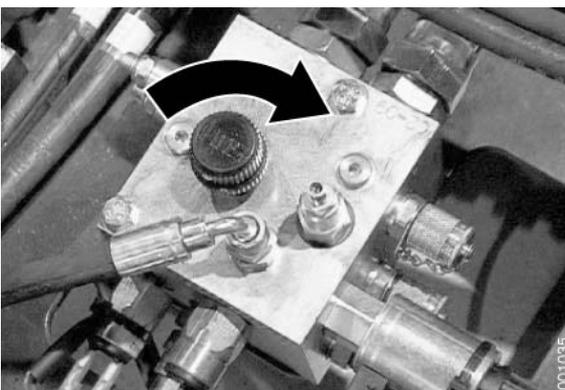


- 9 Connect the hoses to the accumulator charging valve according to marking.

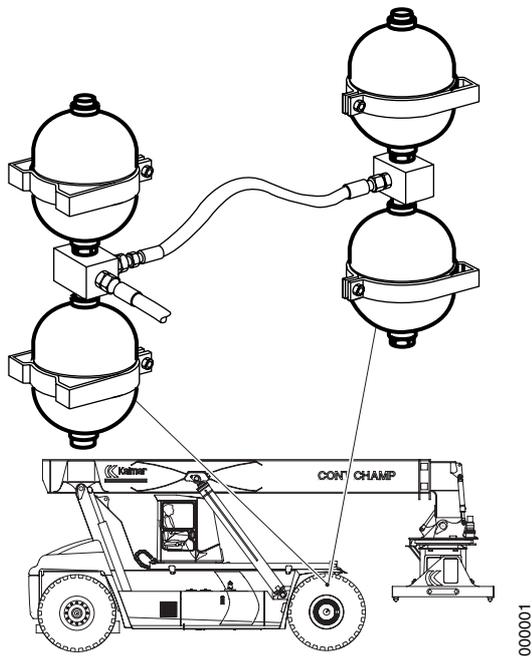
### NOTE

*Check that the O-rings are intact and are fitted correctly.*

- 10 Fit the parking brake valve and make-contact parking brake.
- 11 Connect the wiring to the accumulator charging valve.



- 12 Close the drain valve on the accumulator charging valve.
- 13 Turn on the main electrical power and start the engine.  
Check that the hydraulic connections are sealed tightly.
- 14 Check the charging and changing function, see *Accumulator charging, checking and adjustment page 12*.



### 4.3.4 Accumulator

#### Accumulator, description

The accumulators store pressure so that there is a pressure reserve in the event of the engine stopping or faults in the brake system. The brake system has four accumulators connected in parallel which are located furthest forward in the engine bay, above the drive axle.

The accumulators are the diaphragm type. Each accumulator is divided into two spaces by a membrane. One side of the diaphragm is pressurised with nitrogen gas. The other side is pressurised by hydraulic oil which compacts the nitrogen gas.

The accumulator has a test outlet for checking gas pressure on the side opposite to the pressure connection.

#### Accumulator, checking

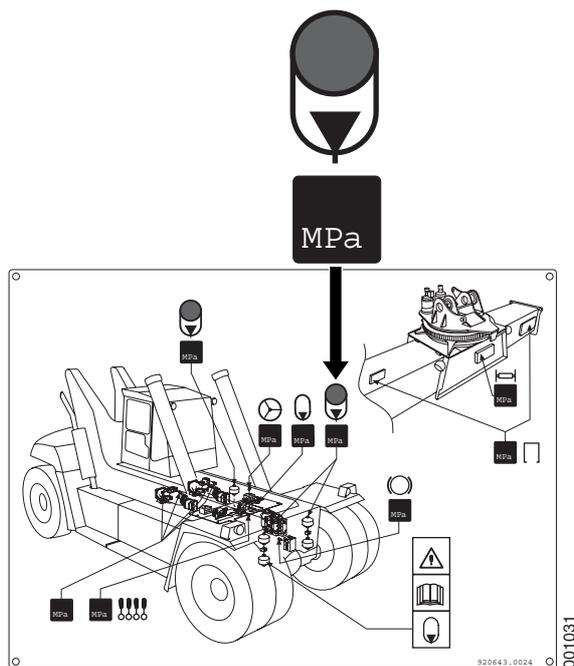
##### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the brake and hydraulic systems, see tab B Safety.
- 3 The accumulators can be tested with separate test equipment or in the machine. Primarily, separate test equipment should be used since it is faster and more exact.

Test equipment can be ordered from Kalmar Industries AB.

- **Test with test equipment:** continue with step 4.
- **Test in machine:** continue with step 6.



Pressure plate, gas pressure brake accumulators

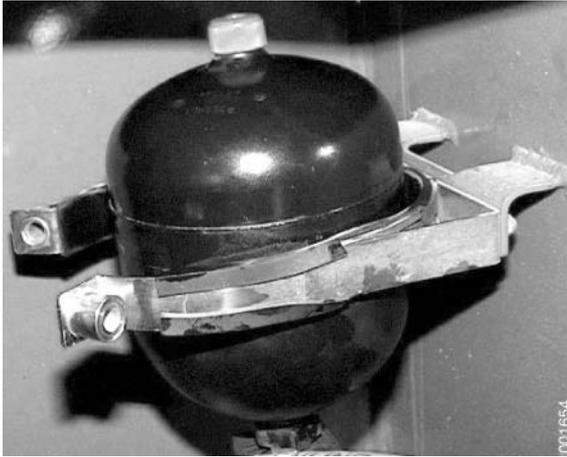


### Checking with test equipment

- 4 Remove the accumulators and test them with the intended test equipment.  
The accumulators' gas pressure should match with the pressure plate.
- 5 Continue with step 17.

### Checking in machine

- 6 Loosen three of the accumulators from the distribution blocks. Plug the connections on the distribution blocks with plugs that can handle high pressure. Plug the connections on the accumulators to protect from impurities.
- 7 Connect a pressure gauge (0–25 MPa) to the measuring outlet for accumulator pressure on the accumulator charging valve.
- 8 Turn on the main electrical power and start the engine.
- 9 Close the drain valve on the accumulator charging valve and charge the accumulator until the accumulator charging valve changes to cooling.
- 10 Check that the plugs remain sealed.
- 11 Turn off the engine.
- 12 Lower the pressure by means of braking carefully several times while checking the pressure on the pressure gauge.  
When the pressure reaches **approx. 10 MPa** the pressure must decrease immediately to 0 MPa.  
If the pressure drops immediately when the engine is shut off, then the accumulator does not have any pre-charge pressure. This indicates internal leakage and the accumulator must be changed.  
If the pressure can be reduced slowly to a pressure below **10 MPa** then the precharge pressure is too low and the accumulator must be replaced or given to authorised personnel for maintenance.
- 13 Depressurize the brake and hydraulic systems, see tab *B Safety*.



- 14 Mark up and disconnect the tested accumulator. Plug the connections. Connect one of the other accumulators to the distribution block.
- 15 Repeat steps 8 - 14 until all accumulators have been checked.
- 16 Depressurize the brake and hydraulic systems, see tab *B Safety*.

### Installing and final checking

- 17 Connect all accumulators to the distribution blocks. If needed, change or fill defective accumulators.

### NOTE

*Check that the seals are intact and are fitted correctly.*

- 18 Turn on the main electrical power and start the engine.
- 19 Close the drain valve on the accumulator charging valve so that the accumulators are charged.
- 20 Check that the accumulators' connections are sealed tightly.
- 21 When the accumulators are fully charged, shut off the engine and turn the start key to position I.
- 22 Check that at least **8** brake applications (pedal depressions) can be performed before the pressure drops to **10 MPa**.

At **11.5 MPa** the warning lamp for low brake pressure must come on.

### Accumulator, replacement

### NOTE

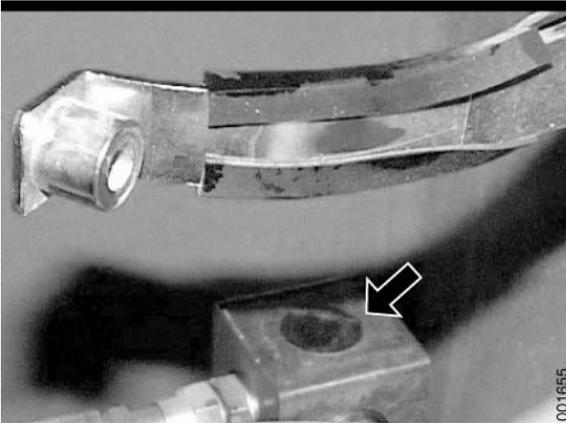
*Read the safety instructions for oil before work, see tab *B Safety*.*

- 1 Machine in service position, see tab *B Safety*.
- 2 Turn off the engine and the main electrical power.
- 3 Depressurize the brake and hydraulic systems, see tab *B Safety*.
- 4 Detach the accumulator's clamp and remove the bolt.
- 5 Detach the accumulator from the distribution block.

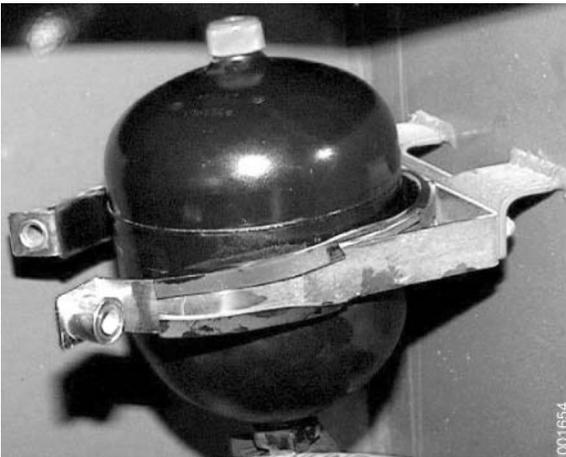
### NOTE

*Hold the block firmly so that the other accumulator does not work loose.*





- 6 Bend the clamp away and remove the accumulator.

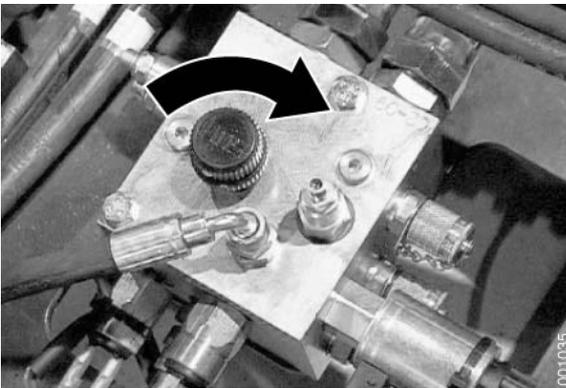


- 7 Fit the new accumulator.

### NOTE

*Check that the seal is intact and is fitted correctly.*

- 8 Secure the accumulator's clamp and tighten the bolt.



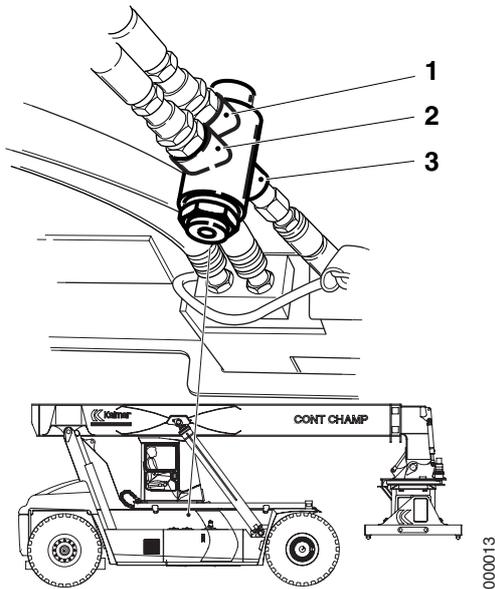
- 9 Close the drain valve on the accumulator charging valve.  
 10 Turn on the main electrical power and start the engine.  
 11 Check that the accumulator's connection is sealed tightly.  
 12 Check pre-charging and function, see *Accumulator, checking* page 14 steps 18-19.

### 4.3.5 Brake valve

#### Brake valve, description

The brake valve, which is located on the underside of the cab underneath the brake pedal, controls the hydraulic pressure to the brakes. A lever transfers the force from the pedal to the valve.

The brake valve is a mechanically activated proportional valve, this means that the pressure in the brake valve increases proportionally to the brake pressure. This provides optimum pedal responsiveness and increased safety as the operator senses if no brake pressure is being built up (no resistance in the pedal).



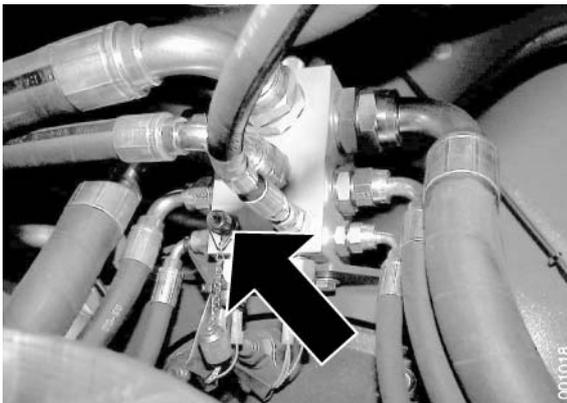
1. Inlet from accumulators [P]
2. Return connection [T]
3. Outlet to brake cylinders [B]

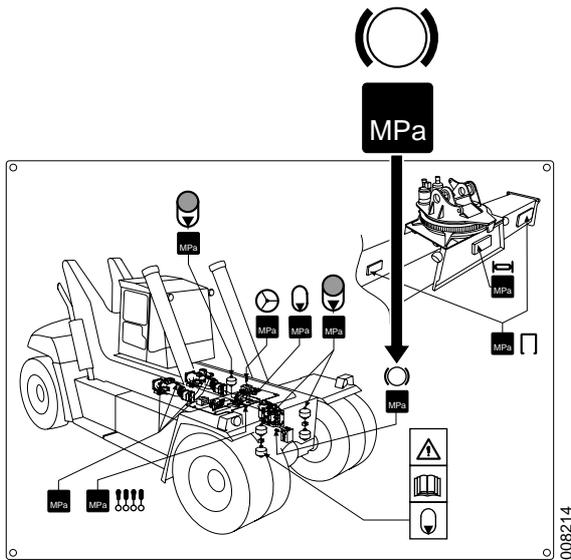
#### Brake valve, checking

#### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Operate and warm up the machine so that the brake oil reaches operating temperature, at least 50 °C.
- 2 Machine in service position, see tab B Safety.
- 3 Depressurize the brake and hydraulic systems, see tab B Safety.
- 4 Connect a pressure gauge (0-25 MPa) to the measuring outlet for brake pressure on the distribution block on the front axle.
- 5 Close the drain valve on the accumulator charging valve.
- 6 Start the machine and run it at idling speed until the accumulators are charged and the accumulator charging valve changes to cooling.
- 7 Press down the pedal completely and read off the pressure. Compare to the pressure plate on the left frame member.
- 8 Turn off the engine.





- 9 Depress the pedal fully and keep it pressed down, check the pressure.  
The brake pressure must correspond with the value specified on the pressure plate and must not decrease from this value for 15 seconds.
- 10 Release the pedal, the brake pressure should drop to 0 MPa immediately. Otherwise the brake valve leaks and may cause the brake to be applied and overheat during operation.  
Replace the brake valve if it is not sealed.
- 11 Depressurize the brake and hydraulic systems, see tab *B Safety*.
- 12 Remove the pressure gauge and fit the protective cap on the measuring outlet.
- 13 Close the drain valve on the accumulator charging valve.

### Brake valve, replacement

#### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Slide the cab forward slightly so that the brake valve is accessible underneath the cab.
- 2 Machine in service position, see tab *B Safety*.
- 3 Depressurize the brake and hydraulic systems, see tab *B Safety*.
- 4 Mark up and detach the hydraulic hoses from the brake valve.

#### NOTE

*Plug the connections immediately to protect the brake system from impurities.*

- 5 Secure the brake valve under the cab.



- 6 Remove the brake valve attaching bolt.
- 7 Remove the brake valve.
- 8 Transfer the connection adapters to the new brake valve.
- 9 Install the new brake valve.

#### NOTE

*Remember the spacer ring.*



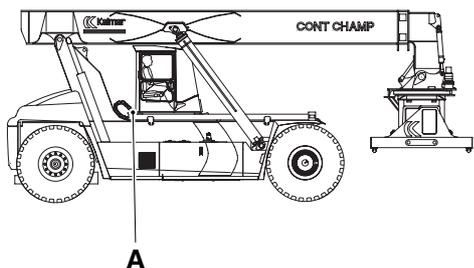
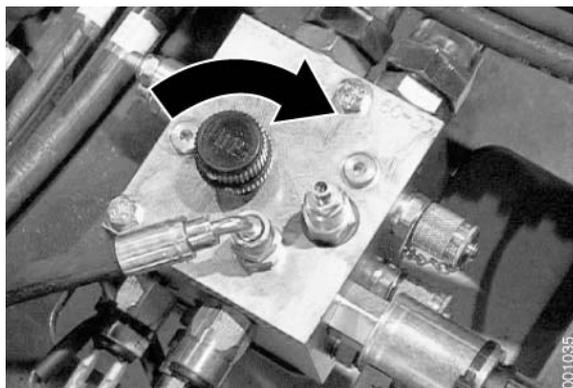


- 10 Connect the hydraulic hoses to the brake valve in accordance with the marking.

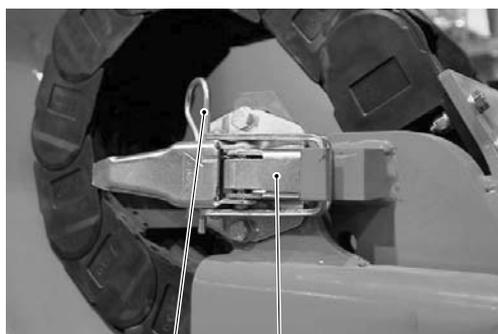
### NOTE

*Check that the O-rings are intact and are fitted correctly.*

- 11 Grease and adjust the brake pedal, see *Brake pedal, checking and adjusting page 3*.
- 12 Close the drain valve on the accumulator charging valve.



- 13 On machines with manual sliding cab. Secure the cab in the rear position with the cab locks.
- 14 Turn on the main electrical power and start the engine. Let the engine idle.
- 15 Test the brakes a couple of times.
- 16 Check that the brake valve's connections are sealed tightly.
- 17 Bleed the wheel brakes' brake cylinders, see *Wheel brakes, bleeding page 26*.



**B**      **C**

- A. Lock handle location  
 B. Lock pin  
 C. Lock handle for securing cab

### 4.3.6 Drive axle block

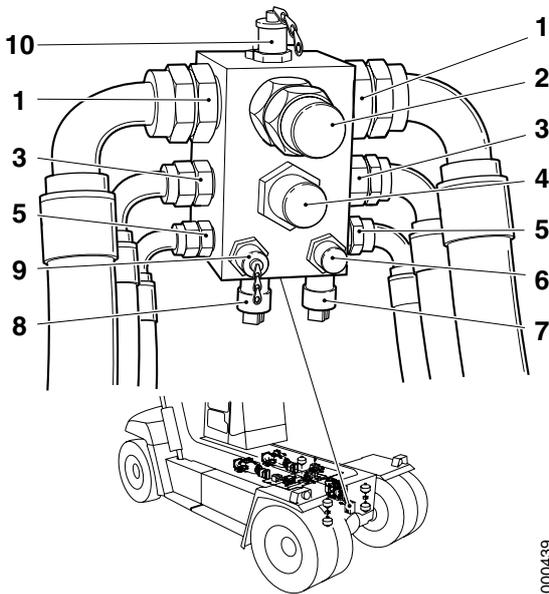
#### Drive axle block, description

The drive axle block distributes the oil flow and brake pressure to the right and left-hand wheel brakes. The drive axle block is located on a bracket above the drive axle differential.

The drive axle block has a measuring outlet for brake pressure and for measuring back pressure in the disc brake's cooling circuit.

The drive axle block has a bypass valve which guides oil directly from the cooling circuit's input to the cooling circuit's return if the resistance in the axle becomes too great. This protects the wheel brake seals, e.g. when the oil is cold.

There are two contacts in the drive axle block, make-contact brake lights (216), see *Make-contact brake lights, description page 23* and make-contact declutch, see tab 2 *Transmission, group 2.8.2 Breaking contact declutch*.



000439

1. Connection brake cooling, return from wheel brake
2. Connection brake cooling, return to cooler
3. Connection brake cooling, to wheel brake
4. Connection brake cooling, from accumulator charging valve
5. Connection brake cylinder, to wheel brake
6. Connection brake pressure, from brake valve
7. Make-contact, declutch (S220)
8. Make-contact, brake lights (S216)
9. Measuring outlet, brake pressure
10. Measuring outlet, back pressure brake cooling

### 4.3.7 Breaking contact brake pressure

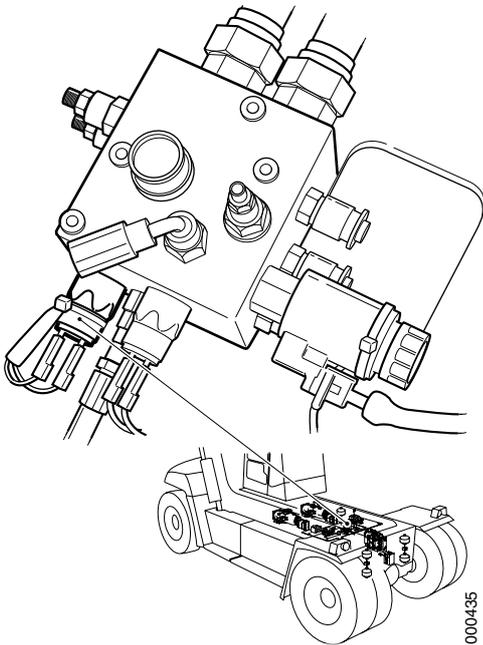
#### Break-contact (opening switch) brake pressure, description

Break-contact brake pressure (S204) senses the pressure in the accumulators. The break-contact is located on the accumulator charging valve on the lift beam in front of the transmission in the engine compartment.

When the pressure in the feed circuit is high enough to ensure braking of the machine, the sensor closes an electric circuit. This is used to warn for pressure-drop in the brake system. The sensor's opening pressure is chosen so that there is pressure for at least 8 brake applications without additional feed from the pump after the light has gone off.

Break-contact brake pressure (S204) is supplied with voltage by Control unit frame front (D797-F). When the pressure increases above the cut-off pressure, then the voltage signal to Control unit frame front (D797-F) is cut off.

The signal can be checked from the diagnostic menu, see tab 8 *Control and monitoring system*, group 8.4.5.4 *HYD*, menu 4.

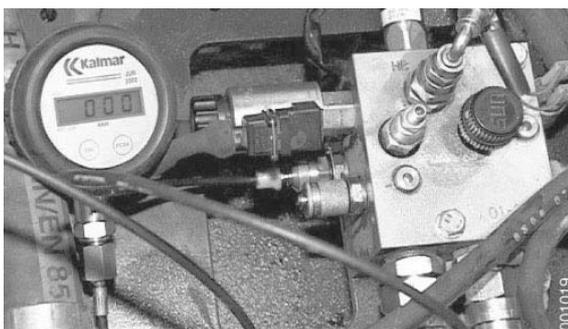


#### Break-contact brake pressure, adjusting

##### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Operate and warm up the machine until the oil reaches operating temperature, at least 50 °C.
- 2 Machine in service position, see tab B Safety.
- 3 Depressurize the brake and hydraulic systems, see tab B Safety.
- 4 Connect a pressure gauge (0-25 MPa) to the measuring outlet for accumulator pressure on the accumulator charging valve.
- 5 Close the drain valve on the accumulator charging valve.
- 6 Start the engine and fully charge the accumulators (the accumulator charging valve changes to cooling).
- 7 Turn off the engine and turn the start key to position I.
- 8 Brake several times, stop when the warning lamp for low brake pressure comes on.
- 9 Read off the accumulator pressure. The pressure should be **approx. 11.5 MPa**.



- 10 If necessary, adjust the warning level by turning the adjusting screw in the rear edge of the sensor, between the contact pins.

## NOTE

*The setting is very sensitive, turn max. 1/4 turn at a time.*

- 11 Repeat steps 6-10 until the warning lamp comes on at 11.5 MPa.
- 12 Seal the adjusting screw with locking fluid.
- 13 Depressurize the brake and hydraulic systems, see tab *B Safety*.
- 14 Remove the pressure gauge and fit the protective cap on the measuring outlet.
- 15 Close the drain valve on the accumulator charging valve.

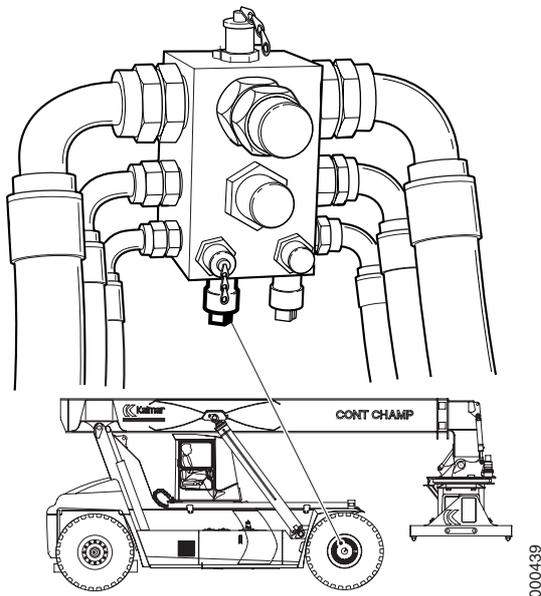
## 4.3.8 Making contact brake light

### Make-contact brake lights, description

Make-contact brake lights controls brake light activation when the machine brakes. The contact is located on the drive axle block which is located on a bracket above the drive axle differential.

Make-contact brake lights (S216) is supplied with and sends a voltage signal to Control unit frame front (D797-F). When the pressure increases above the final pressure, a voltage signal is sent to Control unit frame front (D797-F).

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.5.4 *HYD*, menu 4.

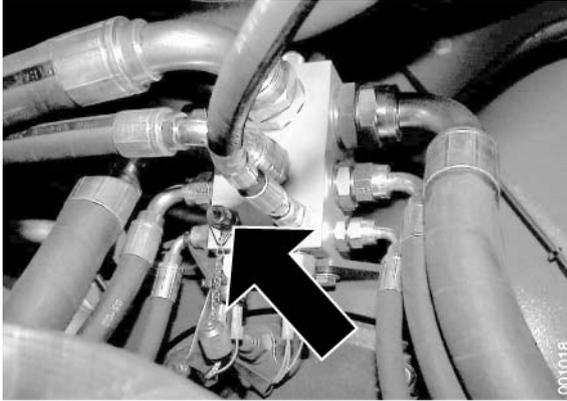


## Make-contact, brake lights, checking

### NOTE

Read the safety instructions for oil before work, see tab B Safety.

- 1 Operate and warm up the machine until the brake oil reaches operating temperature, at least 50 °C.
- 2 Turn off the engine and turn the start key to position I.
- 3 Brake and check that the brake light comes on.
- 4 Depressurize the brake and hydraulic systems, see tab B Safety.
- 5 Connect a pressure gauge (0-25 MPa) to the measuring outlet for brake pressure on the distribution block.
- 6 Close the drain valve on the accumulator charging valve.
- 7 Start the engine.



DIAG HYD	4 (6)
PRESSURE SWITCHES	
BRAKE PRESSURE	X
BRAKE LIGHT PRESS.	X
DECLUTCH PRESSURE	X

000144

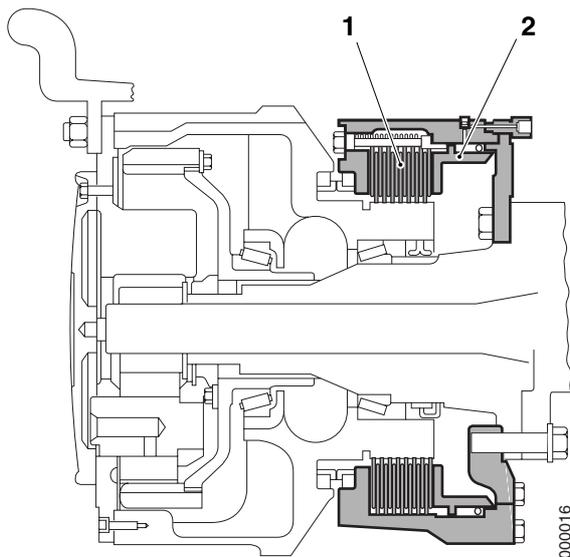
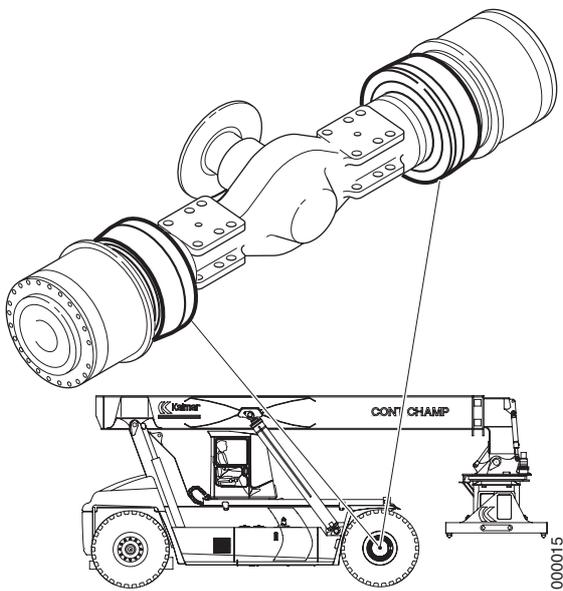
- 8 Use the display, go to the diagnostic menu, see section 8 Control and monitoring system, group 8.4.5.4 HYD, menu 4.  
BRAKE LIGHT PRESS. indicates status for the brake light contact. 1 = Activated contact (brakes applied).
- 9 Press down the brake pedal slowly until the brake light is activated or the status of the input signal changes. Keep the pedal in this position and check the pressure on the pressure gauge.  
The status can be changed and the brake light should come on when the pressure is **approx. 0.2 MPa**.
- 10 Turn off the engine.
- 11 Depressurize the brake and hydraulic systems, see tab B Safety.
- 12 Remove the pressure gauge and fit the protective cap on the measuring outlet.
- 13 Close the drain valve on the accumulator charging valve.

### 4.3.9 Wheel brakes

#### Wheel brake, description

The wheel brakes brake the machine during operation and are located on the drive axle between the drive axle housing and hub reduction.

The wheel brake uses so-called wet disc brakes WDB (Wet Disc Brakes). Wet disc brakes require minimal maintenance and have long life due to effective cooling. Maintenance requirements are minimised since oil circulates in the brake system and prevents corrosion.



The wheel brakes have two main sections, disc package and brake cylinder. The disc package performs the braking. The brake cylinder presses the discs in the disc package together at braking.

Wheel hub and brake, cross section

1. Disc package
2. Brake cylinder

## Wheel brakes, bleeding

### NOTE

Read the safety instructions for oil before work, see tab B Safety.

## IMPORTANT

**Both brake cylinder and disc brake must be bled after work where the brake system is opened or after work on the wheel brake.**

### Brake cylinder

- 1 Machine in service position, see tab B Safety.
- 2 Place a ring spanner on the bleed nipple and connect a transparent hose to the bleed nipple.  
Lead the other end of the hose down into a collection container.
- 3 Start the machine and press down on the brake pedal, keep the pedal pressed down.
- 4 Open the bleed nipple and allow oil to run out of it until the oil is free of air bubbles.

### NOTE

The hydraulic hose between the brake pedal and brake is approx. 7 metres long. Therefore, allow at least two litres of oil to pass through the air bleeder nipple when bleeding to ensure that no air pockets remain in the system.

- 5 Close the bleed nipple.
- 6 Move the spanner and hose and repeat steps 1–4 on the other side.

### Disc brake

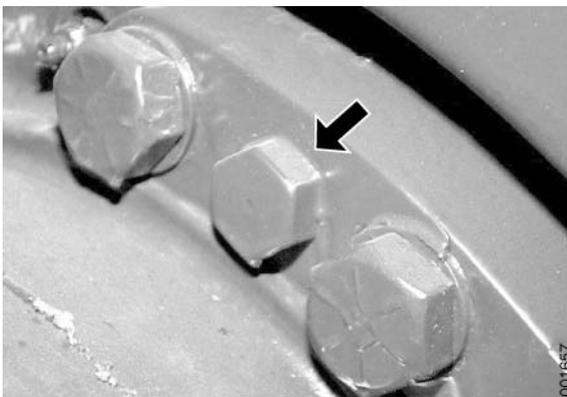
### NOTE

Bleeding the disc brake is vital for correct cooling of the discs.

- 1 Start the engine and run the engine at idling speed. Wait until the brake accumulators are fully charged and the accumulator charging valve has changed to brake cooling.
- 2 Remove the air bleeder screw for the disc brake and let oil flow out of the hole until the oil is free from air bubbles. Install the air bleeder screw.
- 3 Repeat steps 1-3 on the other wheel.
- 4 Check the oil level in the brake system, fill as necessary.



Bleed nipple, brake cylinder, on top of the drive axle at the wheel hub's inner short side (left-hand side).



Bleed nipple, disc brake, on top of the drive axle at the wheel hub's inner short side (left-hand side).

## Wheel brake, replacement

See *supplier documentation drive axle*.

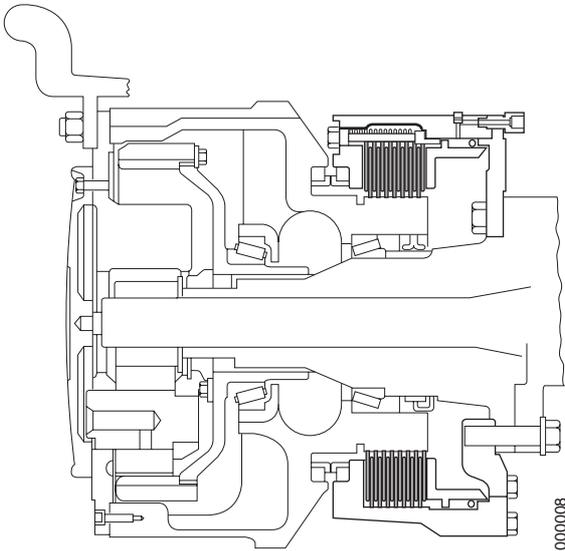
### 4.3.9.1 Disc pack

#### Disc pack, description

The disc package consists of several thin coated metal discs, alternately secured to the wheel brake housing and alternately to the hub reduction housing. The discs are fitted on splines which means that they can move laterally.

Oil circulates between the discs cooling them, thus the name wet disc brake. The oil is the same as in other parts of the brake system.

Braking is effected by the brake cylinder pressing together the discs. This creates friction between the discs that are fixed to the axle and those fixed to the hub reduction.



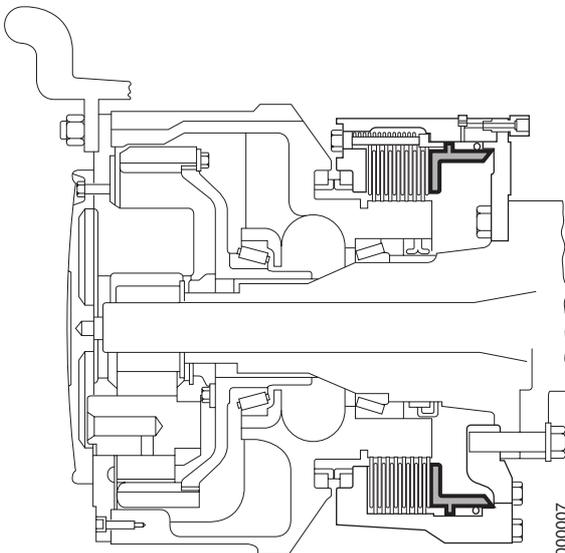
Disc package

### 4.3.9.2 Brake cylinder

#### Brake cylinder, description

The brake cylinder is integrated into the wheel brake and consists of a metal ring (cylinder) with two seal rings. The seal rings are supported laterally by a bevel on the cylinder and a bevel on the wheel brake housing.

The space between the seal rings is pressurised by means of a duct in the wheel brake housing. The pressure makes the metal ring move laterally and forces the disc package together.



Brake cylinder

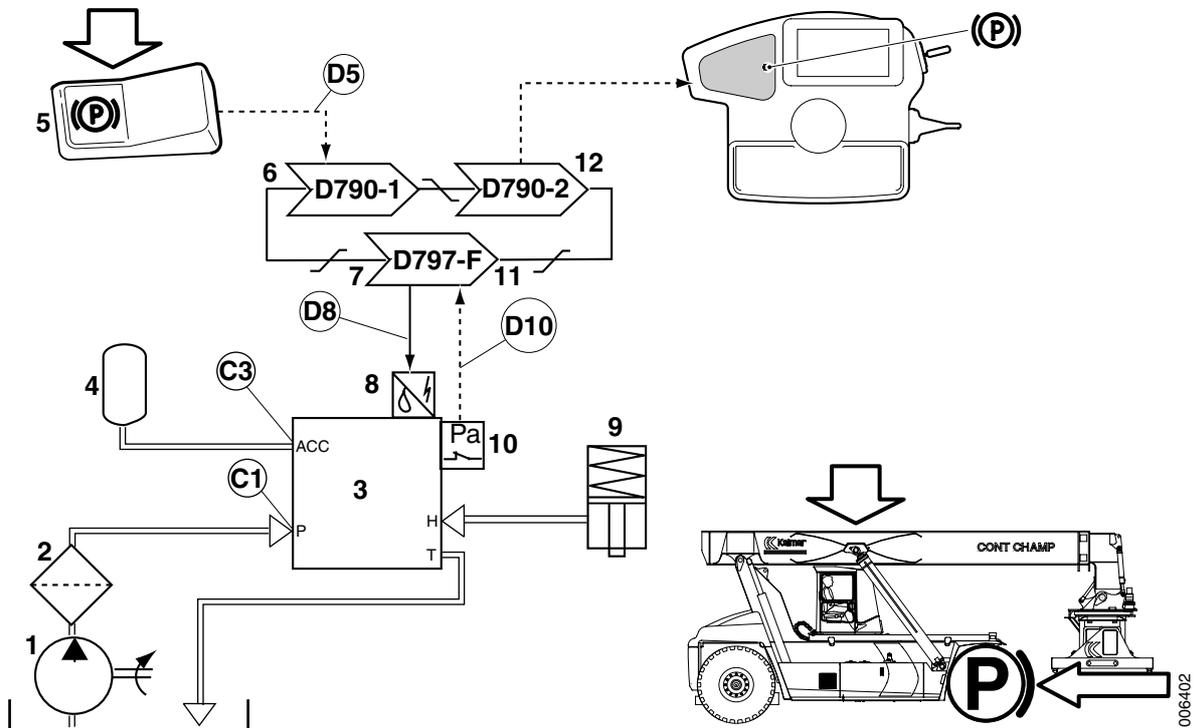
### 4.3.10 Pipes and hoses

#### Pipes and hoses, description

See section 10 *Common hydraulics*, group 10.5.1 *Pipes and hoses*.

## 4.5 Parking brake system

### Parking brake system, function description



Pos	Explanation	Signal description	Reference
1	The brake oil pump pumps oil from the brake tank.	P = 19±0.5 MPa	Brake oil tank, description page 36 Brake oil pump, description page 7
2	The brake oil filter cleans the oil from dirt.	-	Brake oil filter, description page 42
3	The accumulator charging valve directs oil to charging of accumulators or through the brake system's cooling circuit.		Accumulator charging valve, description page 11
4	The accumulators store oil pressure.	See pressure plate on left frame beam.	Accumulator, description page 14
5	Switch parking brake (S107) activates parking brake.  The switch uses two signals, one for applied and one for released parking brake. Both signals must be correct to enable release of the parking brake.	Switch activated: Conn 1, U = 22–28 V Conn 7, U = 0 V  Switch in resting position: Conn 1, U = 0 V Conn 7, U = 22–28 V	Tab 9 Frame, body, cab and accessories, group 9.1 Controls and instrumentation D5: Diagnostic menu, see section 8 Control and monitoring system, group 8.4.5.5 HYD, menu 5
6	Control unit cab (D790-1) sends release or apply parking brake on the CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 Common electric, group 11.5.3.1 Control unit cab

Pos	Explanation	Signal description	Reference
7	Control unit frame front (D797-F) activates Solenoid valve parking brake (Y642).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i>  D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.5.5 <i>HYD</i> , menu 5
8	Solenoid valve parking brake (Y642) affects the valve slide which drains pressure in the parking brake caliper to tank.	Pump pressure.	<i>Solenoid valve parking brake, description page 30</i>  D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.5.5 <i>HYD</i> , menu 5
9	The brake caliper is drained of pressure and the spring applies the parking brake.	0 MPa	<i>Parking brake unit, description page 31</i>
10	Breaking contact parking brake (S200) closes the circuit when the pressure drops.	Applied parking brake: Conn 1: U = 24 V Conn 2: U = 0 V Released parking brake: Conn 1: U = 24 V Conn 2: U = 24 V	<i>Break-contact parking brake, description page 34</i>  D10: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.5.5 <i>HYD</i> , menu 5
11	Control unit frame front (D797-F) sends Parking brake applied on the CAN bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i>
12	Control unit KIT (D790-2) activates indicator light parking brake (508).	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.11 <i>Control unit KIT</i>

Hydraulic diagram basic machine

#### 4.5.1 Brake oil pump

##### Brake oil pump, general

See group 4.3.1 *Brake oil pump*.

#### 4.5.2 Brake oil filter

##### Brake oil filter, general

See *Brake oil filter, description page 42*.

### 4.5.3 Solenoid valve parking brake

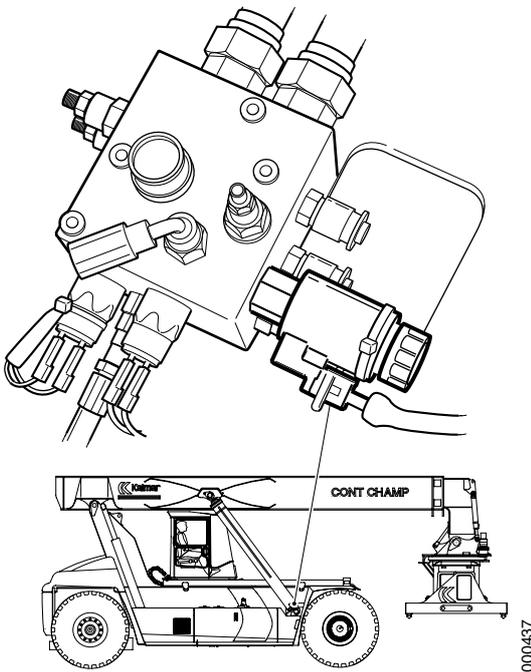
#### Solenoid valve parking brake, description

Solenoid valve, parking brake (Y642) activates the parking brake. The solenoid valve is located on the accumulator charging valve which is fitted on the lift beam in front of the gearbox in the engine bay, see *Accumulator charging valve, description page 11*.

The solenoid valve opens a connection between the accumulators and the parking brake caliper at activation. This means that the parking brake caliper is pressurised and the parking brake is disengaged. When the voltage feed to the solenoid valve is cut the connection between accumulators and parking brake caliper is terminated. Instead, a connection between the parking brake caliper and tank is opened and the parking brake applied. This means that the parking brake is applied if the machine loses electrical power or if the brake system becomes depressurised.

The solenoid valve is supplied with voltage by Control frame front (D797-F) at activation.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.5.5 HYD, menu 5*.



#### Solenoid valve parking brake, checking



## DANGER

**The machine may start to roll. Risk of crushing.**

**Block the wheels so that the machine cannot start to roll when the parking brake is released.**

- 1 Start the engine and run the engine at idling speed until the warning lamp for brake pressure goes out and the accumulator charging valve changes to cooling.
- 2 Turn off the engine and turn the start key to position I.
- 3 Release the parking brake with switch parking brake and check that the parking brake's brake caliper releases. The brake caliper should be able to move.
- 4 Activate the parking brake with the parking brake switch and check that the parking brake's brake caliper is applied.

## 4.5.4 Parking brake unit

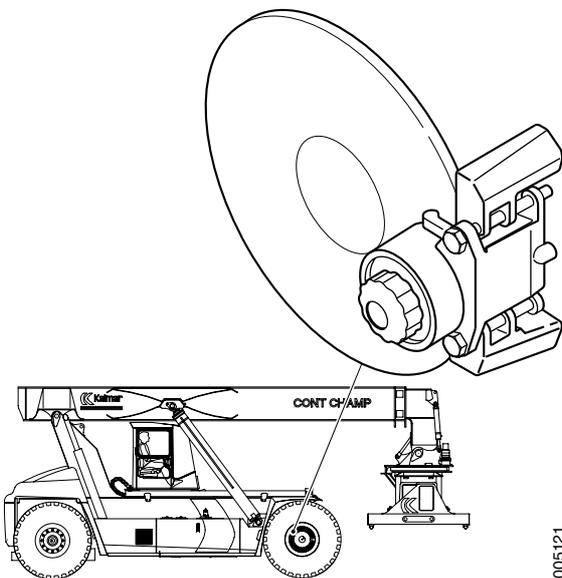
### Parking brake unit, description

The parking brake unit keeps the machine stationary when parking. The parking brake unit is located on the drive axle input shaft between the universal drive shaft and drive axle.

The parking brake acts on the universal drive shaft via a disc mounted on the drive axle input shaft and a brake caliper with dry brake pads mounted in a bracket on the drive axle.

### NOTE

*If the hydraulic pressure in the supply circuit drops, a warning is activated before the pressure drops so low that the parking brake is applied. If the parking brake is applied while the machine is on the move, the brake disc and brake pads must be changed.*



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### Parking brake unit, checking and adjustment (drive axle alternative Kessler)



## DANGER

**The machine may start to roll.**

**Risk of crushing.**

**Block the wheels so that the machine cannot start to roll when the parking brake is released.**

- 1 Start the engine and run up hydraulic pressure until the accumulators are fully charged and the accumulator charging valve switches to cooling.
- 2 Turn off the engine and turn the start key to position I.
- 3 Release the parking brake.
- 4 Check that the parking brake caliper can move on the bracket.
- 5 Check that the brake disc is free from oil and dirt.



6 Remove the cover from the brake caliper.



7 Undo the lock nut.

8 Adjust the adjustment screw so that the brakes are applied.

9 Adjust back the adjusting screw so that the clearance between pad and disc is  $0.5 \pm 0.1$  mm.

10 Tighten the lock nut.

### NOTE

*To avoid turning the adjustment screw as well it must be held still when tightening the lock nut.*

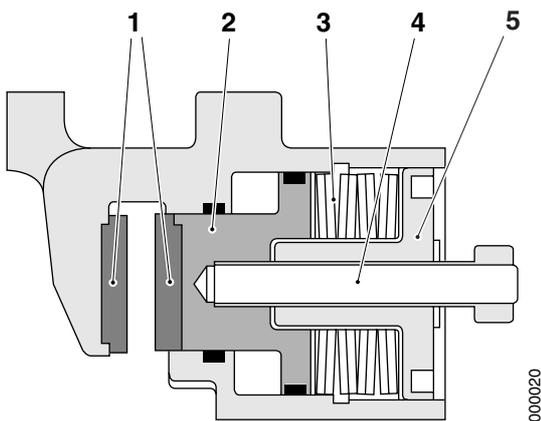
11 Refit the cover to the caliper.

12 Test the operation of the parking brake.

## 4.5.4.1 Parking brake calliper

### Brake caliper, description

The brake caliper has a spring section and a hydraulic section. The spring section applies the brake, the hydraulic section is used to release the brake. This means that the parking brake is applied if the brake system loses pressure. Which in turn means that the machine is braked if a serious fault arises.



1. Brake pads
2. Release cylinder
3. Application spring
4. Release screw
5. Adjusting washer

#### 4.5.4.2 Parking brake pads

##### Brake pads, description

The brake pad consists of a metal disc with friction material (coating).

##### Brake pads, replacement (drive axle alternative Kessler)

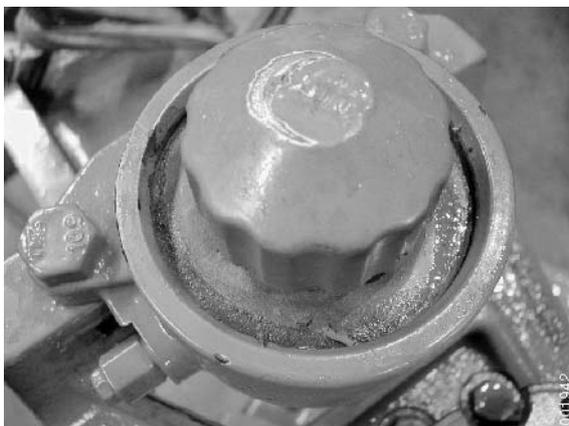
### DANGER

**The machine may start to roll.**

**Risk of crushing.**

**Block the wheels so that the machine cannot start to roll when the parking brake is released.**

- 1 Machine in service position and wheels chocked, see tab *B Safety*.
- 2 Remove the cover from the brake caliper.



- 3 Undo the lock nut.
- 4 Undo the adjusting screw so that the brake pads become loose.
- 5 Remove the split pin and undo the nut on the retaining screw holding the parking brake caliper.



- 6 Pull out the retaining screw so that the brake pads can be twisted out and removed.

### NOTE

*The screw does not need to be removed.*

- 7 Remove the parking brake pads.
- 8 Clean the brake disc with methylated spirit.
- 9 Fit the new parking brake pads.
- 10 Press back the retaining screw.
- 11 Fit the nut and fit a new split pin.
- 12 Adjust the parking brake, see *Parking brake unit, checking and adjustment (drive axle alternative Kessler) page 31.*

#### 4.5.4.3 Parking brake disc

##### Brake disc, description

The brake disc is fitted on the drive axle input shaft. The drive axle ratio reinforces braking force.

#### 4.5.5 Breaking contact parking brake

##### Break-contact parking brake, description

Break-contact parking brake (S200) senses if the parking brake is released or applied. Break-contact is located on the accumulator charging valve, located on the lift beam in front of the transmission in the engine compartment, see *Accumulator charging valve, description page 11.*

Break-contact parking brake (S200) senses the pressure in the parking brake circuit. When the pressure is so high that the parking brake is released, the sensor opens an electric circuit. This is used to indicate that the parking brake is released.

Break-contact parking brake (S200) is supplied with voltage by and sends voltage signal to Control unit frame front (D797-F). When the pressure increases above the opening pressure, then the voltage signal to Control unit frame front (D797-F) is cut off.

The signal can be checked from the diagnostic menu, see tab *8 Control and monitoring system, group 8.4.5.5 HYD, menu 5.*

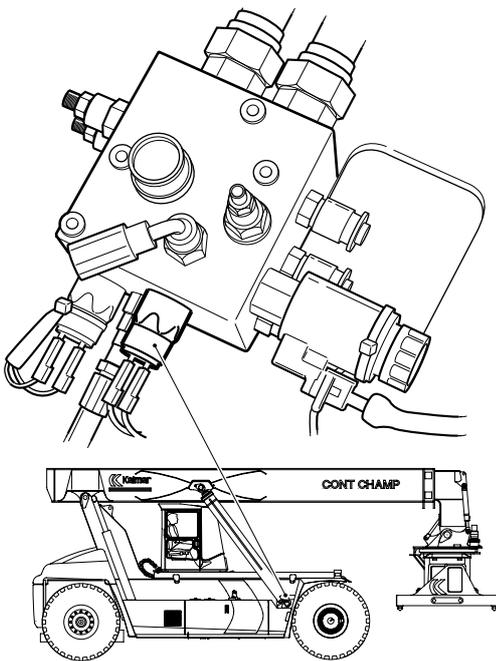
### NOTE

*Gears cannot be engaged when the parking brake is applied.*

#### 4.5.6 Pipes and hoses

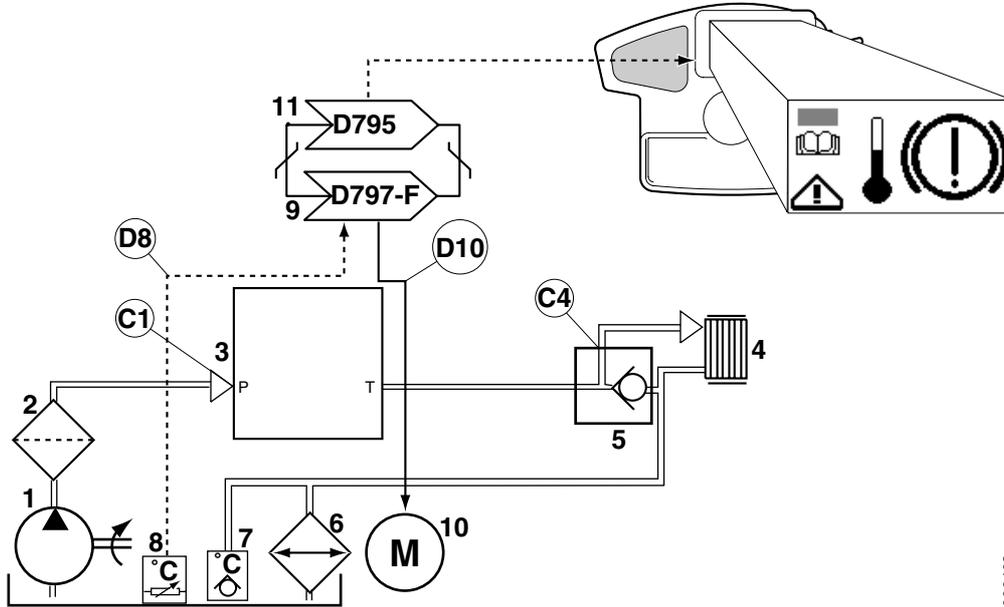
##### Pipes and hoses, description

See section *10 Common hydraulics, group 10.5.1 Pipes and hoses.*



## 4.8 Temperature control, filtration and brake fluid

### Temperature control, cleaning and brake oil, function description



006403

Pos	Explanation	Signal description	Reference
1	The brake oil pump pumps oil from the brake tank.	$P = 19 \pm 0.5 \text{ MPa}$	<i>Brake oil pump, description page 7</i> <i>Brake oil tank, description page 36</i>
2	The brake oil filter cleans the oil.	-	<i>Brake oil filter, description page 42</i>
3	The accumulator charging valve directs oil to charging of accumulators or through the brake system's cooling circuit.	Max. 0.1 MPa	<i>Accumulator charging valve, description page 11</i>
4	The oil cools the wheel brake.	-	<i>Wheel brake, description page 25</i>
5	The by-pass valve in the distribution block leads oil past the drive axle if the back pressure through the wheel brake is too high.	-	<i>Drive axle block, description page 21</i>
6	The cooler cools the oil.	-	<i>Oil cooler, description page 38</i>
7	The thermal by-pass valve leads oil past the cooler if the temperature is too low.	approx. 50 °C	<i>Thermal by-pass valve, description page 39</i>
8	The temperature sensor (B762) senses the oil's temperature and sends voltage signal proportional to the oil temperature to Control unit frame front (D797-F).	$R = 25 \text{ k}\Omega \text{ at } 20 \text{ }^\circ\text{C}$	<i>Sensor brake oil temperature, description page 40</i> D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.5.2 <i>HYD</i> , menu 2

Pos	Explanation	Signal description	Reference
9	Control unit frame front (D797-F) sends oil temperature information on the CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i>
10	When the oil is warm, Control unit frame front (D797-F) activates the cooling fan (M674) and increases air flow through the cooler.	U = 24 V at activated fan Starts at 65 °C Stops at 55 °C	<i>Cooling fan</i> , description page 39 D10: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.5.2 <i>HYD</i> , menu 2
11	If the temperature is high, Control unit KID (D795) activates warning for high brake oil temperature in the display.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>

Hydraulic diagram basic machine

## 4.8.1 Brake oil tank

### Brake oil tank, description

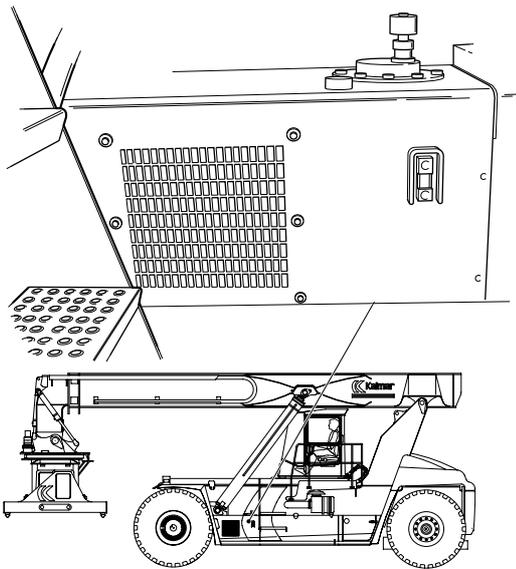
The brake oil unit stores the oil in the brake system and is located on the left-hand side of the machine in front of the fuel tank.

The brake system is separated from other hydraulics and has its own tank and oil filter. This means that the oil in the brake system can be selected so that additives are avoided.

Filling brake oil takes place directly to the tank. In the bottom of the tank is a drain plug. Hatches on the top of the tank facilitate internal cleaning.

The tank has a filtered bleed which allows volume change in the tank due to temperature variations and usage. See *Breather filter*, description page 41.

There is a level glass on the tank for checking the oil level.



## 4.8.2 Tank heater

### Tank heater, safety



#### CAUTION

**High voltage.**

**The tank heater is connected to high voltage (110 - 400 V).**

**Installation and reconnection of the tank heater must only be performed by personnel with high voltage authorisation.**

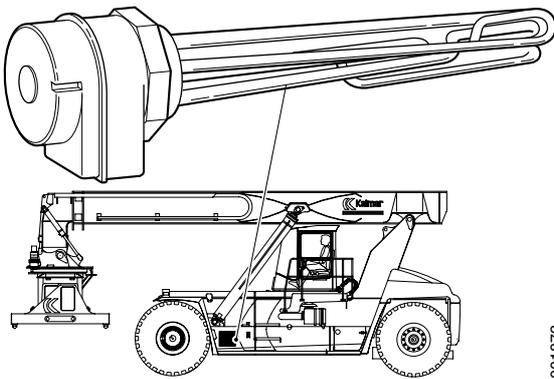
### Tank heater, description



The brake oil tank can be equipped with tank heater. The tank heater heats the oil in the brake oil tank and is located in a flange on the tank's front short side. The tank heater is designed for use in cold climates.

The tank heater is driven by high voltage. The output of the heater is adapted by means of different connections and adaptations to different supply voltages, 110, 230 or 400 V AC. Higher voltage provides higher heat output.

The tank heater can be equipped with a programmable thermostat which maintains the temperature at an even level. The thermostat is fitted directly onto the heating element and can be adjusted with a knob on the junction box. Recommended temperature setting is 50–70 °C.



## 4.8.3 Brake oil pump

### Brake oil pump, general

See group 4.3.1 *Brake oil pump*.

## 4.8.4 Accumulator charging valve

### Accumulator charging valve, general

See 4.3.3 *Accumulator charging valve*.

## 4.8.5 Drive axle block

### Drive axle block, description

See *Drive axle block, description* page 21.

## 4.8.6 Wheel brake

### Wheel brake, general

See 4.3.9 *Wheel brake* and *supplier documentation drive axle*.

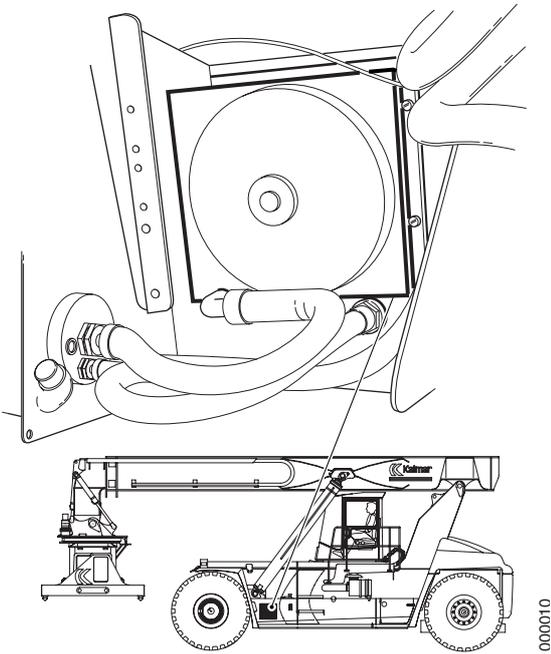
## 4.8.7 Oil cooler

### Oil cooler, description

The oil cooler cools the oil in the brake system in order to maintain the performance of the brakes. The oil cooler is located inside the side cover on the left-hand side behind the front wing.

The brake system uses a through-flow type cooler with electrical cooling fan. The brake system oil is cooled when it passes the cooler. Openings in the frame cover allow air passage through the cooler.

A cooling fan is bolted directly onto the cooler, see *Cooling fan, description page 39*.



### Oil cooler brake system, changing

#### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Machine in service position, see tab B Safety.
- 2 Drain the brake oil tank of oil, see *Oil brake system, changing page 43*.
- 3 Mark up and disconnect hydraulic hoses from the cooler. Let the oil in the cooler drain into the collection container.

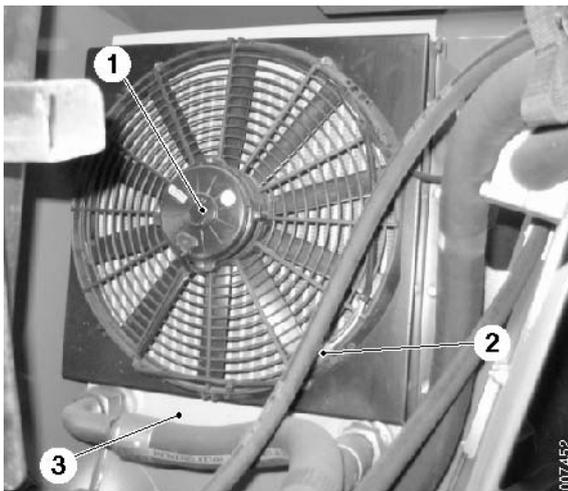
#### NOTE

*Plug all connections immediately to protect the hydraulic system from impurities.*

- 4 Disconnect the cabling from the cooling fan.
- 5 Remove the attaching bolts and lift away the cooler.
- 6 Transfer the cooling fan to the new cooler.
- 7 Install the cooler.
- 8 Connect the cabling to the cooling fan.
- 9 Connect the hydraulic hoses to the cooler.

#### NOTE

*Check that the O-rings are intact and are installed correctly.*



1. Cooling fan
2. Connector
3. Cooler



- 10 Fill oil in the brake oil tank, see *Oil brake system, changing page 43*. The oil level should be visible in the level glass.

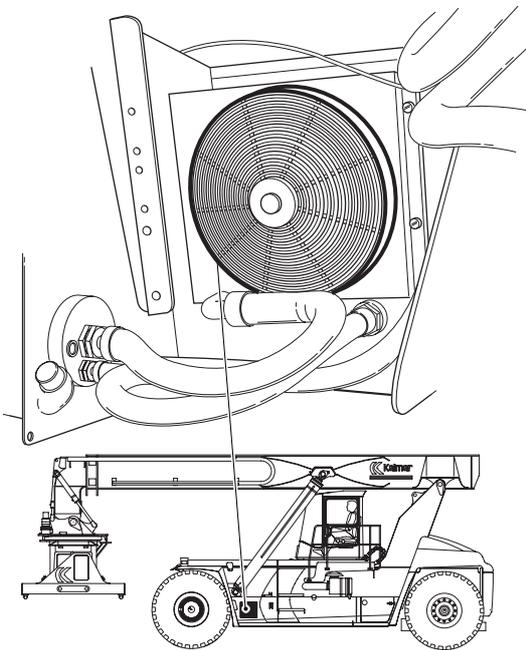
## 4.8.8 Cooling fan

### Cooling fan, description

The cooling fan (M674) is a suction-type electric fan. The fan draws air from the outside of the machine through the cooler and increases the air flow through the oil cooler as necessary. The cooling fan is fitted on the inside of the cooler inside the side cover behind the left-hand drive wheel.

The cooling fan (M674) is supplied with voltage by Control unit, frame front (D797-F). The cooling fan is activated when the oil temperature is 65 °C in the brake oil tank, the fan is switched off when the oil temperature is 55 °C.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.5.2 HYD, menu 2*.



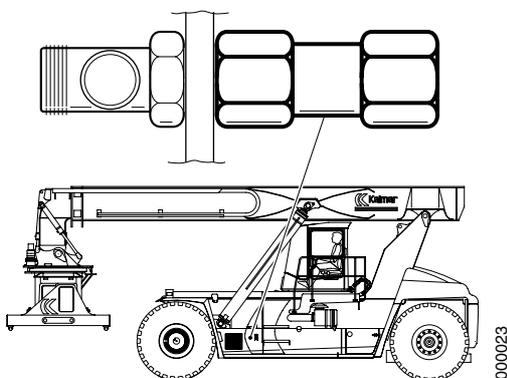
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## 4.8.9 Thermal by-pass valve

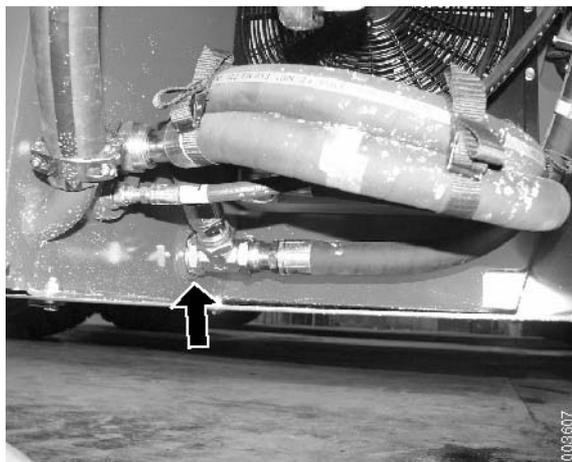
### Thermal by-pass valve, description

When the oil is cold, the thermal by-pass valve leads the oil past the cooler directly to tank. The thermal by-pass valve is located inside the brake oil tank at the hose connections to and from the cooler.

The thermal by-pass valve is a temperature-controlled bi-metal valve. The valve is open at low temperatures and is completely closed at 50 °C.



000023



## Thermo-bypass valve, replacement

### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the brake and hydraulic systems, see tab B Safety.
- 3 Drain the brake oil tank of oil, see *Oil brake system, changing page 43*.
- 4 Remove the thermo-bypass valve which is located inside the hydraulic oil tank.

### NOTE

*Note how the valve is installed.*

- 5 Install in reverse order.

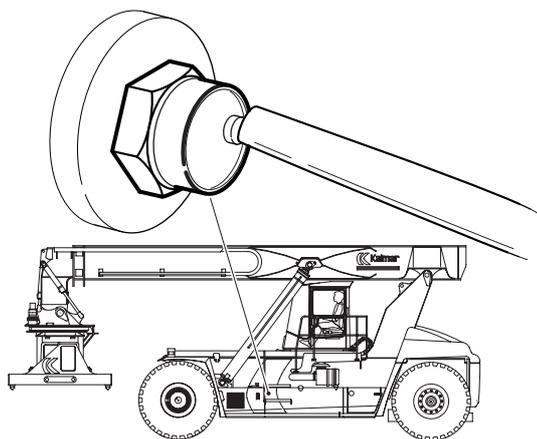
## 4.8.10 Sensor brake oil temperature

### Sensor brake oil temperature, description

Sensor, brake oil temperature (B762), senses the temperature of the oil in the brake system. The sensor is fitted on the brake oil tank rear short side and therefore takes account of the accumulated heat in the oil in the brake system.

Sensor brake oil temperature (B762) is supplied with voltage by and sends a voltage signal proportional to the temperature to Control unit, frame front (D797-F).

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.5.2 HYD, menu 2*.



### Sensor brake oil temperature, changing

### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Machine in service position, see tab B Safety.
- 2 Drain the brake oil tank of oil, see *Oil brake system, changing page 43*.
- 3 Disconnect the cabling from sensor oil temperature.
- 4 Change sensor oil temperature.

### NOTE

*Check that the O-rings are intact and are installed correctly.*

- 5 Connect the cabling to the sensor.



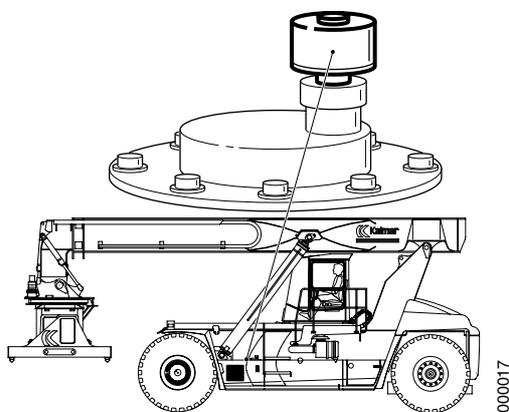
- 6 Fill oil in the brake oil tank, see *Oil brake system, changing* page 43. The oil level should be visible in the level glass.

### 4.8.11 Breather filter

#### Breather filter, description

The breather filter cleans the air which passes the tank's bleed at volume changes which arise with use and temperature changes. The breather filter is fitted in a holder on the top of the brake oil tank.

The breather filter is a paper cartridge filter. The filter cleans the air which passes through the tank's bleed of moisture and dust.



000017

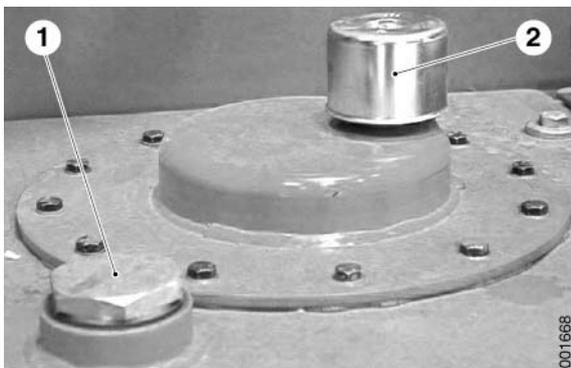
#### Breather filter, changing

- 1 Clean the area around the brake tank's breather filter.
- 2 Remove cover from the filter holder.  
Remove the screw in the middle and lift away the cover.
- 3 Remove the old filter cartridge.
- 4 Clean the filter holder.

#### NOTE

*Work carefully so that impurities do not enter the tank.*

- 5 Fit a new filter cartridge.
- 6 Refit the cover to the filter holder.



1. Filling point, oil for brake system
2. Breather filter, brake oil tank

## 4.8.12 Brake oil filter

### Brake oil filter, description

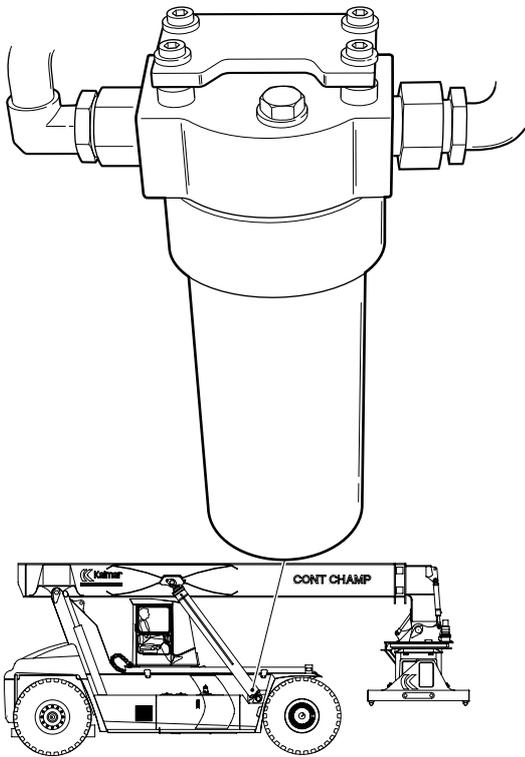
The brake oil filter cleans the oil in the brake system from impurities. The filter is fitted in a bracket in front of the gearbox under the lift beam.

The brake system oil filter is a high pressure filter with detachable filter cartridge, located between pump and accumulator charging valve. The oil is cleaned when it is forced through the filter cartridge filter material which is made of fibreglass before it reaches the accumulator charging valve.

Between the inlet and outlet is a bypass valve which protects the cartridge. If the resistance through the filter surface is too great then the bypass valve opens a passage past the cartridge. The bypass function opens if the oil is viscous (cold or low/high viscosity) or if the filter cartridge is clogged by dirt.

### NOTE

*When the filter is clogged the oil flows past the filter without cleaning, which is why it is of utmost importance that the filter is changed in accordance with the specified interval.*



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### Brake oil filter, changing

### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

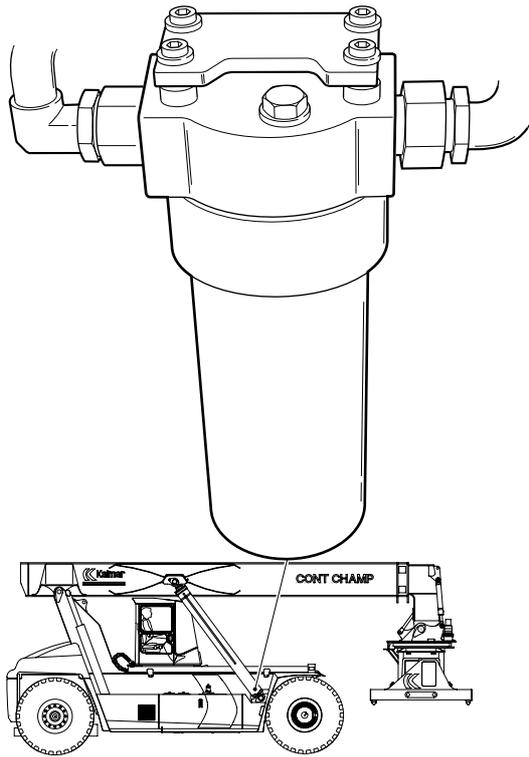
## IMPORTANT

**The filter protects the brake system from impurities. It is very important that new impurities do not enter the brake system when changing the filter.**

- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the hydraulic and brake systems, see tab B Safety.

### NOTE

*Leave the valves open when changing.*



- 3 Remove the drain plug on the underside of the filter.  
Let the oil drain. Wait a while since the oil drains slowly.
- 4 Remove the filter holder.

### NOTE

*The filter holder is heavy, loosen it carefully.*

- 5 Remove the filter cartridge.

### NOTE

*Note the position of the O-rings.*

- 6 Clean the filter holder.
- 7 Fit the O-rings on the filter cartridge and filter holder. Lubricate the O-rings with brake oil.
- 8 Fit the new filter insert to the filter bracket.
- 9 Fit the filter holder and the drain plug.
- 10 Close the valves that were opened to drain the pressure in the hydraulic system.
- 11 Start the engine and check that the filter holder does not leak.

## 4.8.13 Pipes and hoses

### Pipes and hoses, description

See section *10 Common hydraulics*, group *10.5.1 Pipes and hoses*.

## 4.8.14 Oil brake system

### Oil, brake system, general

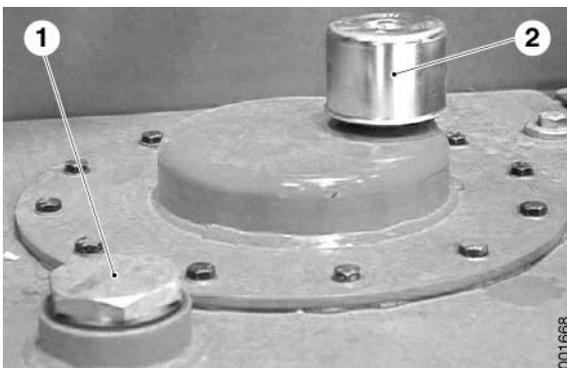
See section *F Technical data*.

### Oil brake system, changing

### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Machine in service position, see tab *B Safety*.
- 2 Depressurize the hydraulic and brake systems, see tab *B Safety*.
- 3 Remove the filler cap and drain the brake oil tank.
- 4 Remove the drain plug and let the last of the oil drain in a collection container.
- 5 Fit the drain plug, use a new gasket washer.
- 6 Fill brake oil until the level is at the middle of the level glass. For volume and quality, see tab *F Technical data*.
- 7 Install the filler cap.



1. Filling point, oil for brake system
2. Breather filter, brake oil tank



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## Table of Contents 5 Steering

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## 5 Steering

### 5.1 Controls and instrumentation

#### 5.1.2 Mini-wheel

##### Mini-wheel, description



On machines with mini-wheel, the machine's steering is electronically controlled. A directional valve pressurises the steering cylinder.

The mini-wheel's control is built into the left armrest. The control consists of two rotary potentiometers and three switches to activate the mini-wheel, select travel direction and activate the horn.

##### NOTE

*If the operator steers with the standard steering wheel, the mini-wheel is disengaged.*

*Mini-wheel or joystick control can only be activated at speeds below 3 km/h.*

##### Mini-wheel

The rotary potentiometers give a signal of 0-5 V during a turn. The potentiometers are phase displaced to be able to determine the direction of the turn. The rotary potentiometers are supplied with voltage and send voltage signals proportional to the turn to Control unit cab (D790-1) to indicate steering angle.

There are 31 possible settings for the relationship between the mini-wheel's and the wheels' angle, from linear to very progressive. It's also possible to adjust how much the steering angle should be adapted to the machine's speed. This is done from the diagnostic menus, see section 8 *Control and monitoring system*, group 8.5.1 *Initiation*.

The signals can be read from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.4 *EL-STEERING*, menu 1.

##### Switch activation mini-wheel

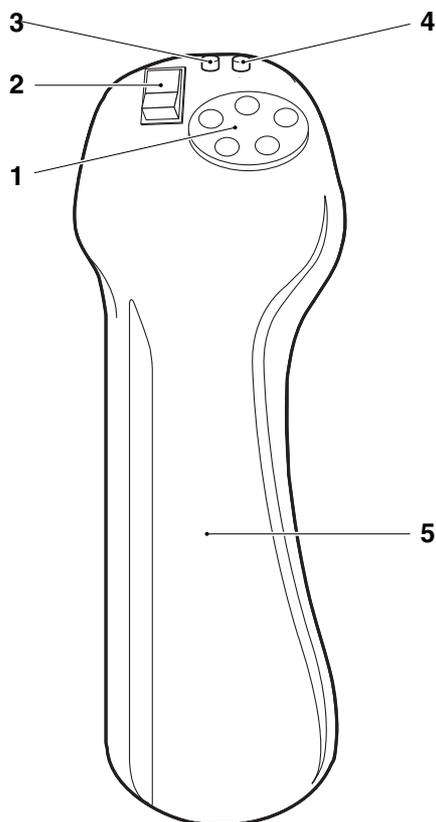
Switch mini-wheel (position 3) activates steering with the mini-wheel. The switch is supplied with voltage from and sends a voltage signal to Control unit, cab (D790-1).

The signals can be read from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.4 *EL-STEERING*, menu 2.

##### Travel direction selector

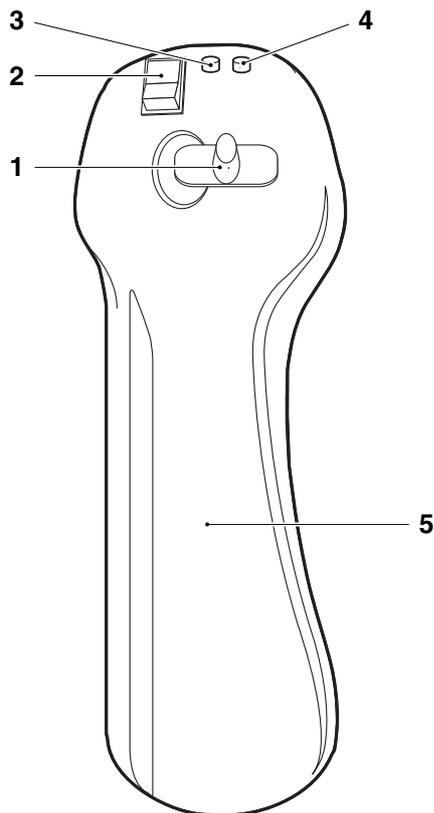
The travel direction selector is used to select travel direction (forward or reverse) when the mini-wheel is activated. The switch is supplied with voltage from and sends a voltage signal to Control unit, cab (D790-1).

The signals can be read from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.4 *EL-STEERING*, menu 2.



1. Mini-wheel
2. Travel direction selector (F / N / R)
3. Switch, activation of mini-wheel
4. Audible signal
5. Armrest

000583



1. Lever steering
2. Travel direction selector (F / N / R)
3. Switch, activation of lever steering
4. Audible signal
5. Armrest

### Audible signal

Audible signal is used to activate the horn when the mini-wheel is activated. The switch is supplied with voltage from and sends a voltage signal to Control unit, cab (D790-1).

The signals can be read from the diagnostic menu, see section *8 Control and monitoring system*, group *8.4.11.4 EL-STEERING*, menu 2.

## 5.1.3 Steering lever

### Lever steering, description



On machines with lever steering, the machine's steering is electronically controlled. A directional valve acts on the steering cylinder.

The lever is built into the left armrest. The control consists of a slide potentiometer and three switches to activate joystick control, select travel direction or activate audible signal.

### NOTE

*If the operator steers with the standard steering wheel, the joystick control is disengaged.*

*Mini-wheel or joystick control can only be activated at speeds below 3 km/h.*

### Lever steering

The slide potentiometer is supplied with voltage by and sends voltage signals proportional to movement to Control unit cab (D790-1) to indicate steering angle.

The signals can be read from the diagnostic menu, see section *8 Control and monitoring system*, group *8.4.11.4 EL-STEERING*, menu 1.

There are 31 possible settings for the relationship between the lever's and the wheels' angle, from linear to very progressive. It's also possible to adjust how much the steering angle should be adapted to the machine's speed. This is done from the diagnostic menus, see section *8 Control and monitoring system*, group *8.5.1 Initiation*.

The lever's positions (left, middle, right) can be calibrated from the diagnostic menus, see section *8 Control and monitoring system*, group *8.5.2.2 Calibrate steering*.

### Switch activation of lever steering

Switch activation of lever steering (position 3) activates lever steering. The switch is supplied with voltage from and sends voltage signals to Control unit, cab (D790-1).

The signals can be read from the diagnostic menu, see section *8 Control and monitoring system*, group *8.4.11.4 EL-STEERING*, menu 2.

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**Travel direction selector**

The travel direction selector is used to select the direction of travel (forward or reverse) when joystick control is activated. The switch is supplied with voltage from and sends voltage signal to Control unit, cab (D790-1).

The signals can be read from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.4 *EL-STEERING*, menu 2.

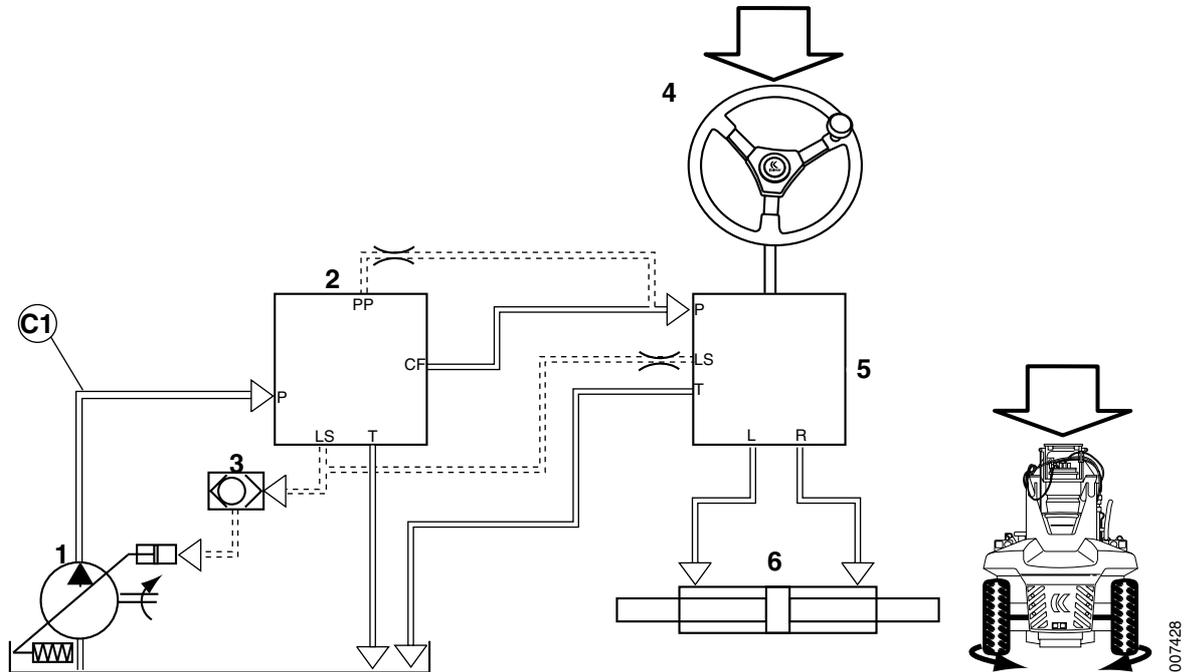
**Audible signal**

The audible signal is used to activate the horn when joystick control is activated. The switch is supplied with voltage from and sends voltage signals to Control unit, cab (D790-1).

The signals can be read from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.4 *EL-STEERING*, menu 2.

## 5.2 Power-assisted system

### Power-assisted steering system, function description



Pos	Explanation	Signal description	Reference
1	The hydraulic oil pumps pump oil to the priority valve.	See pressure plate on left frame beam.	Tab 10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement
2	The priority valve gives priority to pressure supply to the steering valve before the working hydraulics. Also, the priority valve sends control signal to hydraulic oil pump 3 and 4.	Controlled by control and monitoring system, error shown with error code.	Priority valve, description page 10
3	The shuttle valve selects the strongest load signal to the main pumps if hydraulic functions are activated at the same time as the steering wheel is turned.	Controlled by control and monitoring system, error shown with error code.	Tab 10 Common hydraulics, group 10.5.3 Shuttle valve
4	The steering wheel is turned and acts on the steering valve's input shaft.	-	Tab 9 Frame, body, cab and accessories, group 9.1 Controls and instrumentation
5	The steering valve pumps pressurized oil to the steering cylinder and sends load signal to the main pumps.	-	Steering valve, description page 12
6	The steering cylinder turns the wheels.	-	Steering cylinder, description page 14

Hydraulic diagram basic machine

## Joystick steering/mini-wheel, function description



Mini-wheel or joystick is an option for steering, making it possible to steer the machine with an electric control.

The relationship between the control's and the wheels' angle can be set in 31 different positions, from linear to very progressive. It is also possible to adjust how much the steering angle should be adapted to the machine's speed. This is done from the initiation menus, see tab 8 *Control system*, group 8.5.1 *Initiation*.

### NOTE

*If the operator steers with the standard steering wheel, the mini-wheel or joystick steering is disengaged.*

*Mini-wheel or joystick control can only be activated at speeds below 3 km/h.*

Condition	Reference value	Reference
Joystick steering activated	Voltage signal from switch mini-wheel/joystick steering.	<i>Mini-wheel, description page 3 or Lever steering, description page 4</i> Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.4 <i>EL-STEERING</i> , menu 2
Steering wheel stationary	No signal from sensor steering angle.	<i>Sensor steering angle, description page 21</i>
Speed	Below 3 km/h (at engagement)	-
Control switch	Not activated	Tab 11 <i>Common electric</i> , group 11.2.3 <i>Manoeuvre switch</i>



Pos	Explanation	Signal description	Reference
5	Control valve joystick steering or mini-wheel sends load signal to shuttle valve steering.	-	<i>Control valve joystick control or mini-wheel, description page 17</i>
6	The shuttle valve selects the strongest load signal to Hydraulic oil pump 3 and 4 if hydraulic functions are activated at the same time as the steering wheel is turned.	-	<i>Shuttle valve mini-wheel or lever steering, description page 20</i>
7	Hydraulic oil pump 3 and 4 pump oil from the hydraulic oil tank.	See pressure plate on left frame beam.	<i>Tab 10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement</i>
8	The priority valve gives priority to pressure supply to the steering valve before the working hydraulics. Also, the priority valve sends control signal to hydraulic oil pump 3 and 4.	See pressure plate on left frame beam.	<i>Priority valve, description page 10</i>
9	The steering spool changes position and pressurizes the steering cylinder.	-	<i>Control valve joystick control or mini-wheel, description page 17</i>
10	The steering cylinder turns the wheels.	-	<i>Steering cylinder, description page 14</i>
11	The steering wheel is turned and acts on the steering valve's input shaft.	-	<i>Tab 9 Frame, body, cab and accessories, group 9.1 Controls and instrumentation</i>
12	Sensor steering wheel shaft sends voltage signal to Control unit cab (D790-1).	U = 24 V	<i>Sensor steering angle, description page 21</i> D12: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.4 <i>EL-STEERING</i> , menu 3
13	Control unit cab (D790-1) sends interrupt steering on the CAN-bus.	Checked by control and monitoring system, error indicated with error code.	<i>Tab 11 Common electric, group 11.5.3.1 Control unit cab</i>

Hydraulic diagram cab lift + support jacks

## 5.2.1 Hydraulic oil pump

### Hydraulic oil pump, general

Steering is supplied with oil from hydraulic oil pump 3 and 4, see section 10 *Common hydraulics*, group 10.4 *Pumps*.

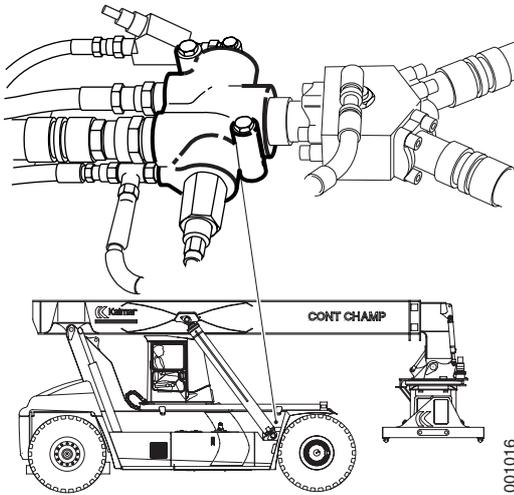
## 5.2.2 Priority valve

### Priority valve, description

The priority valve separates the oil flow from main pump 3 and 4 so that there is always oil to the steering valve. The remainder flows to the working hydraulics or servo circuit.

The priority valve is load sensing and pilot pressure compensating. Load sensing means that the valve adapts the steering signal to steering valve consumption. Pilot pressure compensating means that the priority valve compensates for the pressure drop between the priority valve and the steering valve via a separate line.

The priority valve has an integral pressure limiter on the load signal. The pressure limiter maximises the load signal pressure.

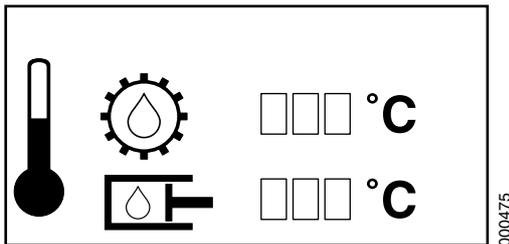


### Steering pressure, checking

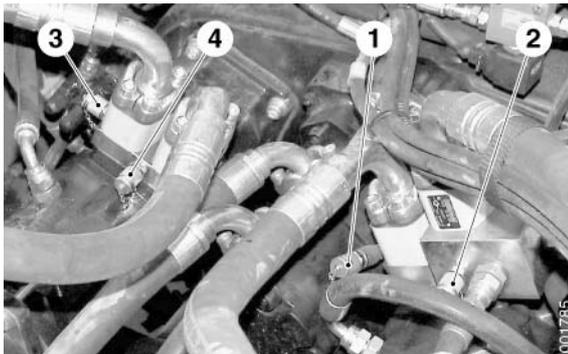
#### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Operate and warm up the machine so that the hydraulic oil reaches operating temperature, at least 50 °C.
- 2 Machine in service position, see tab B Safety.
- 3 Depressurize the hydraulic and brake systems, see section tab B Safety.
- 4 Connect the pressure gauge to the pressure check connection for hydraulic oil pump 3 or 4.
- 5 Start the engine and increase engine speed to approx. 1200 rpm.

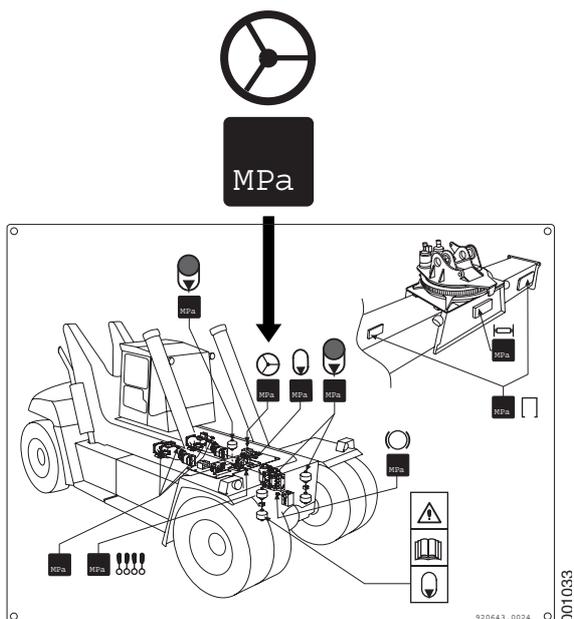


Operating menu, hydraulic oil temperature



Pressure check connections hydraulic oil pumps

1. Hydraulic oil pump 1
2. Hydraulic oil pump 2
3. Hydraulic oil pump 2
4. Hydraulic oil pump 4



- 6 Turn the steering wheel to full lock and read off the pump pressure during the steering movement, compare to the steering pressure on the hydraulic plate. Max. pressure measured on the pump should be **1.5 MPa** higher than the steering pressure on the hydraulic plate.
- 7 Turn off the engine and turn the start key to position I.
- 8 Depressurize the hydraulic and brake systems, see section tab *B Safety*.
- 9 Turn the start key to position 0 and turn off the main electrical power.
- 10 Remove the pressure gauge and fit the protective cover on the measuring outlet.

### Priority valve, replacement

#### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Machine in service position, see tab *B Safety*.
- 2 Depressurize the brake and hydraulic systems, see section tab *B Safety*.
- 3 Turn the start key to position 0 and turn off the main electrical power.
- 4 Mark up and detach the hydraulic hoses from the priority valve.

#### NOTE

*Plug all connections immediately to protect the brake system from impurities.*

- 5 Remove the priority valve attaching bolts.
- 6 Detach the priority valve from the collection block.
- 7 Remove the priority valve.
- 8 Transfer the connection adapters to the new priority valve.

#### NOTE

*Transfer one connection at a time so that the marking is not mixed up.*



- 9 Connect the new priority valve to the collection block.

## CAUTION

**Do not tighten the hydraulic connection between priority valve and collection block before all other connections and attaching bolts are fitted.**

**Stresses in the priority valve may result in incorrect function.**



- 10 Fit the priority valve attaching bolts.
- 11 Connect the hydraulic hoses to the priority valve.
- 12 Check that the collection block is not pressing against the priority valve.
- 13 Tighten the hydraulic connection between priority valve and collection block.
- 14 Start the engine and check that the hydraulic connections at the priority valve are sealed.
- 15 Check the control pressure, see *Steering pressure, checking page 10*.

### 5.2.3 Steering valve

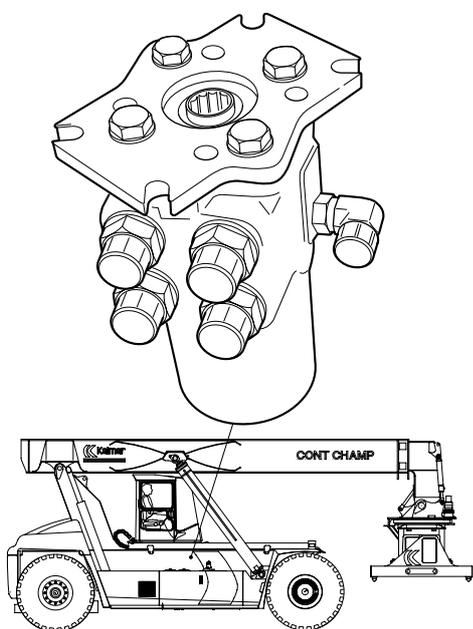
#### Steering valve, description

Steering valve is a “progressive, closed centre, non-reaction” type with load signal connection to the priority valve.

The load signal provides loading dependent control of the oil flow from the priority valve to the steering valve. “Closed centre” means that the steering valve is closed in neutral position. It is essential that signal pressure can be connected to the steering valve.

The steering valve consists of a gear pump and a distribution valve. When the steering wheel is turned oil flows from the main pump over the gear pump to the distribution valve which controls oil to the steering cylinder. The gear pump ensures that the oil flow fed to the cylinder is proportional to the steering wheel turning angle.

There are double shock and anti-cavitation valves in the steering valve. The shock valves protect the hydraulics against pressure spikes which can arise from impacts on the steering wheels. The anti-cavitation valves (non-return valves) protect against vacuum on the piston's rear side, which can lead to cavitation.

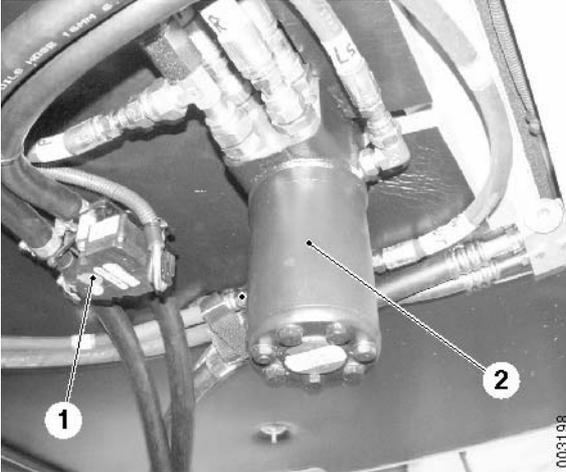


## Steering valve, replacement

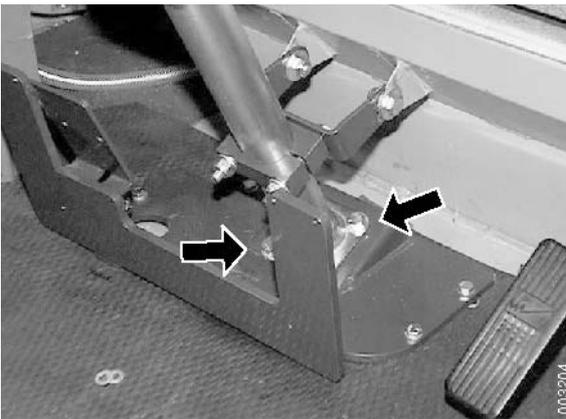
### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Remove the cover plates over the engine compartment.
- 2 Move the cab forward so that the steering valve is easily accessible from below.
- 3 Turn off the engine and turn the start key to position I.
- 4 Depressurize the brake and hydraulic systems, see section tab B Safety.
- 5 Turn the start key to position 0 and turn off the main electrical power.



1. Water valve
2. Steering valve



- 6 Detach the steering valve from the brake pedal.  
Remove the steering valve attaching bolts and lower the steering valve.
- 7 Mark up and detach the hydraulic hoses from the steering valve.

### NOTE

*Plug all connections immediately to protect the brake system from impurities.*

- 8 Remove the steering valve.
- 9 Transfer the connection adapters to the new steering valve.

### NOTE

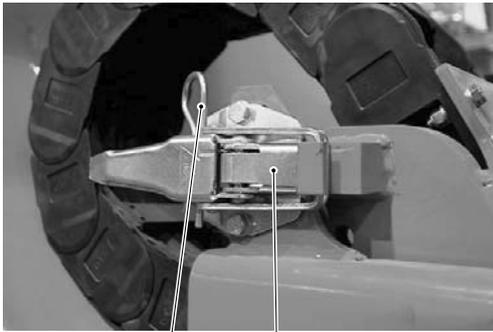
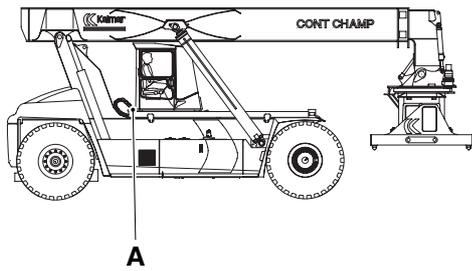
*Transfer one at a time so that the marking is not mixed up.*

- 10 Connect the hydraulic hoses to the steering valve in accordance with the marking.

### NOTE

*Check that the O-rings are intact and are fitted correctly.*

- 11 Connect the new steering valve to the brake pedal.  
Place the steering valve and check that the steering wheel shaft's splines enter straight in the steering valve's slot. Install the attaching bolts.



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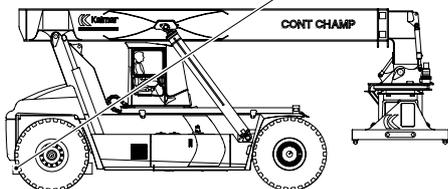
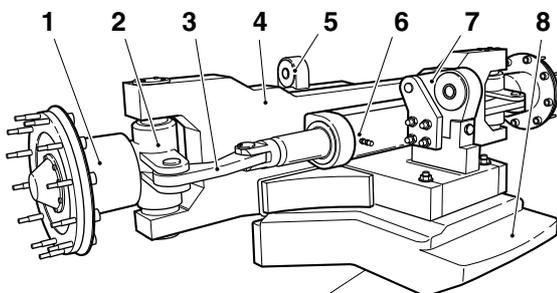
- A. Position lock catch
- B. Lock pin
- C. Lock catch for securing cab

- 12 On machines with manual sliding cab:  
Lock the cab in its rear position with both lock catches.
- 13 Turn on the main electric power and start the engine.
- 14 Check that the connections on the steering valve are sealed.
- 15 Steer very carefully a few times right - left, to bleed the steering valve and steering cylinder.

## 5.2.4 Steering cylinder

### Steering cylinder, description

The steering cylinder acts on the wheels via the link arms. The steering cylinder is a double-acting hydraulic cylinder.



001446

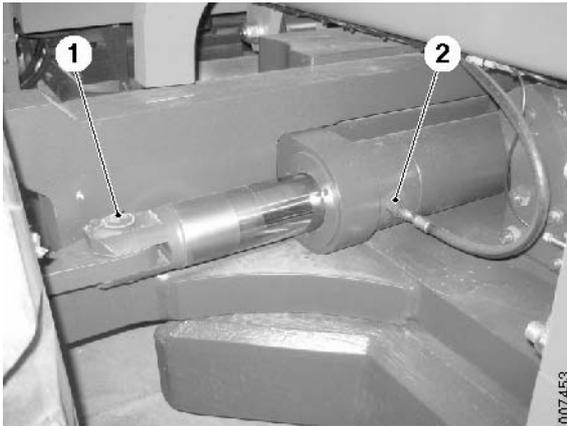
1. Wheel hub
2. Wheel spindle
3. Link arm
4. Steering axle
5. Mounting
6. Steering cylinder
7. Rear mounting
8. Counterweight

## Steering cylinder, changing

### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

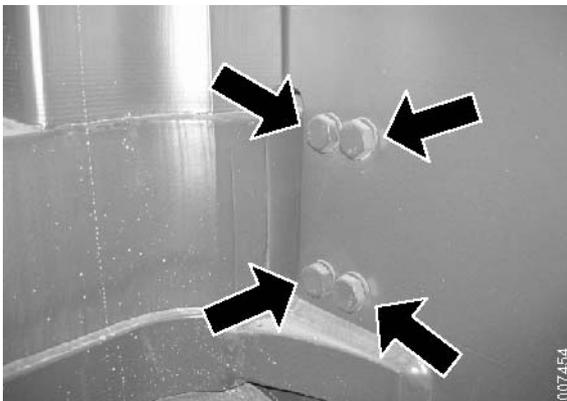
- 1 Park the machine with the wheels fully turned so that the steering cylinder can be lifted out to one side.
- 2 Machine in service position, see tab B Safety.
- 3 Depressurize the brake and hydraulic systems, see section tab B Safety.
- 4 Disconnect the link arms from the steering cylinder.
- 5 Mark up and disconnect the hydraulic hoses from the steering cylinder.



1. Link arm attachment
2. Hydraulic connection

### NOTE

*Plug all connections immediately to protect the brake system from impurities.*



Attaching bolts steering cylinder.

- 6 Remove the steering cylinder's attaching bolts.
- 7 Change the steering cylinder. Lift aside the steering cylinder.

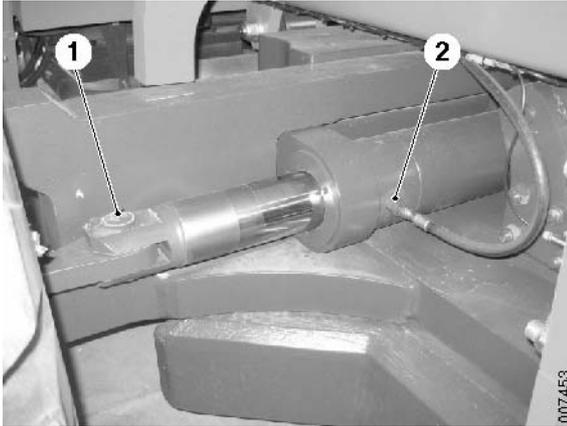
### NOTE

*The steering cylinder is heavy, use lifting equipment.*

- 8 Support the new steering cylinder so that the holes in the attaching bolts are lined up directly opposite the holes in the steering axle.
- 9 Install the steering cylinder's attaching bolts, lubricate the bolts. Tighten the screws crosswise in sequences with increasing torque to 680 Nm.
- 10 Transfer parts to the new steering cylinder.

### NOTE

*Check that the O-rings are intact and are installed correctly.*



1. Link arm attachment
2. Hydraulic connection

- 11 Connect the link arms to the steering cylinder
- 12 Connect the hydraulic hoses to the steering cylinder.

## NOTE

*Check that the O-rings are intact and are installed correctly.*

- 13 Close the drain valve on the accumulator charging valve and relief valve top lift. See tab *B Safety*.
- 14 Start the engine and check for leaks.

## Hydraulic cylinders, repairing

See tab *10 Common hydraulics*, group *10.7.1 Hydraulic cylinders*.

## 5.2.5 Steering axle cradle

### Steering axle cradle, general

See section *6 Wheel suspension*, group *6.2.1 Steering axle cradle*.

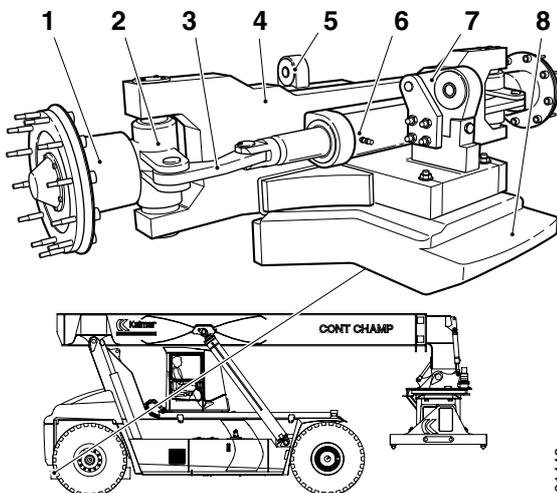
## 5.2.6 Link arm

### Link arm, description

The link arm transfers the lateral movement of the steering cylinder to turning the wheel spindles.

The setting of the steering wheels cannot be adjusted. If the link arms are deformed so that the setting of the steering wheels is changed then they must be replaced.

The link arms must be turned to the right direction, otherwise they can be damaged by the rims with large wheel angles.



1. Wheel hub
2. Wheel spindle
3. Link arm
4. Steering axle
5. Mounting
6. Steering cylinder
7. Rear mounting
8. Counterweight

001446

## 5.2.7 Wheel spindle

### Wheel spindle, general

See section 6 *Wheel suspension*, group 6.2.2 *Wheel spindle*.

## 5.2.8 Wheel hub

### Wheel hub, general

See section 6 *Wheel suspension*, group 6.2.3 *Wheel hub*.

## 5.2.9 Shuttle valve

### Shuttle valve, description

See section 10 *Common hydraulics*, group 10.5.3 *Shuttle valve*.

## 5.2.10 Manoeuvre valve mini-wheel/lever steering

### Control valve joystick control or mini-wheel, description



On machines with joystick control or mini-wheel, the steering cylinder's angle is controlled by control valve for joystick control or mini-wheel. The control valve is located on the inside of the right frame member in front of the engine. The control valve is controlled by control unit for frame option (D797-O).

The control valve is an electro-hydraulically controlled proportional and pressure compensated direction valve. Electrically controlled pressure reducing valves convert electrical current to servo pressure. The servo pressure controls the spring centred valve slides which control pressure and flow for the function in question. The valve slide has a flow limit in order that several functions can be activated simultaneously.

### Valve slide, steering

The valve slide controls the direction and steering angle by controlling the hydraulic pressure to the steering cylinder.

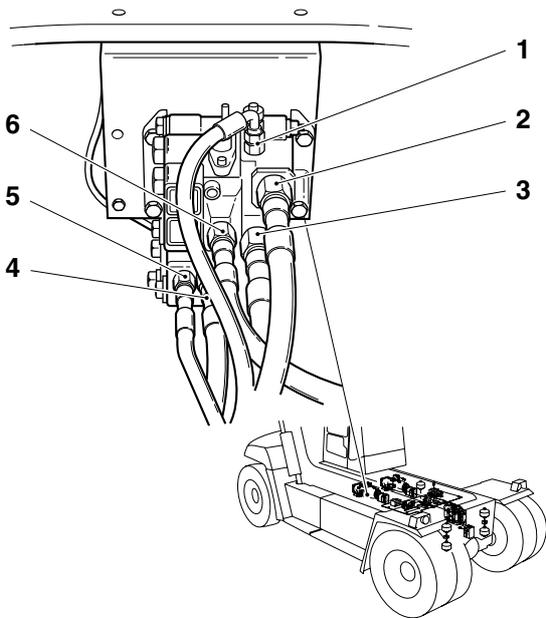
The valve slide is controlled by servo valve right and servo valve left.

### Servo valve right

Servo valve right controls servo pressure to valve slide, steering, so that it controls oil pressure for steering right.

The right servo valve is controlled electrically with Solenoid valve steering right (Y636R) which is activated by the control unit for frame option (D797-O).

The signals can be read from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.4 *EL-STEERING*, menu 5.



1. Load signal (LS)
2. Pressure supply (P)
3. Tank return (T)
4. Connection, steering cylinder (B)
5. Tank return (TP)
6. Connection, steering cylinder (A)

### Servo valve left

Servo valve left controls servo pressure to valve slide, steering, so that it controls oil pressure for steering left.

The left servo valve is controlled electrically with Solenoid valve steering left (Y636L) which is activated by the control unit for frame option (D797-O).

The signals can be read from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.4 *EL-STEERING*, menu 4.

### Control valve joystick steering or mini-wheel, changing



#### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the brake and hydraulic systems, see section tab B Safety.
- 3 Mark up and disconnect the hydraulic hoses from the control valve.

#### NOTE

*Plug all connections immediately to protect the hydraulic system from impurities.*

- 4 Mark up and disconnect the cabling from the control valve.
- 5 Remove the control valve.  
Remove the attaching bolts and lift away the valve. Place the valve on a clean, protected surface.
- 6 Transfer parts to the new control valve.

#### NOTE

*Check that the O-rings on the hydraulic connections are intact and in place.*

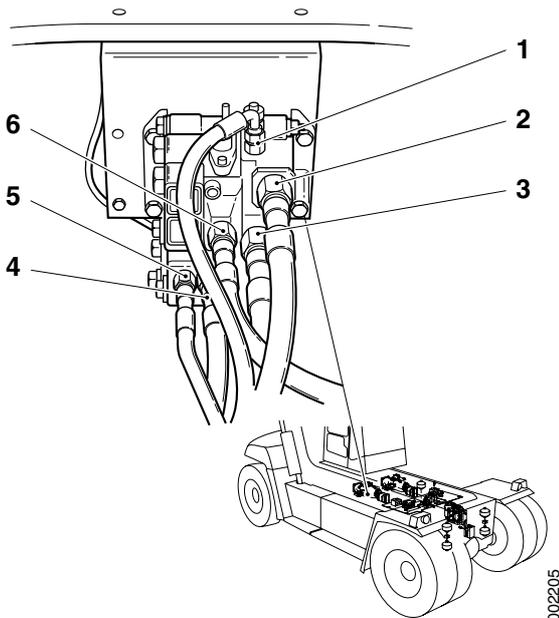
#### NOTE

*Transfer one adapter part at a time so that the marking is not mixed up.*

- 7 Mark up the servo valves on the new control valve.
- 8 Install the valve.
- 9 Connect the cabling to the control valve according to marking.
- 10 Connect the hydraulic hoses to the control valve according to marking.

#### NOTE

*Check that the O-rings are intact and are installed correctly.*



1. Load signal (LS)
2. Pressure supply (P)
3. Tank return (T)
4. Connection, steering cylinder (B)
5. Tank return (TP)
6. Connection steering cylinder (A)

- 11 Start the engine and check for leaks.
- 12 Check the function.

**! CAUTION**

**Air in the hydraulic system may cavitate and can result in product damage.**

**Activate the steering carefully and operate a few times with lowest possible speed to avoid cavitation.**



- 13 Check the oil level in the hydraulic oil tank with the lift cylinders completely down and the extension cylinder completely in. The oil level should be at the top of the level glass. Top up as needed.

**! CAUTION**

**Overfilling of oil, leakage, and environmental damage.**

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

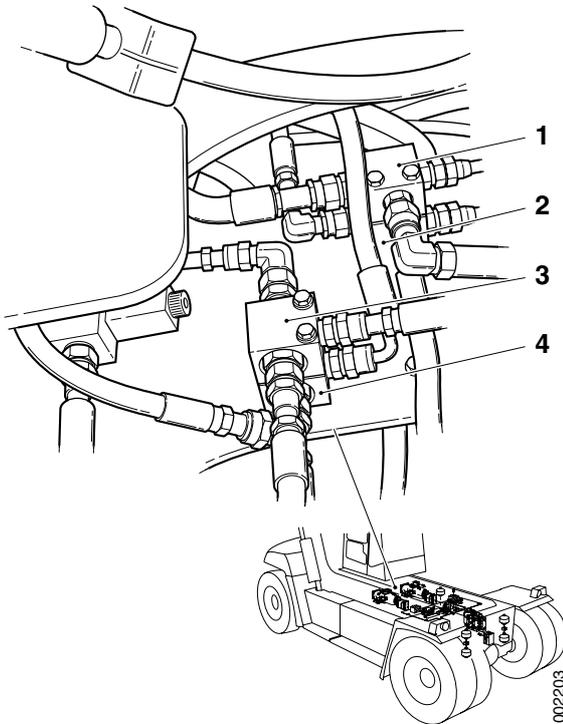
## 5.2.11 Shuttle valve mini-wheel/lever steering

### Shuttle valve mini-wheel or lever steering, description



On machines with lever steering or mini-wheel, there is an extra shuttle valve for the hydraulic oil pumps' control signal lines. The shuttle valves are located on the bracket for the oil filling point and oil dipsticks between the engine and transmission.

The shuttle valve relays the control signal from the control valve to the main pumps.



Shuttle valves on attaching plate between engine and transmission

- 1. Shuttle valve, frame option
- 2. Shuttle valve, lift / steering
- 3. Shuttle valve, lever steering/mini-wheel
- 4. Shuttle valve , lift / attachment

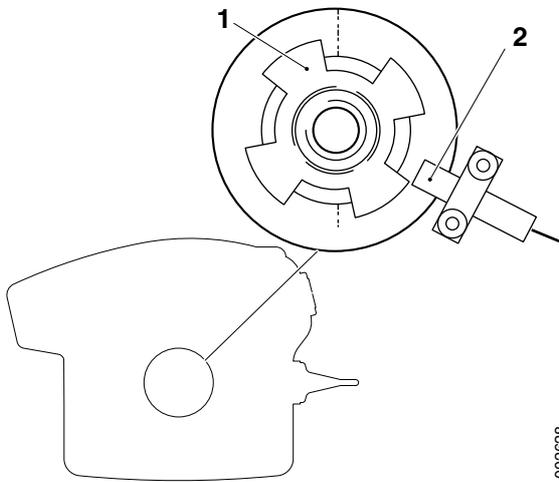
## 5.2.12 Sensor steering wheel angle

### Sensor steering angle, description



Sensor steering angle (B770) senses if the steering wheel is turned and sends a signal to Control unit KIT (D790-2). This is used to disengage joystick control or the mini-wheel. The sensor is located by the steering wheel shaft inside the panels. The sensor is activated by an indicator ring on the steering wheel shaft with four lobes. The location of the sensor and lobes' spacing means that small steering wheel movements can be detected.

The signals can be read from the diagnostic menu, see section *8 Control and monitoring system*, group *8.4.11.4 EL-STEERING*, menu 3.



002628

1. Indicator ring
2. Sensor, steering angle (B770)

### Position sensor, checking and adjustment

See tab 7 *Load handling*.

## 5.2.13 Pipes and hoses

### Pipes and hoses, description

See section *10 Common hydraulics*, group *10.5.1 Pipes and hoses*.



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## Table of Contents 6 Suspension

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# 6 Suspension

## 6.2 Suspension mounting

### Bushing steering axle mounting, changing



## DANGER

**Steering axle and machine are very heavy.**

**Risk of crushing!**

**It is forbidden to enter under a machine that is raised with a jack or similar. For machine weight, see tab *F Technical data*.**

- 1 Machine in service position, see tab *B Safety*.
- 2 Turn the start key to position 0 and turn off the main electric power.
- 3 Remove the counterweights on the rear of the machine.

### NOTE

*Mark up the positions of the counterweights so that they can be refitted in the same way, this is important for the machine's stability.*

- 4 Support under the steering axle so that it cannot fall over.
- 5 Connect lifting equipment to the rear of the machine and take up the slack so that the steering axle's mounts are relieved.

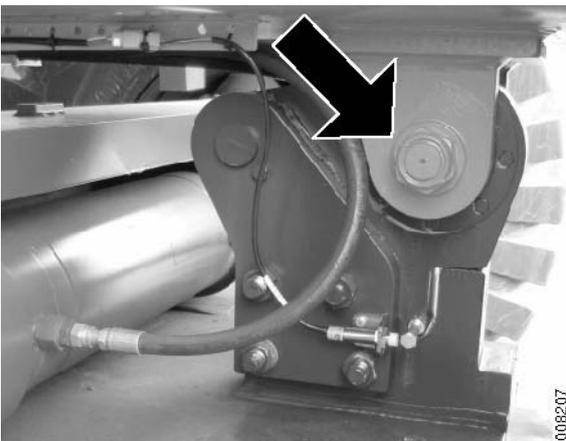
### NOTE

*Do not lift so much that the wheels are off the ground*

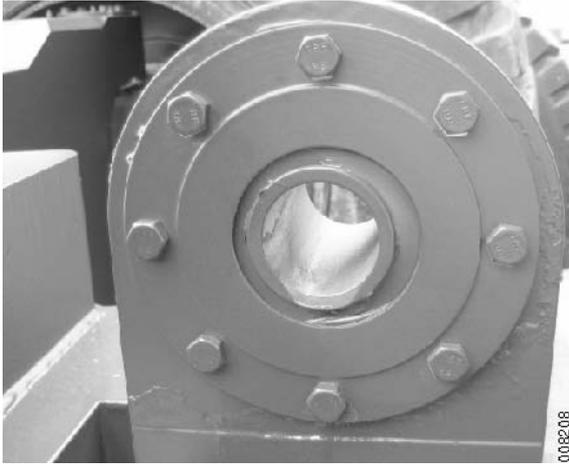
- 6 Remove the pins holding the steering axle.
- 7 Raise the machine so that the frame eases off the axle.
- 8 Support the machine under the frame.
- 9 Move the steering axle so that the mountings can be accessed.

### NOTE

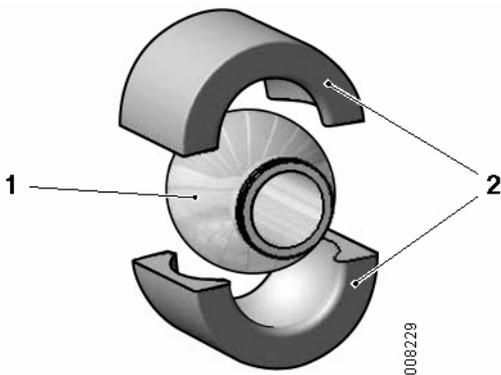
*If needed, disconnect the cabling for the sensors on the steering axle.*



The illustration shows rear mounting.



The illustration shows front mounting.



Parts bushing steering axle

1. Inner race
2. Bearing halves

- 10 Remove the washers that hold the bushing in place.
- 11 Press out the bushing.
- 12 Clean the bearing surfaces on the steering axle.

- 13 Assemble the bushing's parts and press in the new bushing.  
Lube the bushing with grease for easier installation.

### NOTE

*The bearing halves shall be installed horizontally*

- 14 Install the washers that hold the bushing in place.
- 15 Move the steering axle into place under the frame.
- 16 Grease and install the pins by the steering axle's mounts.
- 17 Remove the lifting equipment from the machine.
- 18 Fit the counterweights.

### NOTE

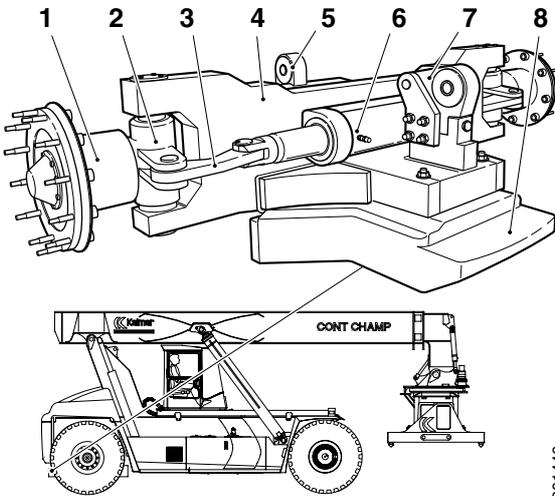
*Make sure that all counterweights are reinstalled and that the counterweights are mounted exactly in the same place as before. The machine's stability is affected if the counterweights are changed.*

## 6.2.1 Steering axle cradle

### Steering axle cradle, description

The steering axle is pendulum suspended with a double-acting steering cylinder. The construction comprises a minimum of moving parts to minimise service points and simplify maintenance.

The chassis suspension comprises maintenance free parts. The rear suspension is designed with a leading knee which is used to indicate inadequate load on the steering axle, so-called "mechanical overload protection", see section 8 *Control and monitoring system*, group 8.2.1 *Overload protection*.



1. Wheel hub
2. Wheel spindle
3. Link arm
4. Steering axle
5. Front mounting
6. Steering cylinder
7. Rear mounting
8. Counterweight

### Steering axle cradle, changing



## DANGER

**Steering axle and machine are very heavy.**

**Risk of crushing!**

**Moving under a machine raised by jacks or similar is prohibited. For machine weight see section tab *F* *Technical data*.**

- 1 Clean the steering axle and its surrounding area.
- 2 Switch off the engine and turn the start key to position I.
- 3 Depressurise the brake and hydraulic systems, see section tab *B* *Safety*.
- 4 Turn the start key to position 0 and turn off the main electric power.

- 5 Remove the counterweights on the rear of the machine.

## NOTE

*Mark up the positions of the counterweights so that they can be refitted in the same way, this is important for the machine's stability.*

- 6 Connect the lifting equipment to the rear section of the machine.
- 7 Tension the lifting equipment, do not lift so high that the wheels start to hang.
- 8 Support the machine's rear section.
- 9 Detach the cable from overload sensor (applies only to machines with mechanical overload protection).
- 10 Detach the hydraulic hoses from the steering cylinder

## NOTE

*Plug all connections immediately to protect the hydraulic system from impurities.*

- 11 Remove the pins holding the steering axle.
- 12 Raise the machine so that the frame eases off the axle.
- 13 Lift out the steering axle.



## CAUTION

**The steering axle may start to roll.**

**Crushing injury!**

**Make sure that the steering axle does not start uncontrolled movement.**

- 14 Adjust the support so that the machine is secured in the new position.
- 15 Lift the steering axle into place underneath the frame.
- 16 Remove the support under the frame.
- 17 Lower the rear section of the machine.
- 18 Fit the pins at the steering axle mountings.
- 19 Connect the hydraulic hoses to the steering cylinder.

## NOTE

*Check that the O-rings are intact and that they are fitted correctly.*

- 20 Connect the wiring to the overload sensor (applies only to machines with mechanical overload protection).
- 21 Remove the lifting equipment from the machine.

22 Fit the counterweights.

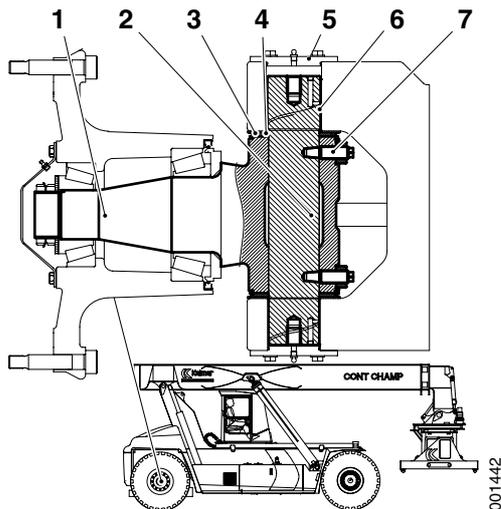
## NOTE

*Make sure that all counterweights are refitted and that they are located exactly as before. The machine's stability can be affected if the counterweights are changed.*

## 6.2.2 Wheel spindle

### Wheel spindle, description

The wheel spindle is the link between steering axle and wheel hubs which means that the wheels can be turned.

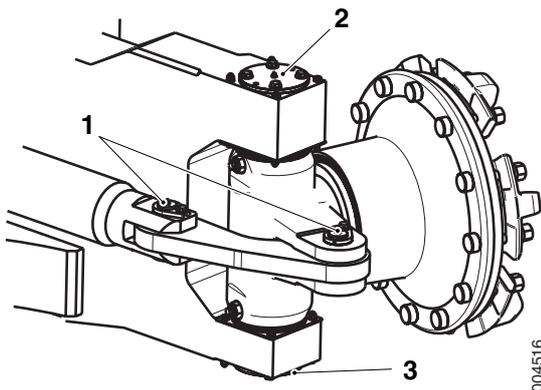


1. Wheel spindle
2. King pin
3. Seal
4. Slide bearing washer
5. Cover
6. King pin bearing
7. Lock bolt



### King pin bearing, replacement

- 1 Clean the wheel spindle and its surrounding area.
- 2 Lift the machine under the steering axle by the wheel in question. Support securely under the steering axle.
- 3 Remove the steering wheel in question.



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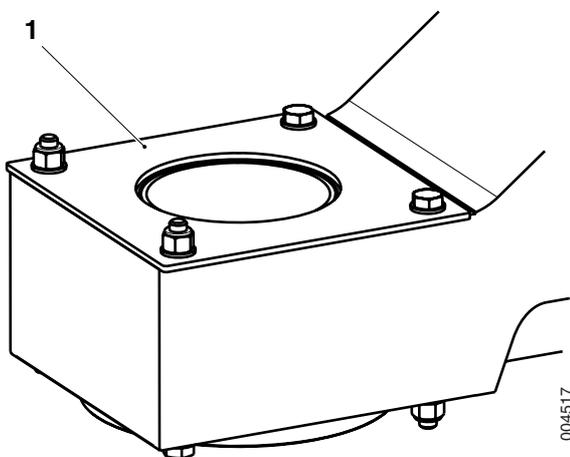
- 1. Pin, link arm
- 2. Cover (upper)
- 3. Cover (lower)



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004517

- 1. Axial bearing

- 4 Detach the link arm from the wheel spindle.  
Remove the lock bolt and remove the pin. Turn aside the link arm.
- 5 Fit a lifting strap inside the hub so that the spindle is secured.
- 6 Remove the covers at the king pin upper and lower bearing.
- 7 Remove the grease between cover and king pin.

- 8 Remove the king pin upper and lower lock bolt.  
Unscrew the nut and remove the lock bolt.
- 9 Adjust the lifting equipment so that the wheel spindle is unloaded.

- 10 Remove the king spin.  
Pull the king pin up, use a slide hammer or similar which is connected to the threaded hole in the centre of the king pin.
- 11 Remove the wheel spindle.  
Place the wheel spindle on a soft surface.

- 12 Remove the axial bearings from the steering axle.
- 13 Replace the bearing races in the steering axle.  
Press out the old bearing races with a drift.
- 14 Clean the surfaces in the steering axle.

- 15 Press in the new bearing races with the drift.  
Thoroughly apply Lubricating grease to the bearing races.

## NOTE

*The upper bearing race should protrude so that it is level with the axial bearing in the wear washer.*

- 16 Install new axial bearings on the steering axle. Turn the reworked side so that it faces the wheel spindle. Install the bolts as shown in the illustration.

Thoroughly apply Lubricating grease to the bearing races. For quality, see tab *F Technical data*.

## IMPORTANT

**Only install the inner attaching bolts, otherwise the wheel spindle cannot be lifted into place. Only slightly tighten the bolts to fix the axial bearings.**

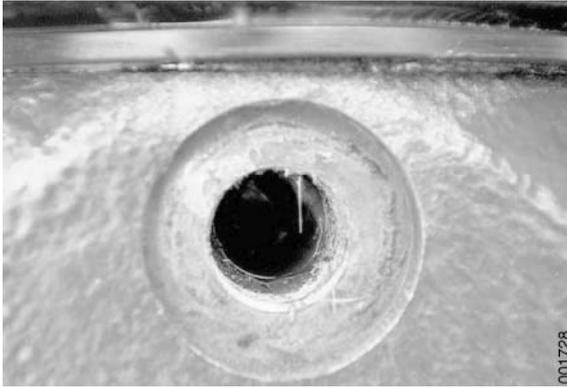
- 17 Fit new O-rings on the wheel spindle.  
Pull the O-ring to the hub.
- 18 Install new axial washers on the wheel spindle.  
Apply Lubricating grease to both sides on the axial washers and place the bearing in the wheel spindle. Note the position of the axial washer so that the guide pin fits in the slot in the bearing.
- 19 Lift the wheel spindle into place in the steering axle.



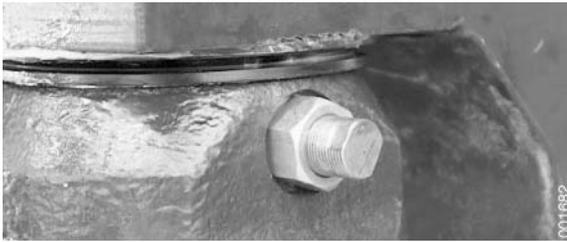
- 20 Fit the king pin.  
Apply Lubricating grease to the king pin and press it into place.

## NOTE

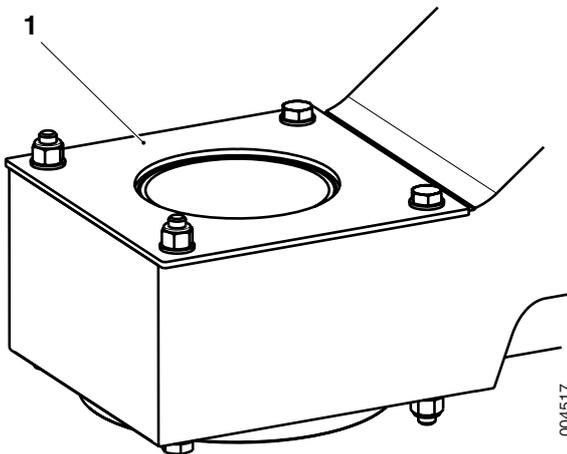
*Check that the king pin is turned so that the holes for the guide bolts end up directly opposite the holes in the wheel spindle. It is important that the king pin is installed correctly before the lock bolts are installed. It is not possible to "tighten" the king pin into place.*



- 21 Install the lock bolts and lock with the lock nut. Torque-tighten with **250 Nm**.
- 22 Apply Lubricating grease to the area between wheel spindle and steering axle.

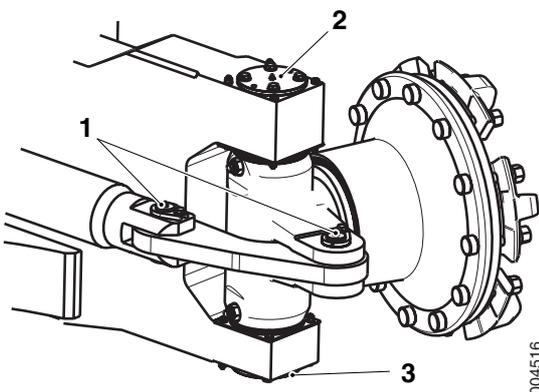


- 23 Pull the O-rings into place.



- 24 Install the remaining attaching bolts for the axial bearings. Install the bolts as shown in the illustration. Torque-tighten with **25 Nm**.

1. Axial bearing



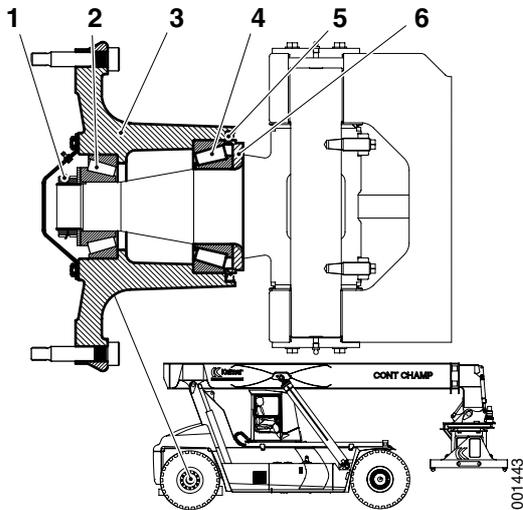
1. Cover (upper)  
2. Pin, link arm  
3. Cover (lower)

- 25 Fit the upper cover and the lower cover.
- 26 Grease the king pin's upper and lower bearing with Lubricating grease.
- 27 Turn the wheel spindle a few times back and forth to spread out the grease. Check that the resistance is even.
- 28 Connect the link arm to the wheel spindle.  
Lubricate the link arm's bearings with Lubricating grease.
- 29 Fit the wheel.
- 30 Remove the support and lower the steering wheel.
- 31 Test-run the machine and test the steering. Check also that the machine feels stable when driving straight ahead.

## 6.2.3 Wheel hub

### Wheel hub, description

The wheel hub holds the wheel in place and means that the wheel can rotate.

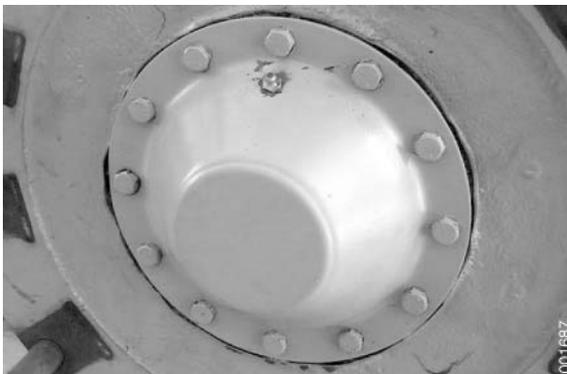


1. Hub nut with lock washer
2. Outer wheel bearing
3. Hub
4. Inner wheel bearing
5. Seal
6. Support ring

### Wheel bearing, replacement



- 1 Lift the machine under the steering axle by the wheel in question. Support securely under the steering axle.
- 2 Remove the steering wheel in question.



- 3 Clean the hub cover and its surrounding area.
- 4 Remove the hub cover.
- 5 Wipe away grease from hub cover and hub nuts. Handle it as environmentally hazardous waste.



- 6 Secure the hub with a lifting strap.

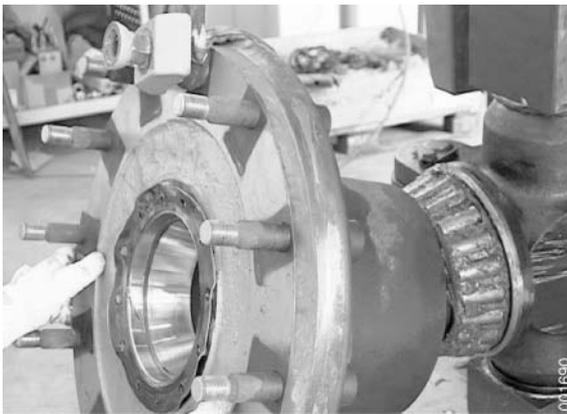
Route the lift sling over the hub and around a wheel bolt. Install a clamp and nut to secure the lift sling. Use manual forklift, pallet forks or similar to lift the hub.



- 7 Bend up the lock washer's tabs, remove the lock nut and the lock washer.

- 8 Tension the lifting equipment so that the hub is unloaded.

- 9 Remove the hub nut.



- 10 Lift out the hub from the spindle.

Remove the outer bearing inner race and pull the hub from the axle.



- 11 Remove the inner bearing from the wheel spindle.



- 12 Remove the seal from the hub.
- 13 Remove the bearings' outer races from the hub.  
Use a drift and press out the bearing races.
- 14 Clean the hub and smear the inside with universal grease "EP2".
- 15 Fit new bearing races in the hub.  
Use a drift and press in the bearing races. Never use directly on the bearings.

### NOTE

*Fit the outer bearings with the larger diameter outward.*



- 16 Fit a new seal on the inside with the seal lip turned out.  
Press in a new seal in the hub. Use a suitable round plate, the seal does not tolerate impacts from a hammer.

### NOTE

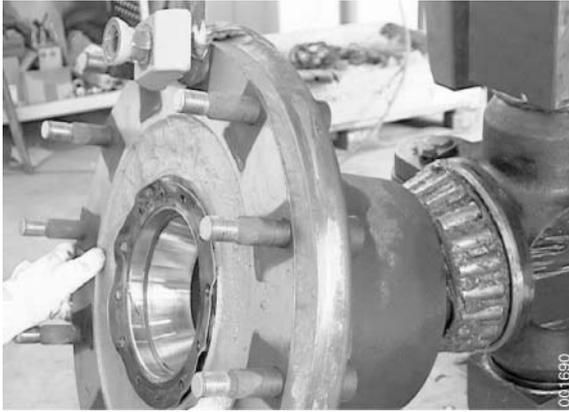
*Turn the seal correctly.*



- 17 Install the inner bearing's inner race and rollers on the wheel spindle. Pack the bearing with universal grease "EP2".



- 18 Fill the empty space in the hub with universal grease "EP2".



19 Fit the hub on the wheel spindle.



20 Install the outer bearing, protecting washer, and bearing nut.

Pack in the bearing with grease and fit the bearing.

Fit the washer and hub nut with the smooth surface in towards the hub.

21 Remove the lifting equipment.



22 Torque the bearing nut as follows.

A. Grease the thread on the side of the nut turned to the bearing with oil (SAE 80W/140).

B. Tighten the nut to 250 Nm.

C. Rotate the hub 10 revolutions.

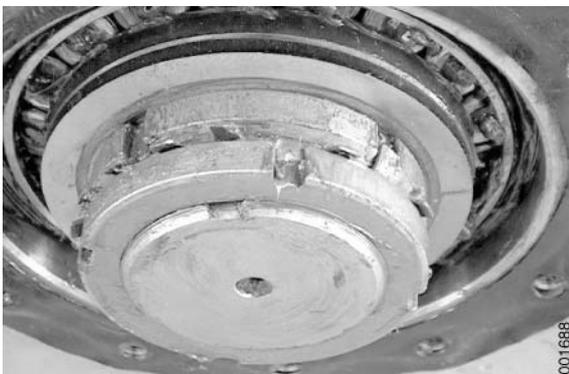
D. Angle torque the nut 45°.

E. Rotate the hub 10 revolutions.

F. Angle torque the nut 45°.

23 Grease the lock washer and fit it.

24 Install the lock nut and tighten with at least **250 Nm** or as tight as is needed to fold the lock washer in the nearest slot. Lock the bearing nut and lock nut with the lock washer.





- 25 Install the bearing cap and fill it with grease.
- 26 Grease the wheel bearing with grease through the grease nipple.  
Lift the seal ring's lip with a small screwdriver to facilitate the escape of air. Grease until grease comes out at the seal.
- 27 Fit the wheel.
- 28 Remove the support and lower the steering wheel.

## 6.3 Tyre and rim system

### Tyre system, safety



## DANGER

Always block the wheels on the side of the axle where no work is to be done before positioning the jack. Always secure the jack to prevent it from sliding out of position.

Deflate the tyre before removal. Otherwise the lock ring and locking clips can loosen and shoot out when the pressure is changed. With double wheel fitting both tyres must be deflated!

Do not release air through the valve if the tyre or rim is damaged. Drill a hole in the tread to release the air. Damaged tyres may explode.

Never stand directly opposite the tyre when deflating or inflating. The lock ring and lock lugs may release and shoot off when the pressure changes.

Never install damaged tyres or rims.

It's prohibited to repair rims with welding.

It's prohibited to operate the machine if one of the tyres is flat.

Wheels, tires and rims are dimensioned and selected for each machine type so that maximal wheel loads and travel speeds are not exceeded. That is why it is forbidden to change tire dimension, tire brand, tire type, rim type or rim brand without approval from Kalmar Industries AB



## CAUTION

**When removing wheels, the wheel nuts should be left in place after loosening. If the wheel nuts are removed immediately, the wheel may release from the hub.**

**When removing drive wheels, make sure that the wheels are fixed when the spacer rings are removed. If the wheels move, they may move the spacer rings and crushing damage may result.**

**When installing drive wheels, ensure that the clamps clamp straight on the spacer ring.**

**Wheel nuts should be check-tightened after 4-5 operating hours.**

**Always follow the tyre manufacturer's or other approved instructions when changing tyres.**

**Never use a steel hammer to install or remove rim components. Instead, use a lead, brass or plastic mallet.**

**Keep the tyre pressure at the prescribed level. Insufficient tyre pressure impairs stability and reduces the machine's capacity.**

**Remove penetrating objects such as crushed glass, pieces of wood, metal filings, etc.**

**Check if tyre wear is abnormal, this could indicate a mechanical fault. Rectify faults immediately and change damaged tyres.**

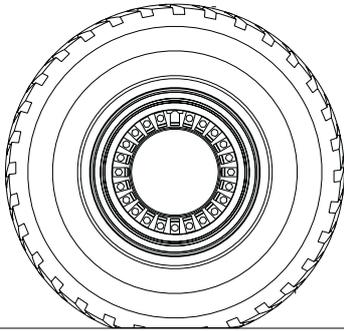
### 6.3.1 Tyres

#### Tyres, description

The tyres are the point of contact between the machine and the ground. These absorb unevennesses and provide suspension.

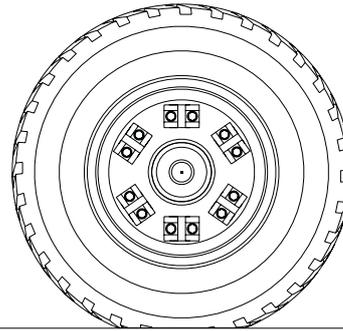
The drive axle is subject to major forces during operation and if each tyre's rolling circumference differs then the stresses on the drive axle increase. For this reason it is important that the tyres on the drive axle have equal wear and correct air pressure.

Spare and exchange tyres shall be of a make approved by Kalmar Industries.



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Front wheels



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Rear wheels

#### Tyres, changing

**DANGER**

**Changing tyres is complicated and dangerous work.**

**FATAL DANGER!**

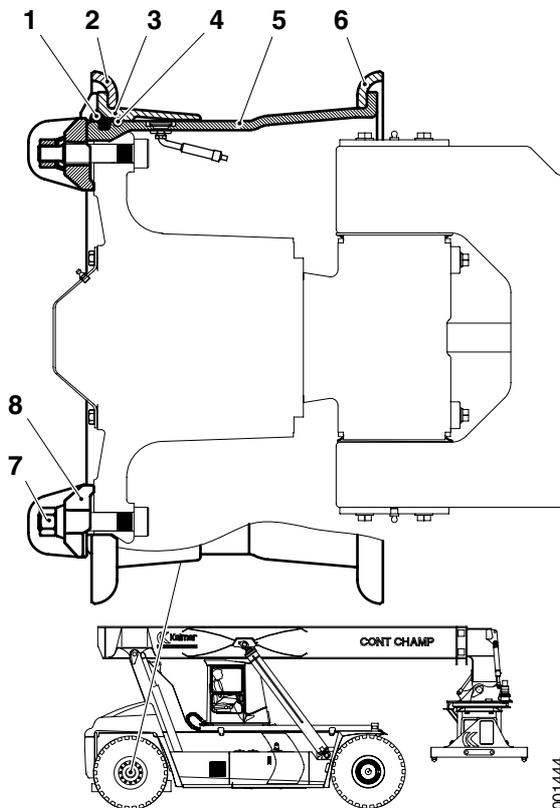
**Leave tyre work to authorized personnel/ tyre company.**

## 6.3.2 Rims

### Rims, description

The rim is split to enable installation of tires. The rim consists of the following parts.

- Rim
- Rim bead seat
- Rim flange
- Lock ring
- Lock lugs
- Hub plate



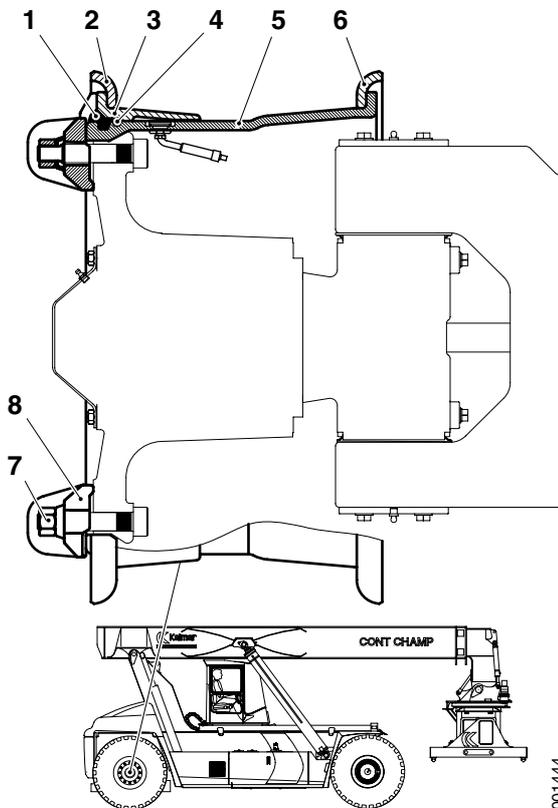
1. Lock ring
2. Rim flange
3. Rim bead seat taper
4. O-ring
5. Rim
6. Rim flange
7. Wheel nut
8. Wheel clamp

### 6.3.3 Nut, washer and clamp (wedge)

#### Nut, washer and clamp, description

The rim is attached to the wheel hub with nuts and clamps.

The number of nuts and number of clamps vary depending on which type of drive axle and steering axle is used.



001444

1. Lock ring
2. Rim flange
3. Rim bead seat taper
4. O-ring
5. Rim
6. Rim flange
7. Wheel nut
8. Wheel clamp

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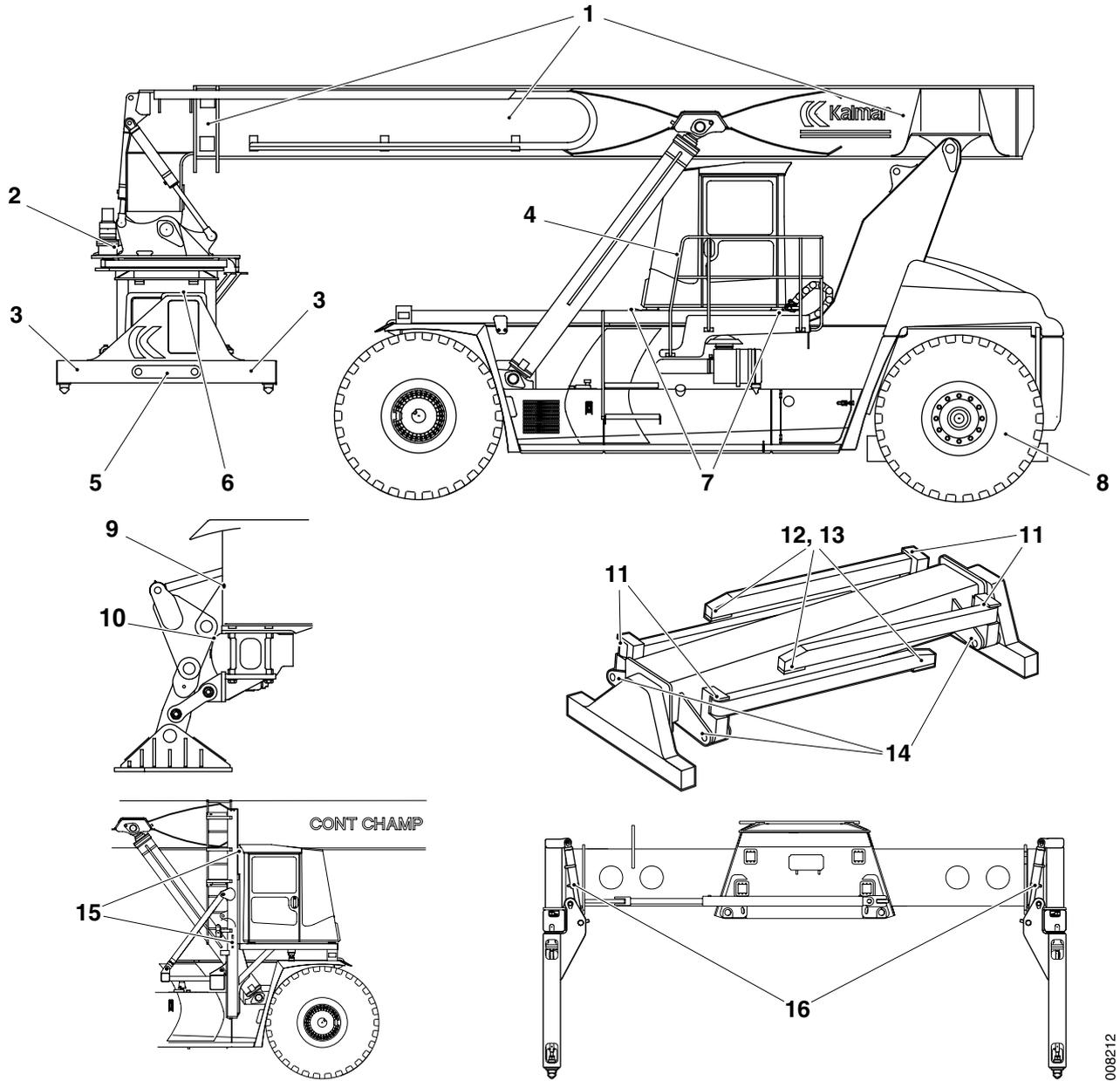
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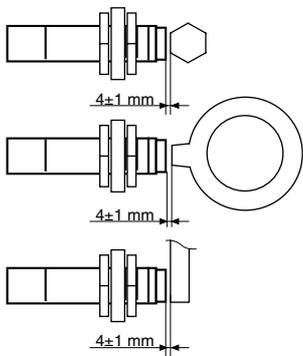
# 7 Load handling

## Position sensor, checking and adjustment



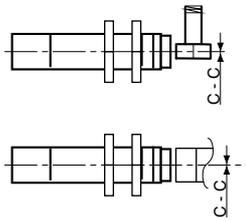
- |  |                                 |  |   |
|--|---------------------------------|--|---|
| 1. Sensor, boom length                                       | 5. Sensor, twistlocks           | 9. Sensor, support jacks up <input checked="" type="checkbox"/>    | 13. Sensor, clamping position                               |
| 2. Sensor, rotation stop <input checked="" type="checkbox"/> | 6. Sensor, spreading            | 10. Sensor, support jacks down <input checked="" type="checkbox"/> | 14. Sensor, knee  |
| 3. Sensor, alignment   | 7. Sensor, damping end position | 11. Sensor, lift leg   | 15. Sensor, lowered cab <input checked="" type="checkbox"/> |

## 4. Sensor, steering angle



Adjusting position sensor - indicator

## 8. Sensor, steering axle



## 12. Sensor, alignment

- 1 Machine in service position, see tab *B Safety*.
- 2 Check that the sensor in question is free of damage and dirt.
- 3 Check that the distance between position sensor and indicator is  $4\pm 1$  mm. Adjust as needed.

## 16. Sensor Overheight-legs up



## IMPORTANT

**It is very important that the bolt head by Sensor steering axle is directly opposite the sensor's centre and that the bolt head faces so that the edge is parallel with the sensor's top.**

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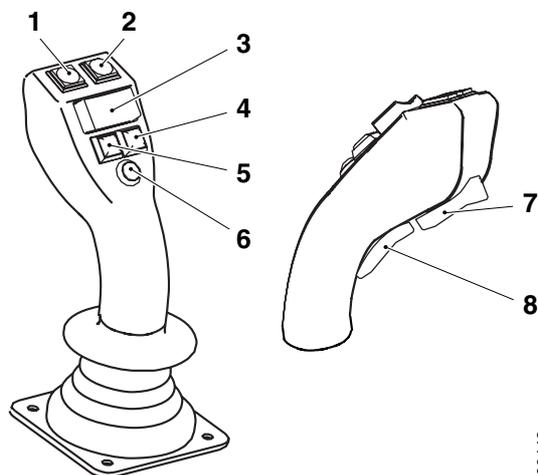
## 7.1 Controls and instrumentation

### 7.1.1 Control lever

#### Control lever, description

Control lever (S815) is used to control the boom and attachment. The lever sends voltage signals to Control unit cab (D790-1).

The control lever has three or four potentiometer-controlled functions and six on/off functions.



1. Tilt lock (S815-T3.1)
2. Levelling lock (S815-T3.2)
3. Rotation (S815-P3)
4. Sideshift right (S815-T1.2)
5. Sideshift left (S815-T1.1)
6. Opening of twistlocks (S815-T2) at full alignment
7. Tilt (S815-P4)
8. Pistol trigger (S815-T4): Activates weighing , changes sideshift function to spreader out (S815-T1.2) and spreader in (S815-T1.1) as well as lift to synchronised lift

#### Lift and lower

Lift and lower is controlled by moving the control lever forward (lower boom) or back (lift boom). See *Lift and lower, function description page 11*.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.8.1 BOOM, menu 1*.

#### Extension

Extension is controlled by moving the control lever right (boom out) or left (boom in). See *Extension, function description page 32*.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.8.1 BOOM, menu 1*.

#### Sideshift or Spreading

When switch (position 4) is pressed down, sideshift right is activated, and when switch (position 5) is pressed down, sideshift left is activated. See *Sideshift, function description page 44*.

If the pistol trigger (position 8) is pressed in at the same time as sideshift right (position 4), then spreader out is activated. If the pistol trigger (position 8) is pressed in at the same time as sideshift left (position 5) then spreader in is activated. See *Spreading, function description page 58*.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.9.2 ATTACH, menu 2*.

#### Rotation

When the potentiometer (position 3) is pressed down on the left side, then rotation clockwise is activated, and rotation counter-clockwise is activated when the right side is pressed down. See *Rotation, function description page 80*.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.9.1 ATTACH, menu 1*.

#### Opening of twistlocks

When the switch (position 6) is activated, the twistlocks are opened, if the conditions for this are fulfilled. See *Twistlocks, function description page 112*.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.9.3 ATTACH, menu 3*.

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### Tilt



When the potentiometer (position 7) is pressed down at the top edge, then tilt out is activated, and tilt in is activated when the switch is pressed in at the bottom edge. See *Tilt control, function description page 97*.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.9.1 ATTACH, menu 1*.

### Tilt lock



When the switch (position 1) is pressed down, then tilt lock is activated. When tilt lock is activated, the light in the switch is on. See *Tilt lock, function description page 95*.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.9.4 ATTACH, menu 4*.

### Levelling



When the potentiometer rotation (position 3) is pressed down on the left side at the same time as the pistol trigger (position 8) is pressed in, then levelling right is activated. When the right side is pressed down at the same time as the pistol trigger is pressed in, then levelling left is activated. See *Hydraulic levelling, function description page 104*.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.9.1 ATTACH, menu 1*.

### Levelling lock



When switch (position 2) is pressed down, levelling lock is activated. When levelling lock is activated, the indicator light in the switch is on. See *Levelling lock, function description page 106*.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.9.4 ATTACH, menu 4*.

### Pistol trigger



The pistol trigger (position 8) activates weighing if the machine is equipped with weight indicator. See *Weight indicator, description page 161*.

The pistol trigger also changes the function of other buttons on the control lever.

If sideshift is activated at the same time as the pistol trigger is pressed in, then spreading is activated. See *Spreading, function description page 58*.

⊕ If lift is activated at the same time as the pistol trigger is pressed in, then synchronized lift is activated, if the machine is equipped with this option. See *Synchronous lift, function description page 171*.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.9.2 ATTACH, menu 2*.

## 7.1.2 Switch lock twistlocks

### Switch lock twistlocks, description

Switch lock twistlocks (S1001) controls locking of twistlocks. The switch has three positions: two fixed and one rocker with the following functions.

1. Automatic locking of the twistlocks at full alignment and released parking brake.
2. Twistlocks open (off).
3. Manual locking of the twistlocks at full alignment and released parking brake (sprung).

Twistlocks are opened with a switch on the control lever, see *Control lever, description page 7*.

The switch is supplied with voltage from and sends a voltage signal to Control unit cab (D790-1).

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.9.3 ATTACH, menu 3*.

## 7.1.3 Switch automatic spreading

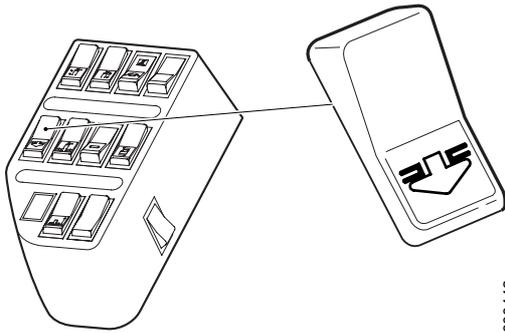
### Switch automatic spreading, description



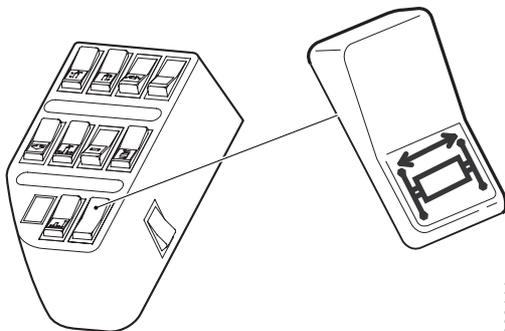
Switch automatic spreading (S1012) activates automatic spreading. When the switch is pressed down spreading automatically goes to next position (20, 30 or 40 foot) if spreading is activated with the control lever.

The switch is supplied with voltage from and sends a voltage signal to Control unit cab (D790-1) when the switch is activated.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.9.4 ATTACH, menu 4*.



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### 7.1.5 Switch stop at 30' or 35'

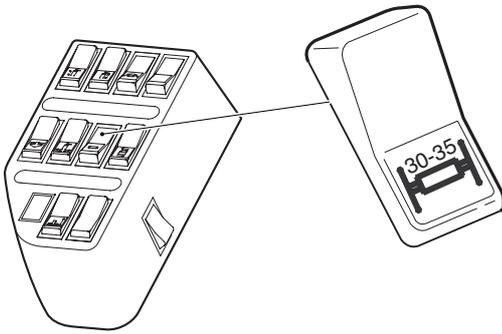
#### Switch stop at 30' or 35', description



Switch stop at 30' or 35' (S1004) activates 30 and 35 foot stop. When the switch is pressed down the spreading function changes from 20'–40' to stop at 30'.

The switch is supplied with voltage from and sends a voltage signal to Control unit cab (D790-1).

The signal can be checked with from the menu, see section *8 Control and monitoring system*, group *8.4.9.2 ATTACH*, menu 2.

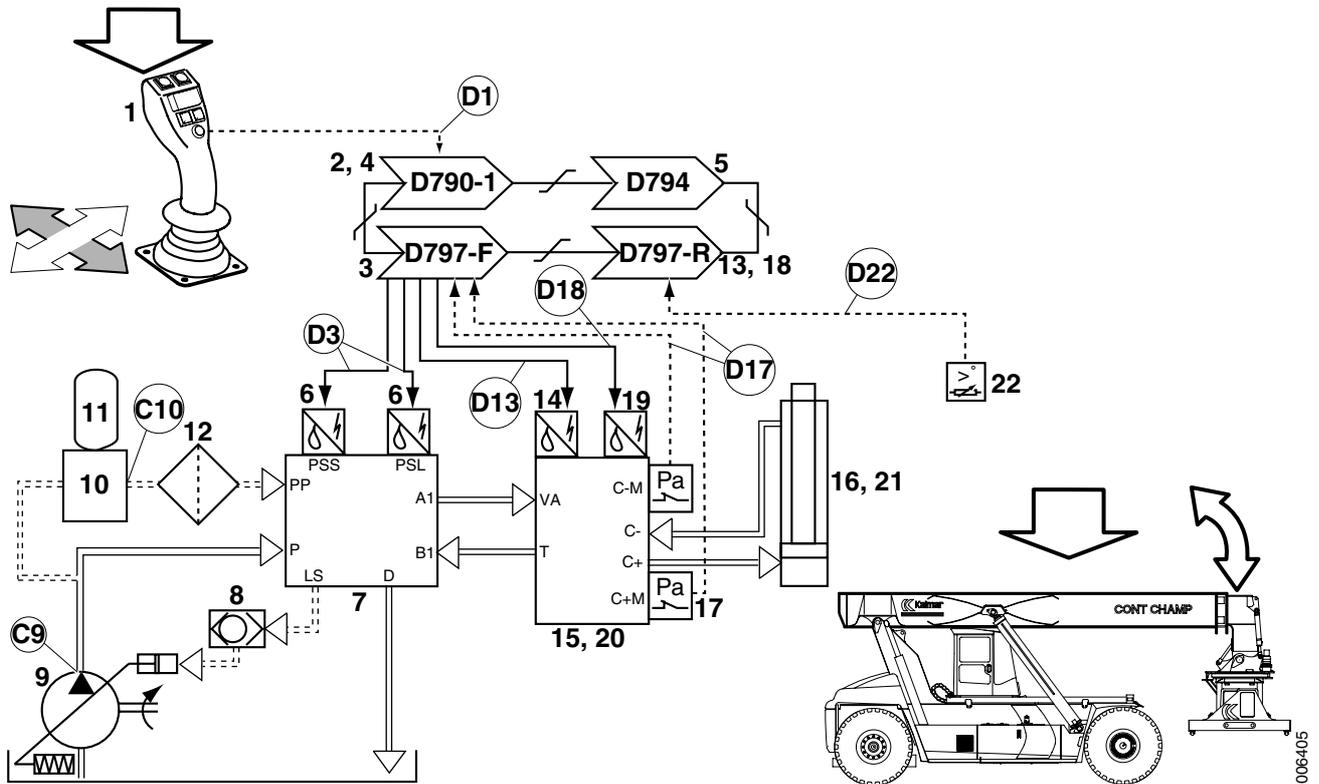


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## 7.2 Lifting/lowering

### Lift and lower, function description

Condition	Reference value	Reference
Control switch	Disengaged	Tab 11 Common electric, group 11.5.1.4 Manoeuvre switch voltage
Twistlocks	Locked or unlocked, not intermediate position	Twistlocks, description page 119
Overload system	Boom up: passive Boom down: passive or by-pass activated	Section 8 Control and monitoring system, group 8.2.1 Overload system
Alignment	Boom down: no alignment	Twistlocks, function description page 112
 Height limitation	By-passed or boom height lower than height limitation	Tab 8 Control system, group 8.2.4 Height limitation



Pos	Explanation	Signal description	Reference
1	Control lever (S815-P1) sends voltage signal proportional to lever movement to Control unit cab (D790-1).	Lower: $U_{S815/P1} = 0.5\text{--}2.0\text{ V}$ Zero position: $U_{S815/P1} = 2.0\text{--}3.0\text{ V}$ Lift: $U_{S815/P1} = 3.0\text{--}4.5\text{ V}$ 0.5 V is the fastest lowering speed and 4.5 V is the fastest lift speed. Lower voltages than 0.5 V and higher voltages than 4.5 V are used to detect malfunctions in cabling and controls.	<i>Control lever, description page 7</i> D1: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.8.1 <i>BOOM</i> , menu 1
2	Control unit cab (D790-1) sends request for Boom up or Boom down with speed information on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
3	Control unit frame front (D797-F) activates Servo valve, lift (Y6005) or Servo valve, lower (Y6004).	$I = 380\text{--}650\text{ mA}$	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i> D3: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.8.4 <i>BOOM</i> , menu 4 and 8.4.8.5 <i>BOOM</i> , menu 5
4	Control unit cab (D790-1) sends request for increased engine rpm on CAN-bus	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
5	Control unit engine (D794) increases engine rpm.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.10 <i>Control unit engine</i>
6	Servo valve, lift (Y6004) or Servo valve, lower (Y6005) pressurizes control valve's lift spool with servo pressure.	-	<i>Control valve lift lower and extension, description page 19</i> D3: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.8.4 <i>BOOM</i> , menu 4 and 8.4.8.5 <i>BOOM</i> , menu 5
7	The control valve's lift spool changes position and pressurizes valve block lift cylinder and sends load signal to the hydraulic oil pumps.	-	<i>Control valve lift lower and extension, description page 19</i>
8	The shuttle valve sends the strongest load signal if several functions are activated simultaneously.	-	Tab 10 <i>Common hydraulics</i> , group 10.5.3 <i>Shuttle valve</i>
9	The hydraulic oil pumps pump oil from the hydraulic oil tank.	See pressure plate on left frame beam.	Tab 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
10	The pressure reducer reduces the oil pressure from the hydraulic oil pumps to servo pressure for the control valve.	See pressure plate on left frame beam.	<i>Pressure reducer, description page 15</i>

Pos	Explanation	Signal description	Reference
11	The accumulator stores servo pressure. The non-return valve in the pressure reducer makes it possible to store the pressure when the engine is shut off.	See pressure plate on left frame beam.	<i>Accumulator servo circuit, description page 17</i>
12	The servo filter cleans the servo oil before the control valve.	-	<i>Servo filter, description page 15</i>
13	At boom down Control unit frame front (D797-F) activates Servo valve, blocking right (Y6001) and Servo valve, blocking left (Y6002).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i> D13: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.8.2 <i>BOOM</i> , menu 2
14	For boom down, Servo valve, blocking right (Y6001) and Servo valve, blocking left (Y6002) affect the blocking valves in the valve blocks for left and right lift cylinder, respectively.	-	<i>Valve block lift cylinder, description page 21</i> D13: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.8.2 <i>BOOM</i> , menu 2
15	For boom up, the blocking valves are opened in the valve blocks for left and right lift cylinder, respectively, by the hydraulic pressure from the control valve.  For boom down, the blocking valve opens and releases pressure from the lift cylinder.	-	<i>Valve block lift cylinder, description page 21</i>
16	The lift cylinders' piston side are pressurized and the boom lifts.	-	<i>Lift cylinder, description page 24</i>
17	<b>Regeneration</b> Sensor hydraulic pressure lift cylinder piston side left (B768-L1) sends voltage signal proportional to oil pressure to Control unit frame front (D797-F).  <b>NOTE</b> <i>Regeneration is not possible near end-position or at overload.</i>	U <sub>B768-L1/1</sub> = 5 V U <sub>B768-L1/2</sub> = 0 V U <sub>B768-L1/5</sub> = 0.5-4.5 V Regeneration is activated when the pressure in the lift cylinders is 8.5 MPa, regeneration is interrupted if the pressure reaches 18.5 MPa.	<i>Sensor hydraulic pressure lift cylinder, description page 28</i> D17: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.10.3 <i>OP</i> , menu 3
18	Control unit frame front (D797-F) activates Solenoid valve regeneration right (Y6051) and Solenoid valve regeneration left (Y6052) if the pressure is sufficiently low for regeneration.	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i> D18: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.8.3 <i>BOOM</i> , menu 3
19	Servo valve, regeneration pressurizes the regeneration valve.	-	<i>Valve block lift cylinder, description page 21</i>
20	The regeneration valve changes position and leads oil from the lift cylinder's rod side to the piston side.	-	<i>Valve block lift cylinder, description page 21</i>

Pos	Explanation	Signal description	Reference
21	Lift speed increases.	-	-
22	<p><b>Damping</b></p> <p>When the boom is approx. 4° from any end-position, then damping is activated.</p> <p>Sensor boom angle (B771) sends voltage signal proportional to boom angle to Control unit frame rear (D797-R) which request damping on the CAN-bus.</p>	-	<p>Tab 8 Control system, group 8.2.1.5 Sensor boom angle</p> <p>Tab 11 Common electric, group 11.5.3.3 Control unit frame rear</p> <p>D22: Diagnostic menu, see tab 8 Control system, group 8.4.8.8 BOOM, menu 8</p>

Hydraulic diagram basic machine

### Lowering speed, checking



## DANGER

**The lowering speed must be correct. If lowering speed is too high, there is a risk of tipping over.**

**The machine may absolutely not be used before the lowering speed is verified.**

- 1 Operate and warm up the machine and hydraulics until the hydraulic oil has reached operating temperature **50 °C**.
- 2 Lift a container that weighs 35-45 tons.
- 3 Drive the machine aside to a level and safe place.

### NOTE

*It is important that the ground surface is level and does not slope.*

- 4 Run in the boom completely and lift max.
- 5 Measure the time it takes to lower from top position until the container is approx. 20 cm from the ground.  
Lowering should take **18-21 seconds**.
- 6 If the time is incorrect, contact Kalmar Industries for further instructions.

## 7.2.1 Hydraulic oil pump

### Hydraulic oil pump, general

See section 10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement.

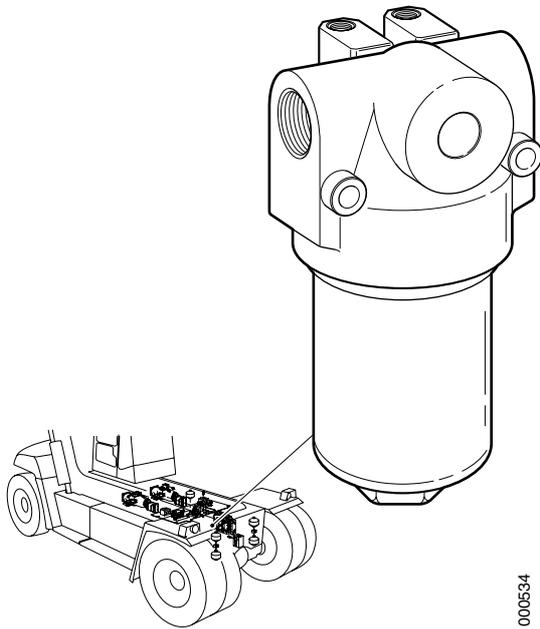
## 7.2.2 Servo filter

### Servo filter, description

The servo filter protects the control valve's servo circuits against impurities. The servo filter is located in the front edge of the lift beam on the right-hand side in the engine bay, between the pressure reducer and control valve lift, lower and extension.

The servo filter is a low pressure filter with detachable filter cartridge. The oil is cleaned when it passes through the filter cartridge filter material.

The filter cartridge is pressed against the upper section of the filter housing by a spring. Rubber gaskets seal between cartridge and filter housing. If the back pressure through the filter is too great the cartridge is pressed down so that the oil passes through the cartridge. This occurs if the oil is viscous (cold or incorrect viscosity) or if the filter cartridge is clogged.



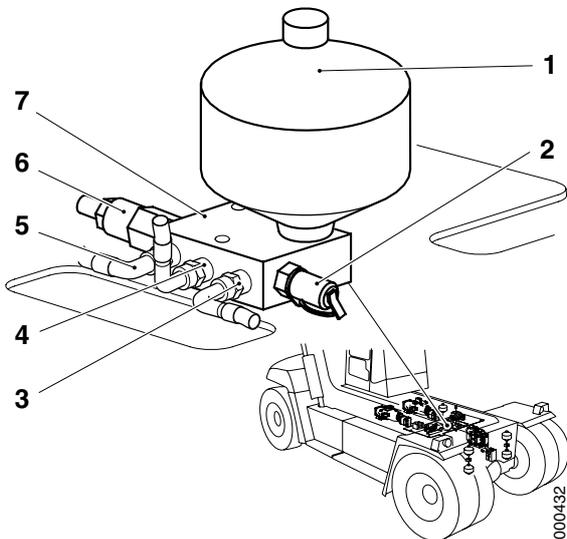
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## 7.2.3 Pressure reducer

### Pressure reducer, description

The pressure reducer reduces the pressure from the hydraulic oil pumps to servo pressure for the control valve. The pressure reducer is located to the right on the lift beam in the engine compartment with the accumulator for servo pressure.

Servo pressure is stored in an accumulator. A built-in non-return valve prevents pressure leakage from the accumulator when the machine is not used.



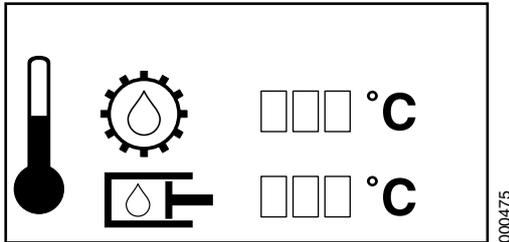
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1. Accumulator servo pressure
2. Pressure check connection, servo pressure
3. Pressure supply from servo filter
4. Return to tank
5. Servo pressure to control valve
6. Adjusting screw, servo pressure.

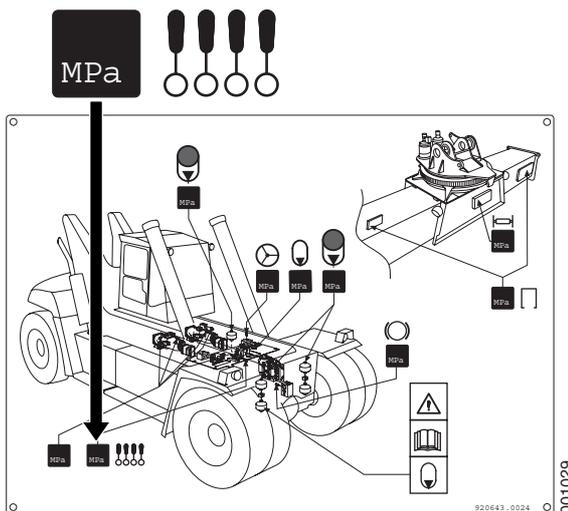
## Servo pressure, checking and adjusting

### NOTE

Read the instructions for oil before working, see tab B Safety.



Operating menu hydraulic oil temperature



- 1 Operate and warm up the machine so that the hydraulic oil is at operating temperature, at least 50 °C. As an alternative, operate until the cooling fan is activated.
- 2 Machine in service position, see tab B Safety.
- 3 Depressurise the brake and hydraulic systems, see tab B Safety.
- 4 Connect a pressure gauge (0–25 MPa) to the test outlet on the pressure reducer.

- 5 Start the engine and check the servo pressure. Compare with the pressure plate.

Turn the steering wheel or activate a load handling function to activate the hydraulic oil pumps. The servo pressure is higher than the standby pressure of the hydraulic oil pumps.



- 6 If needed, adjust the pressure with the adjusting screw. Loosen the lock nut and turn the adjusting screw.

### NOTE

*If the servo pressure is too high, a load handling function must be activated so that servo pressure is used from the accumulator for a reduction on the adjusting screw to be seen on the pressure gauge. Sometimes the engine has to be shut off between the checks.*

**Clockwise:** reduce pressure.

**Counter-clockwise:** increase pressure.

- 7 Depressurise the brake and hydraulic systems, see tab *B Safety*.
- 8 Remove the pressure gauge and fit the protective cap on the pressure check connection.

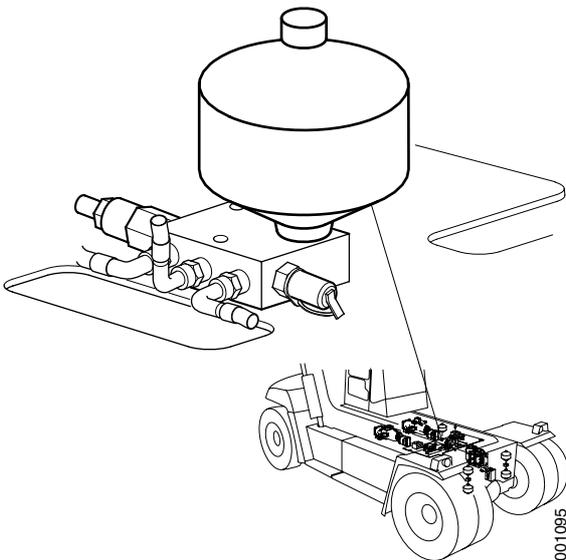
## 7.2.4 Accumulator servo circuit

### Accumulator servo circuit, description

The accumulator stores pressurised oil and ensures that there is servo pressure for activating the control valve's functions. The accumulator is located on the pressure reducer to the right of the lift beam in the engine bay.

The accumulator is a diaphragm type and is divided into two spaces by a diaphragm. One side of the diaphragm is pressurised with nitrogen gas. The other side is pressurised by hydraulic oil which compacts the nitrogen gas.

Furthest up on the accumulator is a test outlet for checking gas pressure and filling gas.

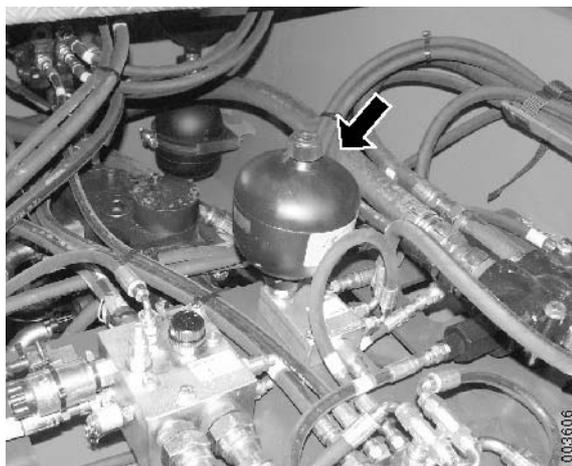


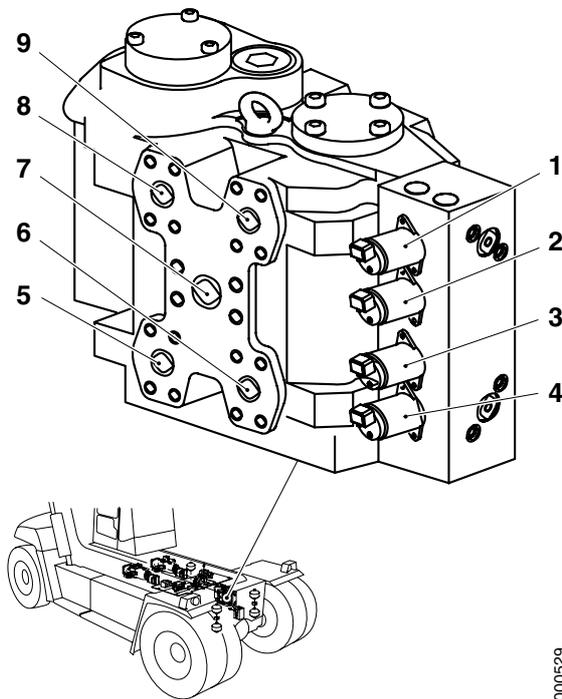
## Accumulator servo circuit, replacement

### NOTE

*Read the safety instructions for oil before working, see tab B Safety.*

- 1 Depressurize the brake and hydraulic systems, see tab *B Safety*.
- 2 Machine in service position, see tab *B Safety*.
- 3 Detach the accumulator from its mounting.
- 4 Replace the accumulator.
- 5 Fit in the reverse order.
- 6 Check the oil level and fill with hydraulic oil as necessary.





1. Servo valve boom out (Y6006)
2. Servo valve boom in (Y6007)
3. Servo valve lower (Y6004)
4. Servo valve lift (Y6005)
5. Connection, rod side, right lift cylinder (B2)
6. Connection, piston side, right lift cylinder (A1)
7. Connection, feed from hydraulic oil pumps (P)
8. Connection, rod side, extension cylinder (B1)
9. Connection, piston side, extension cylinder (A1)

000529

## 7.2.5 Manoeuvre valve lift, lower, protrude

### Control valve lift lower and extension, description

The control valve controls the speed and direction of lift and extension. The control valve is located on a bracket in the space between the lift beam and front axle.

The valve has two sections: one for the lift function and one for boom extension. The sections have great similarities but are described separately for each function. For extension, see *Control valve lift, lower and extension, description page 36*. Electric servo valves control the flow from the valve.

The control valve is a proportion valve controlled by servo valves. This means that both size and direction of flow from the valve can be adjusted and that the valve also sends a control signal to the variable pumps.

Electrically controlled pressure reducing valves (servo valves) convert electrical current to a small hydraulic pressure proportional to the current, so-called "servo pressure". The servo pressure acts on spring centred control slides in the control valve for the function in question and this way control the main flow.

The speed of the function is controlled by means of the flow being regulated in proportion to the lever movement.

### Lift slide

The lift slide controls direction and flow of oil to the lift cylinder.

### Servo valve lift

Servo valve lift controls servo pressure to the lift slide so that this controls oil pressure for lift. The valve is controlled electrically with Solenoid valve lift (Y6005) which is activated by Control unit frame front (D797-F).

The signals can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.8.4 *BOOM*, menu 4.

### Servo valve lower

Servo valve lower controls servo pressure to the lift slide so that it controls oil pressure for lowering. The valve is controlled electrically with Solenoid valve lower (Y6004) which is activated by Control unit frame front (D797-F).

The signals can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.8.5 *BOOM*, menu 5.

**Control valve lift, lower, and extension, changing****DANGER**

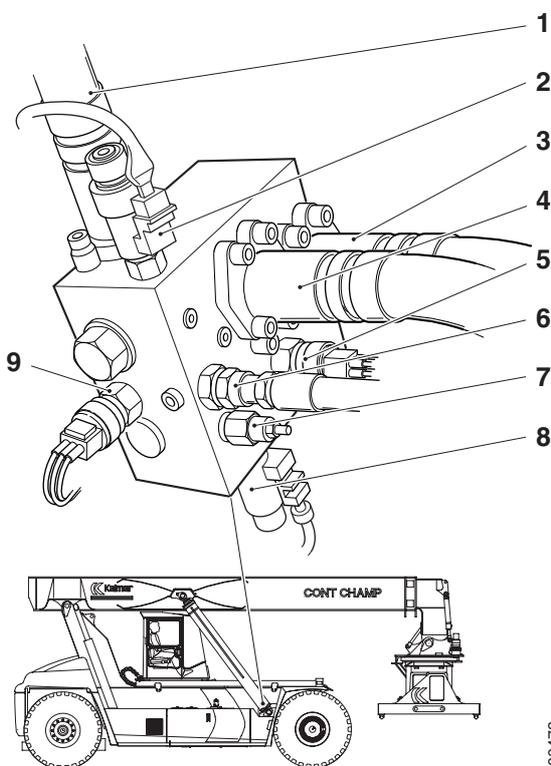
**The lowering speed must be correct. If lowering speed is too high, there is a risk of tipping over.**

**The machine may absolutely not be used before the lowering speed is verified.**

After changing Control valve lift, lower and extension, or parts of the valve, the lowering speed must be checked. See *Lowering speed, checking page 14*.

**7.2.6 Shuttle valve****Shuttle valve, description**

See section *10 Common hydraulics, group 10.5.3 Shuttle valve*.



1. Connection, rod side, lift cylinder (C-)
2. Servo valve, regeneration (Y6051 or Y6052)
3. Connection, pressure supply (VA)
4. Connection tank (T)
5. Pressure sensor, piston side (C+M)
6. Drain servo valves (D)
7. Shock valve
8. Servo valve, blocking (Y6001 or Y6002)
9. Pressure sensor, rod side (C-M)

## 7.2.7 Valve block lift cylinder

### Valve block lift cylinder, description

Valve block lift cylinder directs the oil to the lift cylinder and is bolted directly on the lower part of the lift cylinder. The valve block contains a blocking valve, regeneration valve, non-return valve and shock valve.

#### Blocking valve

The blocking valve prevents unwanted lowering and angling of the lift cylinders. The blocking valve holds the load by ensuring that the connection to the lift cylinder's piston side is closed. (The pressure passes through a restriction as blocking pressure and holds the valve slide closed.)

Servo valve blocking affects the blocking valve. The servo valve is controlled electrically with Solenoid valve, blocking left (Y6002) and Solenoid valve, blocking right (Y6001), which are activated by Control unit frame front (D797-F).

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.8.2 *BOOM*, menu 2.

#### Regeneration valve

The regeneration valve directs oil from the cylinder's rod side back to the piston side. This makes it possible to re-use the oil for lifting. For more information on regeneration, see *Lift and lower, function description page 11*. The regeneration valve is controlled by servo valve regeneration.

Servo valve for regeneration actuates the regeneration valve. The servo valve is controlled electrically with Solenoid valve, regeneration right (Y6051) and Solenoid valve, regeneration left (Y6052), which are activated by Control unit frame front (D797-F).

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.8.3 *BOOM*, menu 3.

#### Shock valve

The shock valve protects the hydraulic system against surges which can occur when operating with a load. The shock valve opens a connection between the lift cylinder piston side and tank if the pressure becomes too high.

#### Non-return valve

The non-return valve prevents oil from flowing the wrong way during regeneration.

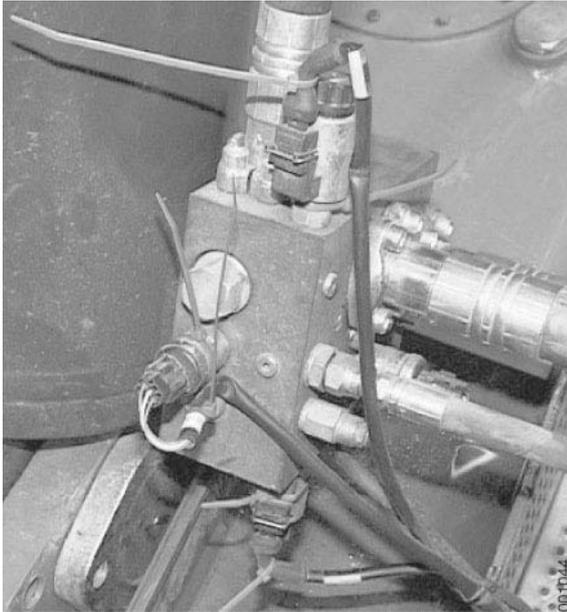
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## Valve block lift cylinder, replacement

### NOTE

*Read the safety instructions for oil before working, see tab B Safety.*

- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the brake and hydraulic systems, see tab B Safety.
- 3 Turn the start key to position 0 and turn off the main electric power.
- 4 Mark up and detach the wiring from the valve block.
- 5 Remove the cabling's clamping at the valve block.

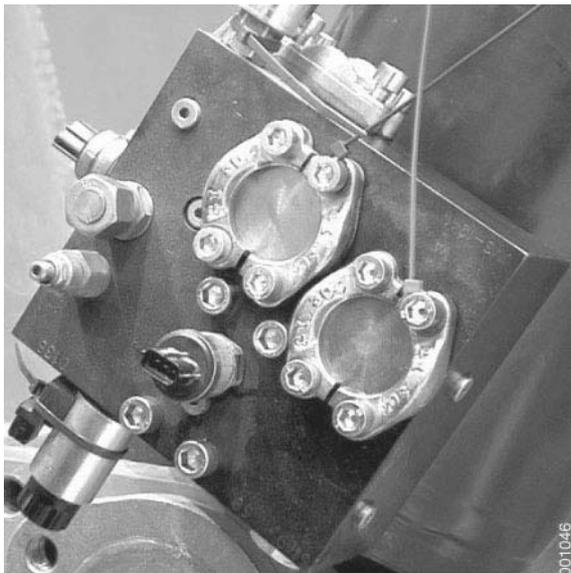


- 6 Mark up and detach the hydraulic hoses from the valve block.

### NOTE

*Plug all connections immediately to protect the hydraulic system from impurities.*





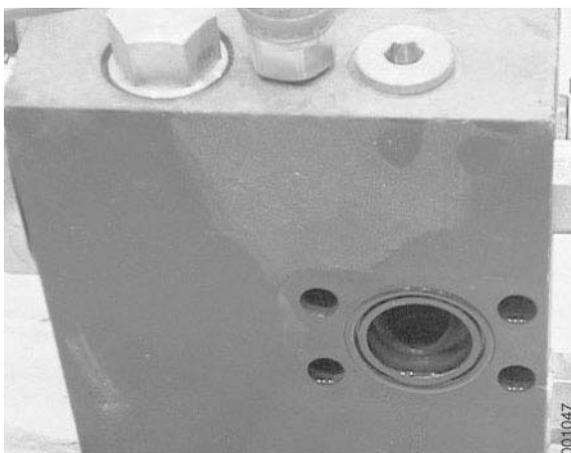
- 7 Remove the valve block from the lift cylinder.  
Remove the attaching bolts and lift away the valve block.
- 8 Transfer the connection adapters, sensors and servo valves to the new valve block.

**NOTE**

*Check that the O-rings are intact and correctly fitted.*

**NOTE**

*Transfer one part at a time so that the marking is not mixed up.*



- 9 Fit a new valve on the lift cylinder.

**NOTE**

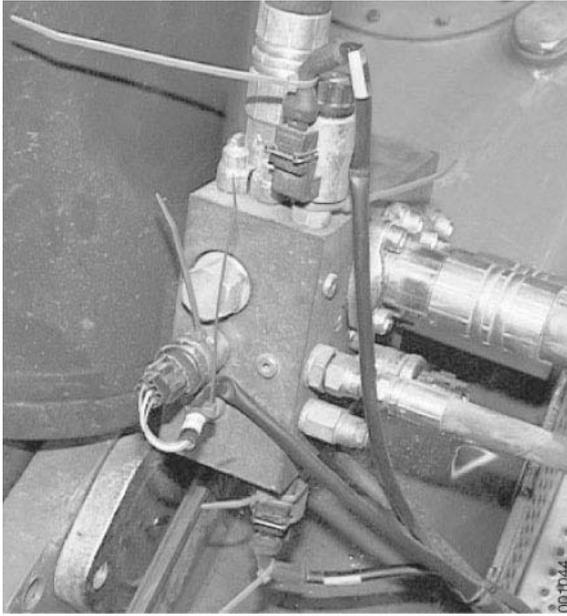
*Check that the O-rings are intact and correctly fitted.*



- 10 Connect the hydraulic hoses to the valve block in accordance with the marking.

**NOTE**

*Check that the O-rings are intact and correctly fitted.*



- 11 Connect the wiring to the valve block in accordance with the marking.
- 12 Clamp the cable harness as before.
- 13 Turn on the main electric power and start the engine.
- 14 Activate lift carefully.

## CAUTION

**Air in the hydraulic system may cavitate and can result in product damage.**

**Activate the functions carefully and operate at the lowest possible speed a couple of times to avoid cavitation.**

- 15 Check for leaks.
- 16 Check the oil level in the hydraulic oil tank with the lift cylinders completely down and the extension cylinder completely in. The oil level should be at the top of the level glass. Top up as needed.



## CAUTION

**Overfilling of oil.**

**Leakage and environmental damage.**

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

- 17 Check the lowering speed, see *Lowering speed, checking page 14*.

## 7.2.8 Lift cylinder

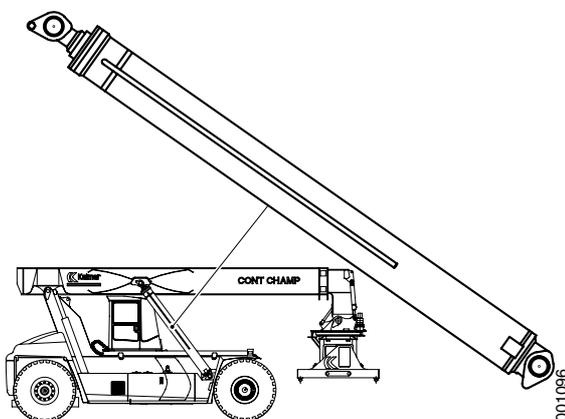
### Lift cylinder, description

The lift cylinders lift and lower (angle) the lift boom. The lift cylinders are located between boom and frame in the front edge of the machine, one on the right and one on the left-hand side.

On each lift cylinder is a valve block which controls pressurising and regeneration of the lift cylinder.

The lift cylinder is equipped with pivot bearings both in the cylinder and the piston rod bracket. The piston rod bracket is threaded in the piston rod and locked with a lock nut.

The lift cylinders are connected in parallel and fed from control valve lift, lower and extension, see *Control valve lift lower and extension, description page 19*.



### Lift cylinder, changing

## DANGER

### Fatal danger, risk of crushing!

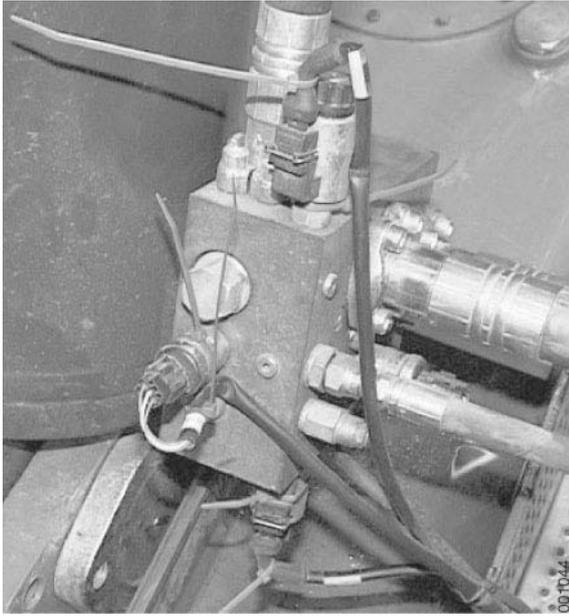
**Be certain to compensate for the lift cylinder's carrying of the boom by lifting the boom's leading edge with the lifting equipment.**

**A lift cylinder weighs approx. 2 tons. Use wooden blocks as protection between the cab and lift cylinder when the lift cylinder is lowered or lifted.**

**The boom may move when the pins are removed. Make sure that the pins are relieved. Stand to the side of the boom attachment so that the boom attachment gives protection in case of any movement.**

- 1 Place the cab in the forward position.
- 2 Machine in service position, see tab *B Safety*.
- 3 Depressurize the hydraulic and brake systems, tab *B Safety*.
- 4 Turn the start key to position 0 and turn off the main electrical power.
- 5 Connect lifting equipment at the leading edge of the boom.
- 6 Lift the boom at the leading edge so that the bearings on the lift cylinders are relieved.

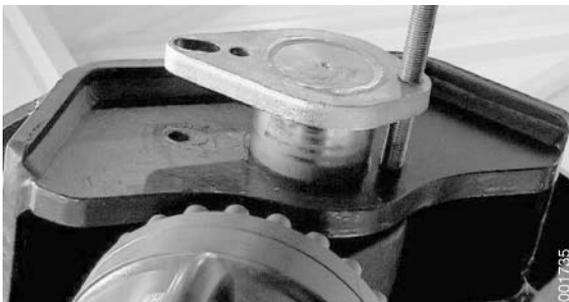




- 7 Mark up and disconnect the hydraulic hoses from the lift cylinder.



- 8 Connect lifting equipment to the lift cylinder.



- 9 Remove the upper pin for the lift cylinder.  
 10 Relieve the lower bearing on the lift cylinder.  
 11 Remove the lower pin for the lift cylinder.  
 12 Lift away the lift cylinder.  
 13 Install new bearing races in the lift cylinder.  
 14 Lubricate the lift cylinder's bearing races as well as the holes for the pins in the frame and boom thoroughly with aluminium paste.

## NOTE

*The bearings are only lubricated when they are changed.*

- 15 Lift the new lift cylinder into place  
 16 Install the pins for the lift cylinder.

- 17 Connect the hydraulic hoses to the lift cylinder.
- 18 Carefully activate the lift function.

## CAUTION

**Air in the hydraulic system may cavitate and can result in product damage.**

**Activate the functions carefully and operate at the lowest possible speed a couple of times to avoid cavitation.**

- 19 Check for leaks.
- 20 Check the oil level in the hydraulic oil tank with the lift cylinders completely down and the extension cylinder completely in. The oil level should be at the top of the level glass. Top up as needed.



## CAUTION

**Overfilling of oil.**

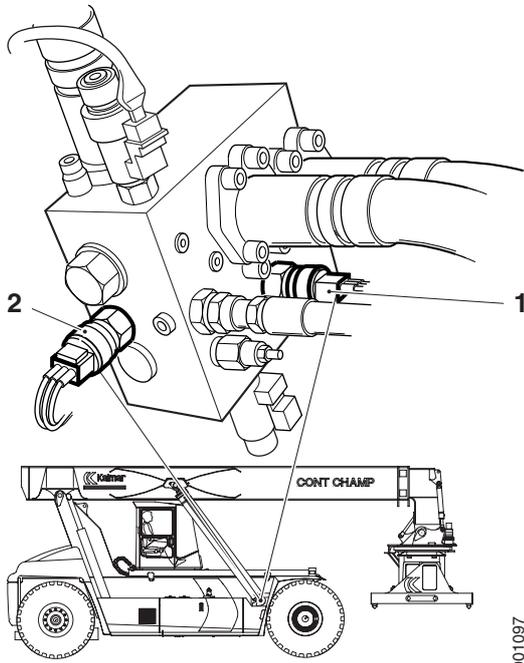
**Leakage and environmental damage.**

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

- 21 Check the lowering speed, see *Lowering speed, checking page 14*.

### **Hydraulic cylinders, repairing**

See tab *10 Common hydraulics*, group *10.7.1 Hydraulic cylinders*.



1. Sensor hydraulic pressure lift cylinder piston side left (B768-L1)

⊕ Sensor hydraulic pressure lift cylinder piston side right (B768-R1)

2. ⊕ Sensor hydraulic pressure lift cylinder piston rod side left (B768-L2)

⊕ Sensor hydraulic pressure lift cylinder piston rod side right (B768-R2)

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## 7.2.9 Sensor hydraulic pressure lift cylinder

### Sensor hydraulic pressure lift cylinder, description

Sensor hydraulic pressure lift cylinder measures the pressure in the lift cylinders and is located on valve block lift cylinder.

The pressure is measured to decide if regeneration can be engaged. A sensor measures the pressure on the piston side of the left lift cylinder.



If the machine is equipped with the option fixed scale an extra pressure sensor is used, on the piston side for the right lift cylinder.



If the machine is equipped with the option electric dynamic scale, then two pressure sensors are used, one for the piston rod side and one for the piston side on the right and left lift cylinder, respectively (a total of four sensors).

The sensors are supplied with voltage from and send a voltage signal proportional to hydraulic oil pressure to Control unit frame front (D797-F).

The signals can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.10.3 *OP*, menu 3.

### Sensor, hydraulic pressure, lift cylinder, replace

#### NOTE

*Read the safety instructions for oil before working, see tab B Safety.*

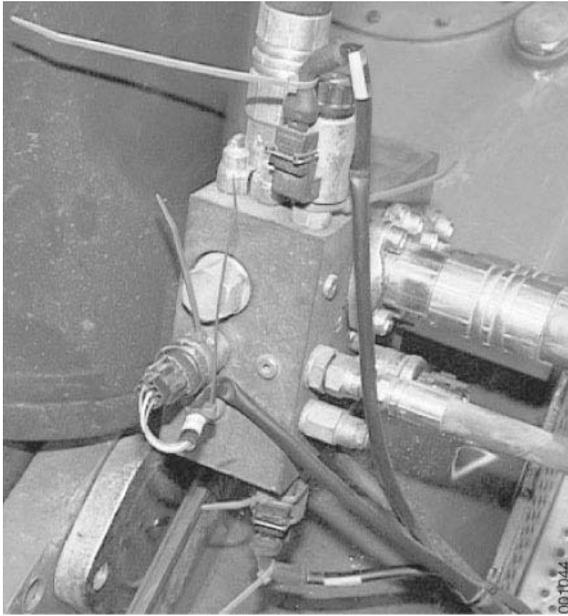
- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the brake and hydraulic systems, see tab B Safety.
- 3 Detach the wiring from the lift cylinder hydraulic pressure sensor.
- 4 Remove the lift cylinder hydraulic pressure sensor.

#### NOTE

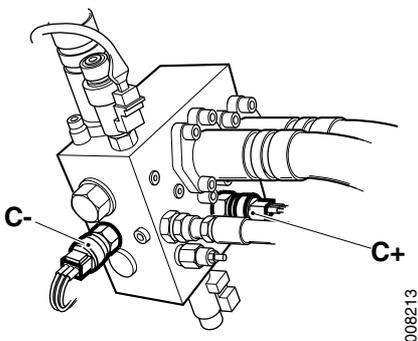
*Plug all connections immediately to protect the hydraulic system from impurities.*

- 5 Fit a new sensor.

#### NOTE



DIAG OP		3 (x)
PRESENT INPUT SIGNAL		
LIFT CYL	LE	RI
C-	X.XXV	X.XXV
C+	X.XXV	X.XXV



Check that the O-rings are intact and correctly fitted.

- 6 Connect the wiring to the hydraulic pressure sensor.
- 7 Clamp the cable harness as before.
- 8 Turn on the main electric power and start the engine.
- 9 Activate lift carefully.

**! CAUTION**

**Air in the hydraulic system may cavitate and can result in product damage.**

**Activate the functions carefully and operate at the lowest possible speed a couple of times to avoid cavitation.**

- 10 Check that the valve block's hydraulic connections are sealed and that lift and lower function correctly.
- 11 Check the oil level in the hydraulic oil tank with the lift cylinders completely down and the extension cylinder completely in. The oil level should be at the top of the level glass. Top up as needed.

**! CAUTION**

**Overfilling of oil.**

**Leakage and environmental damage.**

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

- 12 Check the function of the sensor with diagnostic menu. See tab 8 *Control system, group 8.4.10.3 OP, menu 3.*

Raise the boom and check that the sensor sends values. The value should be approx. the same as from the sensor on the other lift cylinder (RI/LE).

## 7.2.10 Lift boom

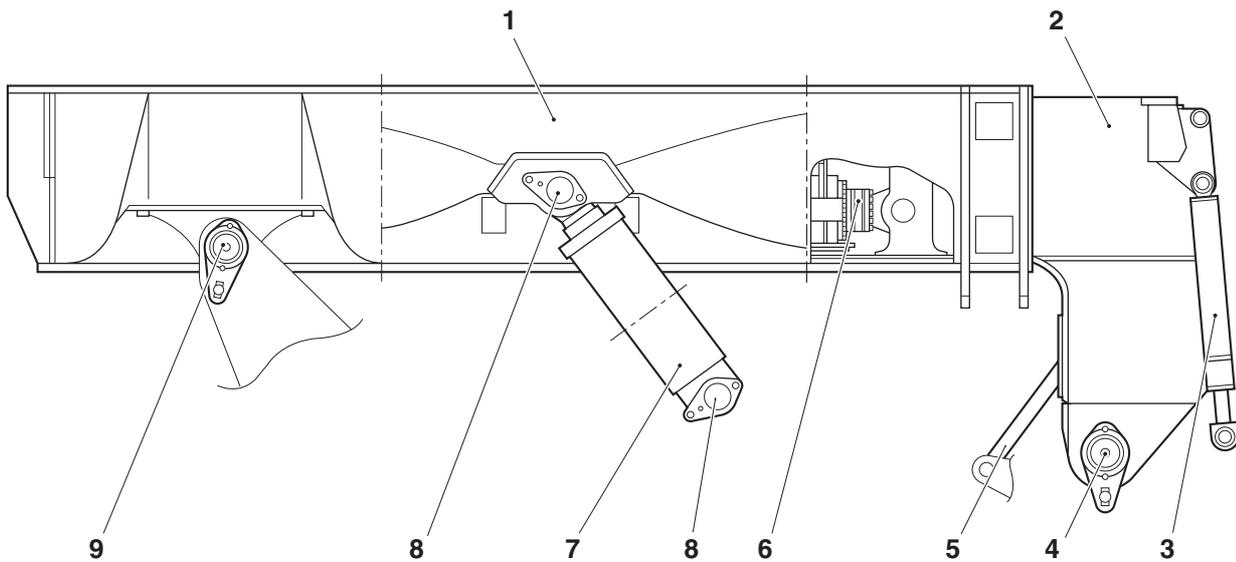
### Lift boom, description

The lift boom lifts the load. The rear section of the boom is secured into the frame with two bearing-mounted shafts. In the front edge is a lift attachment and in the centre on each side of the boom are lift cylinders which are secured with bearing-mounted shafts. The lift cylinders angle the boom and raise the front section of the boom in this way. The lift boom is available in several versions depending on reach and load capacity.

The boom consists of outer boom and inner boom manufactured in high-strength steel with a minimum number of welds to provide maximum strength.

The inner boom runs in the outer boom and can be extended longitudinally with the extension cylinder. There are slide plates between inner boom and outer boom which reduce the friction between them. The slide plates are located in the front edge of the outer boom and the rear edge of the inner boom.

Running along the left-hand side is a cable chain for hydraulic hoses and cables between outer and inner boom.



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- |                              |                             |                            |
|------------------------------|-----------------------------|----------------------------|
| 1. Outer boom                | 4. Mounting attachment      | 7. Lift cylinder           |
| 2. Inner boom                | 5. Tilt cylinder, left side | 8. Mounting, lift cylinder |
| 3. Tilt cylinder, right side | 6. Extension cylinder       | 9. Rear boom mounting      |

## 7.2.11 Sensor boom angle

### Sensor boom angle, general

See section 8 Control and monitoring system, group 8.2.1.5 Sensor boom angle.

## **7.2.12 Pipes and hoses**

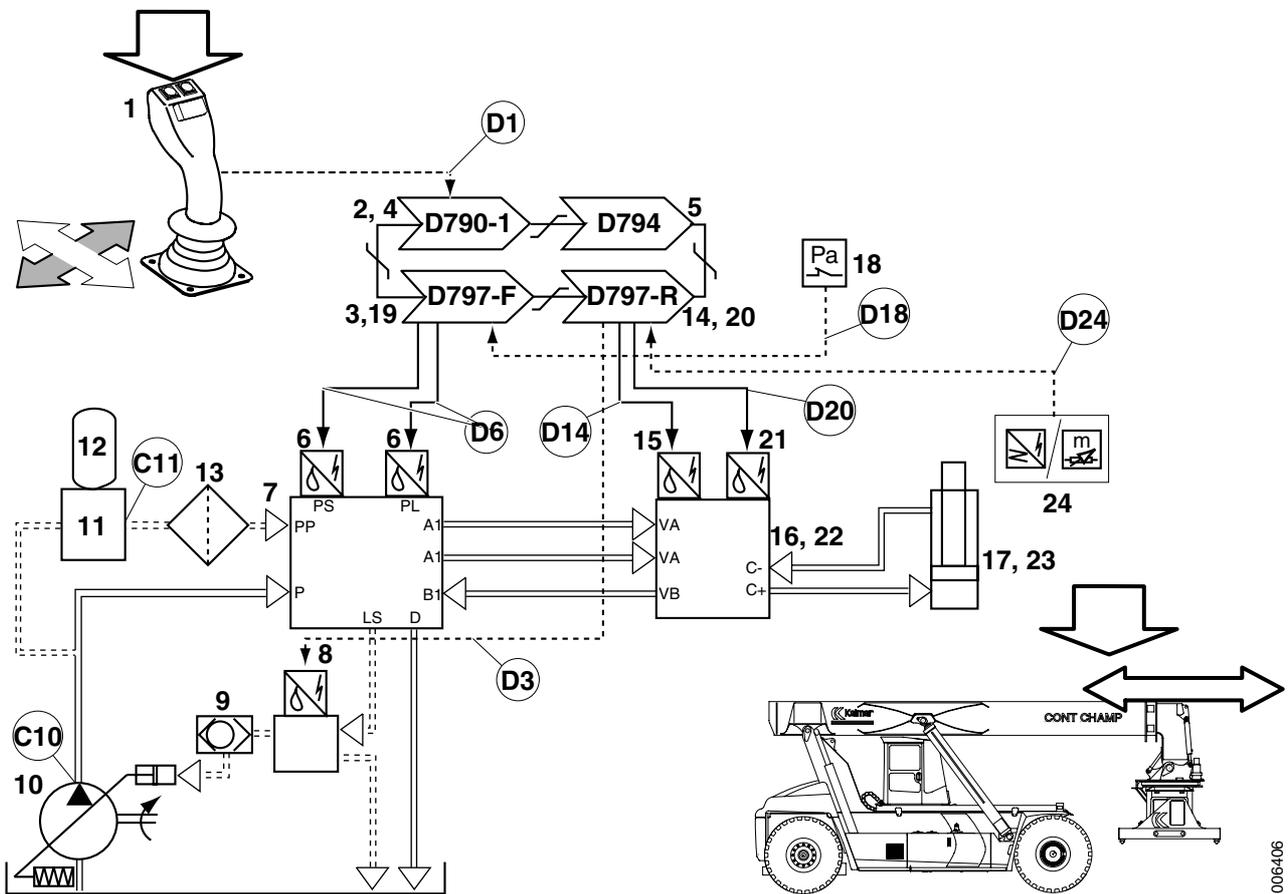
### **Pipes and hoses, description**

See section *10 Common hydraulics*, group *10.5.1 Pipes and hoses*.

## 7.3 Protruding

### Extension, function description

Condition	Reference value	Reference
Control switch	Disengaged	Tab 11 <i>Common electric</i> , group 11.5.1.4 <i>Manoeuvre switch voltage</i>
Overload system	Boom out: passive	Section 8 <i>Control and monitoring system</i> , group 8.2.1 <i>Overload system</i>
 Load centre limitation	By-passed or attachment within limit for load centre limitation.	Tab 8 <i>Control system</i> , group 8.2.3 <i>Load centre limitation</i>
 Height limitation	By-passed or boom height lower than height limitation	Tab 8 <i>Control system</i> , group 8.2.4 <i>Height limitation</i>



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Pos	Explanation	Signal description	Reference
1	Control lever (S815-P2) sends voltage signal proportional to lever movement to Control unit cab (D790-1).	Boom in: $U_{S815/P2} = 0.5\text{--}2.0\text{ V}$ Zero position: $U_{S815/P2} = 2.0\text{--}3.0\text{ V}$ Boom out: $U_{S815/P2} = 3.0\text{--}4.5\text{ V}$  0.5 V is the fastest retraction speed and 4.5 V is the fastest extension speed. Lower voltages than 0.5 V and higher voltages than 4.5 V are used to detect malfunctions in cabling and controls.	<i>Control lever, description page 7</i> D1: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.8.1 <i>BOOM</i> , menu 1
2	Control unit cab (D790-1) sends request for Boom out <i>or Boom in</i> with speed information on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
3	Control unit frame front (D797-F) activates Servo valve boom out (Y6006) <i>or Servo valve boom in</i> (Y6007).  At retraction of the boom Control unit frame rear (D797-R) activates Solenoid valve pump unloading (Y6062).	$I = 380\text{--}650\text{ mA}$	<i>Control valve lift, lower and extension, description page 36</i> D3: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.8.6 <i>BOOM</i> , menu 6, 8.4.8.7 <i>BOOM</i> , menu 7 and 8.4.8.2 <i>BOOM</i> , menu 2
4	Control unit cab (D790-1) sends request for increased engine rpm on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
5	Control unit engine (D794) increases engine rpm.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.10 <i>Control unit engine</i>
6	Servo valve boom out (Y6006) <i>or Servo valve boom in</i> (Y6007) pressurizes the control valve's extension spool with servo pressure.	-	<i>Control valve lift, lower and extension, description page 36</i> D6: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.8.6 <i>BOOM</i> , menu 6 and 8.4.8.7 <i>BOOM</i> , menu 7
7	The control valve's extension spool changes position and pressurizes valve block extension cylinder and sends load signal to the hydraulic oil pumps.	-	<i>Control valve lift, lower and extension, description page 36</i>
8	At boom retraction, valve block pump unloading drains the load signal to two of the hydraulic oil pumps to tank so that only two pumps generate pressure.	-	<i>Valve block pump unloading, description page 40</i>

Pos	Explanation	Signal description	Reference
9	The shuttle valve sends the strongest load signal if several functions are activated simultaneously.	-	Tab 10 Common hydraulics, group 10.5.3 Shuttle valve
10	The hydraulic oil pumps pump oil from the hydraulic oil tank.	See pressure plate on left frame beam.	Tab 10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement
11	The pressure reducer reduces the pressure from the hydraulic oil pumps to servo pressure.	See pressure plate on left frame beam.	Pressure reducer, description page 15
12	Servo pressure is stored in the accumulator. The non-return valve in the pressure reducer makes it possible to store the pressure when the engine is shut off.	See pressure plate on left frame beam.	Accumulator servo circuit, description page 17
13	The servo filter filters the oil before the control valve.	-	Servo filter, description page 15
14	At boom in Control unit frame rear (D797-R) activates Servo valve, blocking extension (Y6050).	U = 24 V	Valve block extension cylinder, description page 37 D14: Diagnostic menu, see tab 8 Control system, group 8.4.8.2 BOOM, menu 2
15	At boom in Servo valve, blocking extension (Y6050) acts on the blocking spool in valve block extension cylinder.	-	Valve block extension cylinder, description page 37
16	At boom out the blocking spool in valve block extension cylinder is opened by hydraulic pressure from the control valve. At boom in the blocking valve opens and releases the pressure from the extension cylinder.	-	Valve block extension cylinder, description page 37
17	Extension cylinder extends or retracts the boom.	-	Extension cylinder, description page 37
18	<b>Regeneration</b> Sensor hydraulic pressure lift cylinder piston side left (B768-L1) sends voltage signal proportional to cylinder pressure in lift cylinders to Control unit frame front (D797-F).	$U_{B768-L1/1} = 5 \text{ V}$ $U_{B768-L1/2} = 0 \text{ V}$ $U_{B768-L1/3} = 0.5\text{--}4.5 \text{ V}$	Sensor hydraulic pressure lift cylinder, description page 28 D18: Diagnostic menu, see tab 8 Control system, group 8.4.10.3 OP, menu 3
19	Control unit frame front (D797-F) sends information about pressure in lift cylinders.	Controlled by control and monitoring system, error shown with error code.	Tab 11 Common electric, group 11.5.3.2 Control unit frame front

Pos	Explanation	Signal description	Reference
20	Control unit frame rear (D797-R) activates Servo valve, regeneration (Y6046), if the pressure is sufficiently low for regeneration.	U = 24 V	<i>Valve block extension cylinder, description page 37</i> D20: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.8.3 <i>BOOM</i> , menu 3
21	Servo valve, regeneration (Y6046) pressurizes the regeneration valve.	-	<i>Valve block extension cylinder, description page 37</i>
22	The regeneration valve changes position and leads oil from the lift cylinder's rod side to the piston side.	-	<i>Valve block extension cylinder, description page 37</i>
23	Extension speed increases.	-	<i>Valve block extension cylinder, description page 37</i>
24	<p><b>Damping</b></p> <p>When extension is approx. 0.4 m from end-position, then damping is activated.</p> <p>Mechanical overload system</p> <p>Sensor boom length (B769-3 or B769-4) sends voltage signal to Control unit frame rear (D797-R) which sends damping on the CAN-bus.</p> <p></p> <p>Mechanical overload system with analogue position sensor, or Electronic overload system:</p> <p>Sensor boom length (B777) sends voltage signal proportional to boom extension to Control unit frame rear (D797-R) which sends damping on the CAN-bus.</p>	-	<p>Tab 8 <i>Control system</i>, group 8.2.1.6 <i>Sensor boom length</i></p> <p>Mechanical overload system</p> <p>D24: Diagnostic menu, see tab 8 <i>Control system</i>, group 8.4.10.1 <i>OP</i>, menu 1</p> <p></p> <p>Mechanical overload system with analogue position sensor, or Electronic overload system:</p> <p>D24: Diagnostic menu, see tab 8 <i>Control system</i>, group 8.4.10.4 <i>OP</i>, menu 4 and 8.4.10.6 <i>OP</i>, menu 6</p>

Hydraulic diagram basic machine

### 7.3.1 Hydraulic oil pump

#### Hydraulic oil pump, general

See section 10 *Common hydraulics*, group 10.4.2 *Axial piston pump with variable displacement*.

### 7.3.2 Servo filter

#### Servo filter, description

See *Servo filter, description page 15*.

### 7.3.3 Pressure reducer

#### Pressure reducer, description

See *Pressure reducer, description page 15.*

### 7.3.4 Accumulator servo circuit

#### Accumulator servo circuit, description

See *Accumulator servo circuit, description page 17.*

### 7.3.5 Manoeuvre valve lift, lower, protrude

#### Control valve lift, lower and extension, description

The control valve has two sections: one for the lift function and one for boom extension. The sections have great similarities but are described separately for each function.

For general information on the control valve, see *Control valve lift lower and extension, description page 19.*

#### Extension slide

The extension slide controls direction (in or out) and oil flow to valve block extension cylinder.

#### Servo valve boom out

Servo valve boom out, controls servo pressure to the extension slide so that it controls oil pressure for extension.

Servo valve boom out is controlled electrically with Solenoid valve boom out (Y6006) which is activated by Control unit frame front (D797-F).

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.8.7 BOOM, menu 7.*

#### Servo valve boom in

Servo valve boom in, controls servo pressure to the extension slide so that it controls oil pressure for boom retraction.

Servo valve boom in is controlled electrically with Solenoid valve boom in (Y6007) which is activated by Control unit frame front (D797-F).

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.8.6 BOOM, menu 6.*

#### Shock valve, extension

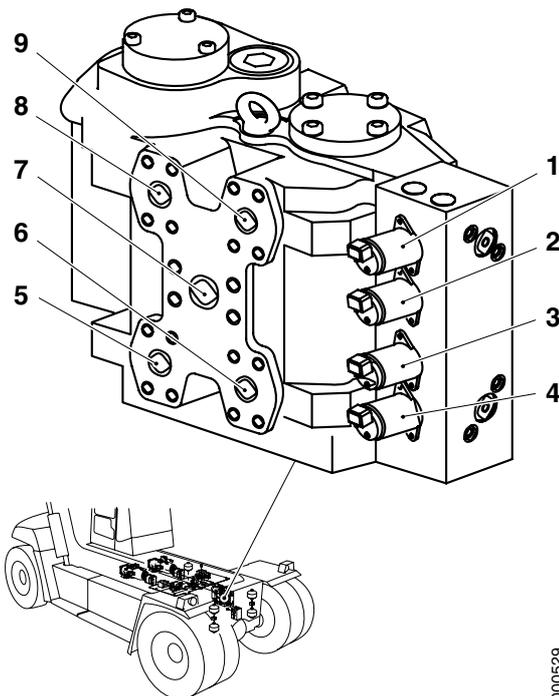
Two shock valves protect the hydraulic system against surges which can occur when operating on uneven ground or when stopping.

The shock valve opens a connection between the extension cylinder piston side and tank if the pressure becomes too high.

### 7.3.6 Shuttle valve

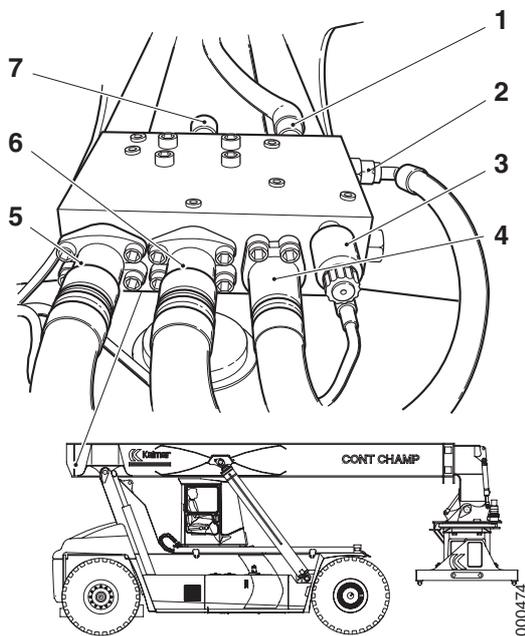
#### Shuttle valve, description

See section 10 *Common hydraulics, group 10.5.3 Shuttle valve.*



1. Servo valve boom out (Y6006)
2. Servo valve boom in (Y6007)
3. Servo valve lower (Y6004)
4. Servo valve lift (Y6005)
5. Connection, rod side, right lift cylinder (B2)
6. Connection, piston side, right lift cylinder (A1)
7. Connection, feed from hydraulic oil pumps (P)
8. Connection, rod side, extension cylinder (B1)
9. Connection, piston side, extension cylinder (A1)

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1. Connection, rod side (C-)
2. Draining (D)
3. Servo valve regeneration (Y6046)
4. Connection, control valve (VB)
5. Connection, control valve (VA)
6. Connection, control valve (VA)
7. Servo valve blocking (Y6050)

## 7.3.7 Valve block protrude cylinder

### Valve block extension cylinder, description

Valve block extension cylinder directs pressure to the extension cylinder. The valve block is located at the trailing edge of the extension cylinder in the lift boom and contains a blocking valve, regeneration valve, and non-return valve.

#### Blocking valve

The blocking valve prevents unwanted lowering. The valve holds the load by keeping the connection to the extension cylinder's piston side closed. The pressure passes through a restriction providing a blocking pressure and holds the valve slide closed.

Solenoid valve blocking (Y6050) acts on the blocking valve. Solenoid valve, blocking extension (Y6050) which is activated by Control unit frame rear (D797-R).

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.8.2 *BOOM*, menu 2.

#### Regeneration valve

The regeneration valve directs oil from the rod side back to the piston side. This makes it possible to re-use the oil for extension. For more information on regeneration, see *Extension, function description page 32*. The regeneration valve is controlled by servo valve regeneration.

Solenoid valve, extension (Y6046) pressurises the regeneration valve. Solenoid valve, extension (Y6046) is activated by Control unit frame rear (D797-R).

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.8.3 *BOOM*, menu 3.

## 7.3.8 Extension cylinder

### Extension cylinder, description

The extension cylinder forces out and pulls in the inner boom. The extension cylinder is located in the lift boom. The rear section is secured in the outer boom, the front section is secured in the inner boom. On the extension cylinder is a valve block which controls pressurising of the cylinder and regeneration for boom out.

The extension cylinder piston rod end is designed as a lug with a flange which is secured on the piston rod with hexagonal bolts.

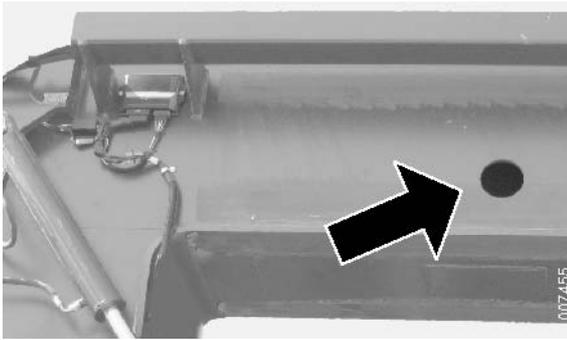
## Extension cylinder, changing

### NOTE

Read the safety instructions for oil before working, see tab B Safety.

### Removing

- 1 Machine in service position, see tab B Safety.
- 2 Run out the boom until the inspection holes in the side of the inner boom can be accessed.
- 3 Depressurize the brake and hydraulic systems, see tab B Safety.



- 4 Remove the lock rings and press out the pin for the front cylinder mounting in the inner boom.

- 5  Machine with analogue sensor boom length.

Remove sensor boom length from the boom, see tab 8 Control system, group 8.2.1.6 Sensor boom length.

- 6 Mark up and disconnect the hydraulic hoses from the extension cylinder.

### NOTE

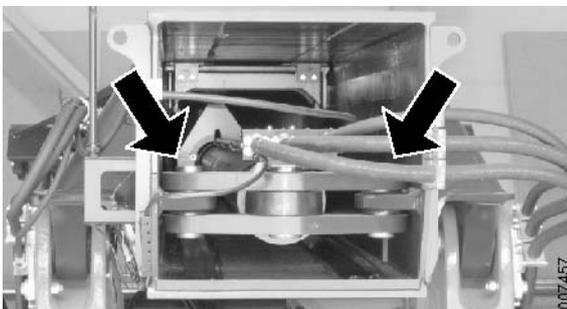
Plug all hydraulic connections immediately.

- 7 Mark up and disconnect the cabling from the valve block on the extension cylinder.
- 8 Remove the valve block from the extension cylinder.

### NOTE

Plug all hydraulic connections immediately.

- 9 Remove the lock rings and press out the outer pins for the rear cylinder mountings in the outer boom.
- 10 Connect lifting equipment to the rear extension cylinder mounting.
- 11 Carefully pull out the extension cylinder. When the cylinder has come out a short distance, connect a second lifting equipment which is moved forward on the lift cylinder during the whole dismantling to stabilize the lift.
- 12 Place the cylinder on wooden blocks.
- 13 Transfer parts to the new extension cylinder.



Outer pins extension cylinder

### Installing

- 14 Clean and grease all bearing surfaces.

- 15 Measure how far the old extension cylinder is extended and pull out the new cylinder to the same length.

### NOTE

*If this is not done, the front cylinder mounting will not reach all the way.*

- 16 Lift the extension cylinder into place.

### CAUTION

**Use double lifting equipment to balance the lift. The front one shall be routed behind the support at the leading edge of the cylinder so that it can be pushed into the boom.**

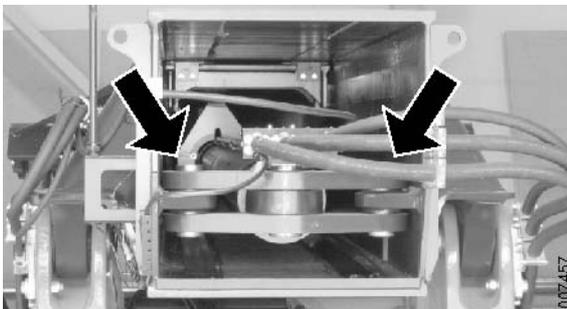


- 17 Install the pin at the front cylinder mounting in the inner boom.

### NOTE

*Grease the pin before installing.*

- 18 Install the locks on the pin.



- 19 Install the pins at the rear cylinder mountings.

### NOTE

*Grease the pin before installing.*

- 20 Install the locks on the pins.
- 21 Install the valve block on the extension cylinder.

### NOTE

*Check that the O-rings are intact and correctly fitted.*

- 22 Connect the hydraulic hoses and cabling to the extension cylinder.
- 23  Machine with analogue sensor boom length.  
Install sensor boom length, see tab 8 Control system, group 8.2.1.6 Sensor boom length.
- 24 Start the engine and check for leaks.
- 25 Check the oil level in the hydraulic oil tank, see tab 10 Common hydraulics, group 10.6.8 Hydraulic oil.
- 26 Calibrate sensor boom length, see tab 8 Control system, group 8.5.2.1 Calibrate SCALE steps 9 - 12.

## Hydraulic cylinders, repairing

See tab 10 *Common hydraulics*, group 10.7.1 *Hydraulic cylinders*.

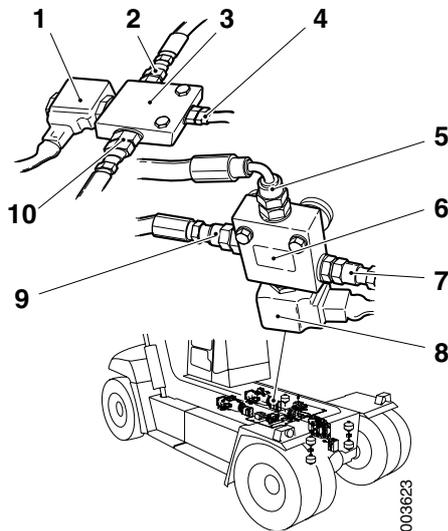
### 7.3.9 Valve block pump unloading

#### Valve block pump unloading, description

For boom in, only a small oil flow is required. Solenoid valve pump unloading (Y6062) drains the control signal to hydraulic oil pump 2, to the tank. This results in only one pump unit building up pressure, which reduces the use of engine power and thus fuel consumption. If other functions are activated at the same time then the pressure signal will pass through the shuttle valve, see tab 10 *Common hydraulics*, group 10.5.3 *Shuttle valve*. The load signal travels to the pumps required. The valve block is located standing on the bracket for the oil filling point between the engine and transmission.

Solenoid valve pump unloading (Y6062) is supplied with voltage by Control unit frame rear (D797-R) on activation.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.8.2 *BOOM*, menu 2.



1. Solenoid valve engagement hydraulic pressure (Y6003)
2. Pressure signal to hydraulic oil pump 2
3. Valve block top lift hydraulics
4. Tank drain
5. Pressure signal in, from shuttle valve
6. Valve block pump unloading
7. Pressure signal to hydraulic oil pump 2
8. Solenoid valve pump unloading (Y6062)
9. Tank drain
10. Pressure signal in, from shuttle valve 1

## 7.3.10 Lift boom

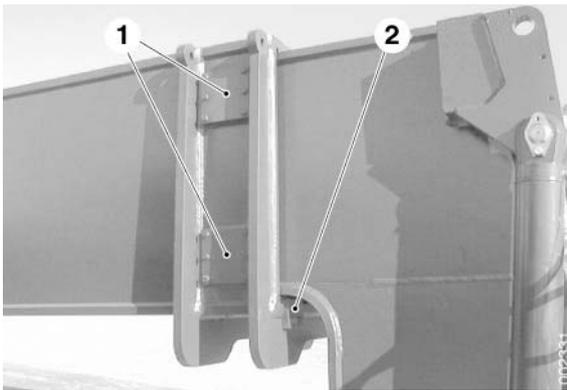
### Lift boom, general

See *Lift boom, description page 30*.

### Slide plates lift boom, changing

#### NOTE

*When adjusting side-mounted slide plates it is important to check the clearance for the whole boom's stroke, and that the inner boom is centred in the outer boom.*



1. Side-mounted slide plates
2. Lower slide plates

#### Front slide plates

- 1 Place the boom in its lowest position with the inner boom run out approx. 50 cm.
- 2 Remove the cover plate for the side-mounted slide plates and remove the spacer plates and slide plate.
- 3 Fit in the reverse order.
- 4 Check the clearance between the boom and slide plate, clearance should be **1 mm**. Adjust with spacer plates if needed.

#### NOTE

*The inner boom shall be centred in the outer boom.*

- 5 Remove the lock bolts and the slide plates' consoles, and pull out the upper slide plates and spacer plates.
- 6 Relieve the lower slide plates, lift the inner boom at the leading edge and use wooden spacers.

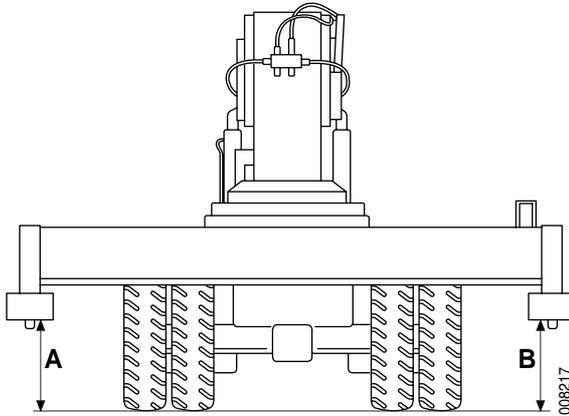


## WARNING

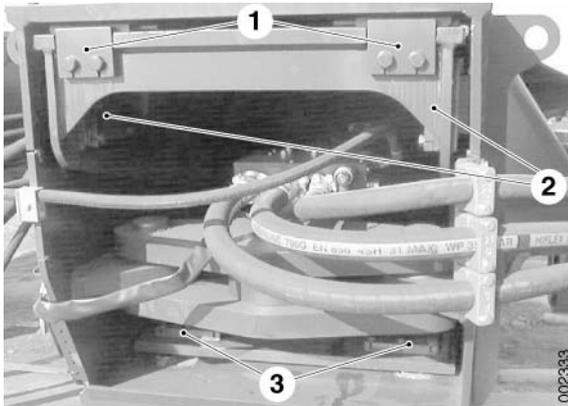
### Risk of crushing!

**Secure the inner boom in relation to the outer boom with wooden blocks.**

- 7 Remove the lock bolts, slide plates' consoles and pull out the lower slide plates.
- 8 Transfer the nuts for the lock bolts for the lower slide plates to the new slide plates.
- 9 Install the new lower slide plates, lock bolts, and consoles.
- 10 Remove the wooden blocks and let down the inner boom so that it rests on the lower slide plates.
- 11 Transfer the nuts for the lock bolts for the upper slide plates to the new slide plates.
- 12 Install the new slide plates, spacer plates, lock bolts, and consoles.



Measuring points deformation attachment



1. Upper slide plates
2. Side-mounted slide plates
3. Lower slide plates

- 13 Check the clearance between the boom and stop at the leading edge/top edge of the boom, clearance may be **max. 2 mm**. Adjust the slide plates with spacer plates if needed.

### Checking attachment deformation

- 14 Park the machine on level ground.
- 15 Lower the boom completely and centre the attachment.
- 16

Measure the distance between extension beam and the ground on the right and left side of the attachment.

The difference between the measurements for right (A) and left (B) side may not be more than 50 mm at the 20'-position or 100 mm for the 40'-position.

Check both measurements with the boom completely retracted and completely extended.

- 17 If needed, adjust the lower slide plates so that the attachment is straight.

### Rear slide plates

- 18 Start the engine and run in the boom completely (fully retracted)
- 19 Remove the cover plate for the side-mounted slide plates and remove the spacer plates and slide plate.
- 20 Fit in the reverse order.
- 21 Check the clearance between the boom and slide plate, clearance should be **1 mm**. Adjust with spacer plates if needed.
- 22 Relieve the lower slide plates, use wooden spacers.

## **WARNING**

### **Risk of crushing!**

**Secure the inner boom in relation to the outer boom with wooden blocks.**

- 23 Remove cover plates, spacer plates, and the lower slide plates.
- 24 Install new slide plates, spacer plates, and cover plate.
- 25 Relieve the upper slide plates, use wooden spacers.

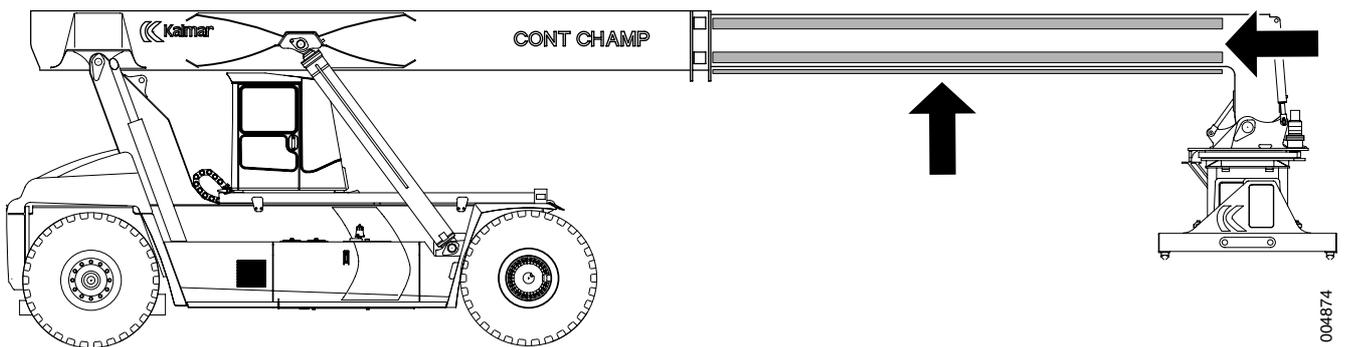
## **WARNING**

### **Risk of crushing!**

**Secure the inner boom in relation to the outer boom with wooden blocks.**

- 26 Remove the lock bolts, the slide plates' consoles, and pull out the upper slide plates and spacer plates.
- 27 Transfer the nuts for the lock bolts for the upper slide plates to the new slide plates.
- 28 Install the new slide plates, spacer plates, lock bolts, and consoles.
- 29 Check the clearance between outer and inner boom, clearance may be **max. 2 mm**. Adjust slide plates with spacer plates if needed.

### Lubrication



#### *Glide surfaces boom*

- 30 Run out the inner boom completely and lubricate the glide surfaces inside the outer boom and on the inner boom with white lubrication paste.
- 31 Run the boom in and out approx. 10 times and stop with the boom completely out.
- 32 Wipe off excess lubrication paste by the slide plates and on the glide surfaces.

## 7.3.11 Sensor boom length

### Sensor boom length, general

See section 8 *Control and monitoring system*, group 8.2.1.3 *Sensor boom length*.

## 7.3.12 Pipes and hoses

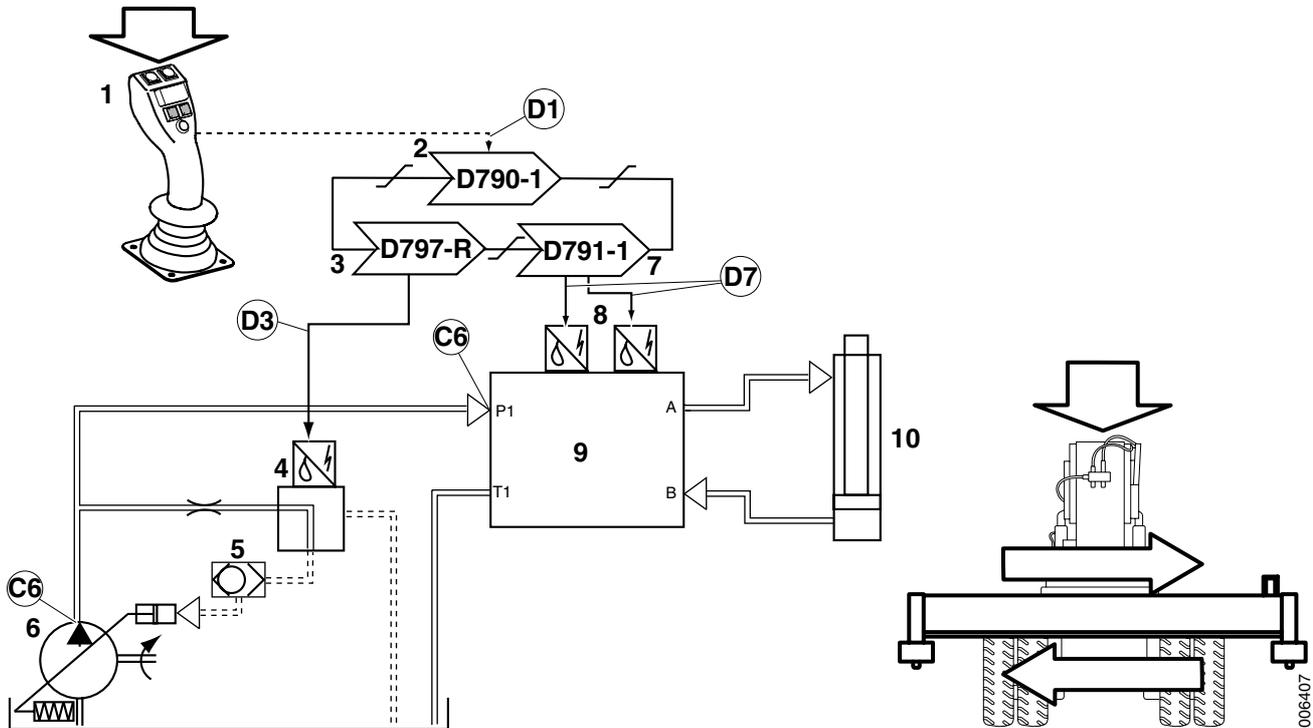
### Pipes and hoses, description

See section 10 *Common hydraulics*, group 10.5.1 *Pipes and hoses*.

## 7.4 Side-shift

### Sideshift, function description

Condition	Reference value	Reference
Control switch	Disengaged	Tab 11 <i>Common electric</i> , group 11.5.1.4 <i>Manoeuvre switch voltage</i>



Pos	Explanation	Signal description	Reference
1	Control lever (S815-T1.1) sends voltage signal to Control unit cab (D790-1).	Left: $U_{S815-T1.1} = 24\text{ V}$ Right: $U_{S815-T1.2} = 24\text{ V}$	<i>Control lever, description page 7</i> D1: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.2 <i>ATTACH</i> , menu 2
2	Control unit cab (D790-1) sends side-shift left or right on the CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
3	Control unit frame rear (D797-R) activates Solenoid valve, engagement of hydraulics for top lift (Y6003).	$U = 24\text{ V}$	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i> D3: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
4	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens and pressurizes valve block lift cylinder and sends load signal to hydraulic oil pump 2.	-	<i>Valve block top lift hydraulics, description page 46</i> D3: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6

Pos	Explanation	Signal description	Reference
5	The shuttle valve sends the strongest load signal to the hydraulic oil pumps if several functions are activated simultaneously.	-	Tab 10 <i>Common hydraulics</i> , group 10.5.3 <i>Shuttle valve</i>
6	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See pressure plate on left frame beam.	Tab 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
7	Control unit attachment (D791-1) activates Servo valve, sideshift left (Y6020) or Servo valve, sideshift right (Y6021).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i> D7: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.8 <i>ATTACH</i> , menu 8
8	Servo valve, sideshift left (Y6020) or Servo valve, sideshift right (Y6021) pressurizes the sideshift spool in control valve attachment.	-	<i>Control valve attachment, description page 47</i> D7: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.8 <i>ATTACH</i> , menu 8
9	The control valve's sideshift spool changes position and pressurizes sideshift cylinders.	-	<i>Control valve attachment, description page 47</i>
10	The sideshift cylinders push in the main beam sideways in relation to the sideshift frame.	-	<i>Sideshift cylinder, description page 52</i>

Hydraulic diagram top lift

Hydraulic diagram top lift, tilt lock and controllable tilt

Hydraulic diagram combi attachment

Hydraulic diagram top lift, tilt lock, controllable tilt and hydraulic leveling

## 7.4.1 Hydraulic oil pump

### Hydraulic oil pump, general

See section 10 *Common hydraulics*, group 10.4.2 *Axial piston pump with variable displacement*.

## 7.4.2 Valve block top lift hydraulics

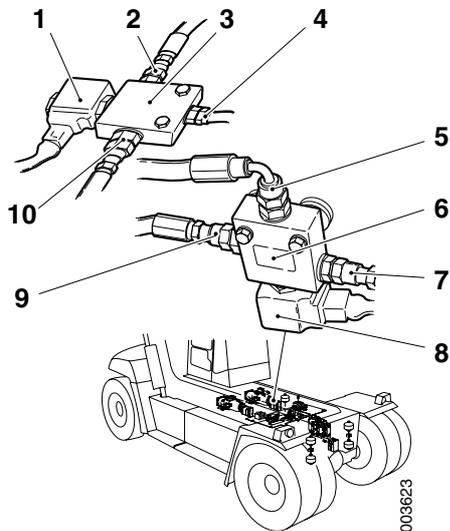
### Valve block top lift hydraulics, description

The valve block for top lift hydraulics is an electrically controlled valve. It leads a reduced constant pressure as the load signal to the hydraulic oil pumps when attachment functions are activated. The valve block is located lying down on the bracket for the oil filling point between the engine and transmission.

When the solenoid valve is activated, pressure is directed from the top lift hydraulics' supply through a shuttle valve to the hydraulic oil pumps' control. A restriction before the valve block ensures that the pressure to the hydraulic oil pumps' control does not become too high. When the solenoid valve is not activated, the load signal is drained to tank and the inlet from the top hydraulics' supply is closed.

The valve is controlled electrically with Solenoid valve, engagement hydraulic pressure (Y6003) which is activated by Control unit frame rear (D797-R).

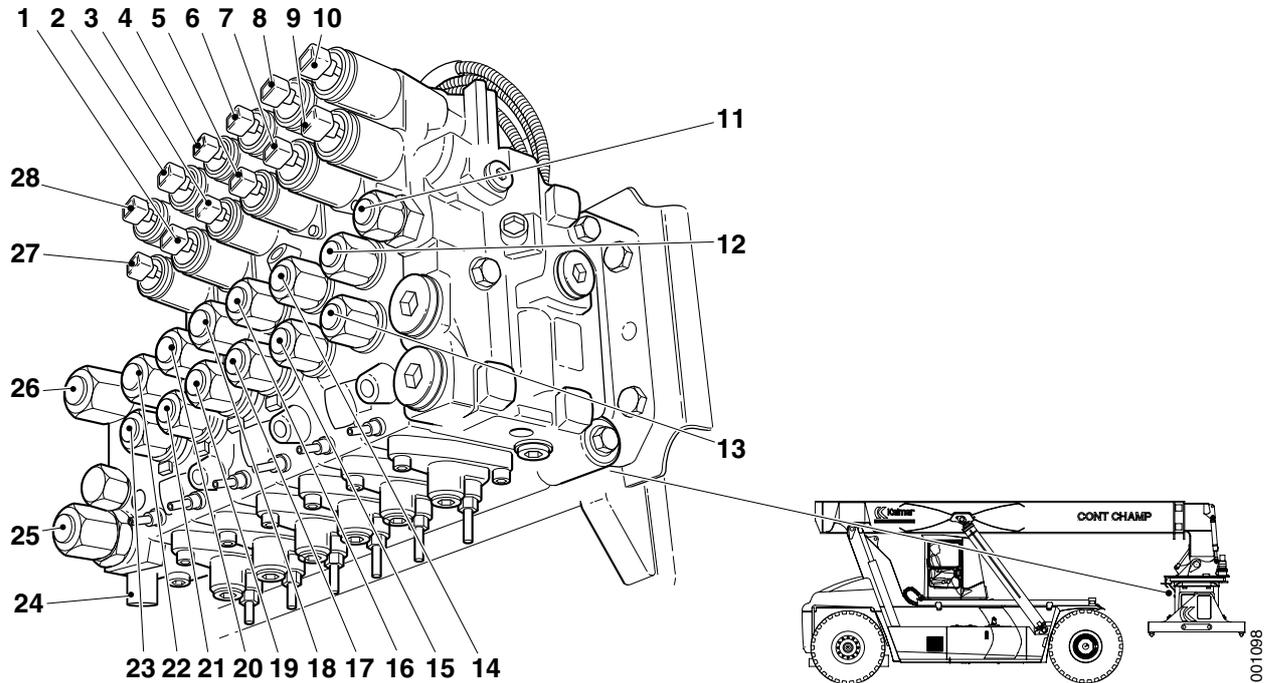
The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system, group 8.4.5.6 HYD, menu 6.*



1. Solenoid valve engagement hydraulic pressure (Y6003)
2. Pressure signal to hydraulic oil pump 2
3. Valve block top lift hydraulics
4. Tank drain
5. Pressure signal in, from shuttle valve
6. Valve block pump unloading
7. Pressure signal to hydraulic oil pump 2
8. Solenoid valve pump unloading (Y6062)
9. Tank drain
10. Pressure signal in, from shuttle valve 1

## 7.4.3 Control valve attachment

### Control valve attachment, description



- |   |  |
|---|--|
| 1. Solenoid valve, tilt out (Y6010)                   | 15. Connection to spreading motor              |
| 2. Solenoid valve tilt in (Y6011)                     | 16. Connection to sideshift cylinder           |
| 3. Solenoid valve, rotation clockwise (Y6008)         | 17. Connection to sideshift cylinder           |
| 4. Solenoid valve, rotation counter-clockwise (Y6009) | 18. Connection to rotation motor               |
| 5. Solenoid valve, sideshift right (Y6021)            | 19. Connection to rotation motor               |
| 6. Solenoid valve, sideshift left (Y6020)             | 20. Connection to tilt cylinder                |
| 7. Solenoid valve, spreading out (Y6018)              | 21. Connection to tilt cylinder                |
| 8. Solenoid valve, spreading in (Y6019)               | 22. Connection to levelling cylinder           |
| 9. Solenoid valve, lock twistlocks (Y6040)            | 23. Connection to levelling cylinder           |
| 10. Solenoid valve, open twistlocks (Y6039)           | 24. Test outlet feed pressure to control valve |
| 11. Drain to tank                                     | 25. Feed from hydraulic oil pump 2             |
| 12. Connection to lock cylinder                       | 26. Return to tank (through tank filter)       |
| 13. Connection to lock cylinder                       | 27. Solenoid valve levelling right (Y6035)     |
| 14. Connection to spreading motor                     | 28. Solenoid valve levelling left (Y6036)      |

Sideshift is controlled by a separate section in the control valve attachment.

The attachment control valve controls hydraulic functions on the attachment. The control valve is located in the middle of the back of the attachment. Electric servo valves control the flow from the valve.

The control valve is an electro-hydraulically controlled, proportional and pressure compensated direction valve. Electrically controlled servo valves convert current to servo pressure. The servo pressure controls the spring centred valve slides which control pressure and flow for the function in question. The valve slides have a flow limit in order that several functions can be activated simultaneously, and this way control the main flow.

The control valve has an integral pilot pressure supply. This means that the valve has an integral pressure reducer which converts feed pressure to servo pressure for the different functions. The pilot pressure supply is common for all functions. This reduces pressure variations due to long hoses and reduces the number of hoses to the valve.

The control valve has the following sections:

- Sideshift
- Spreading
- Rotation
- Twistlocks
- Controllable tilt 
- Hydraulic levelling 

#### **Sideshift slide**

The valve slide controls sideshift direction and speed.

The valve slide is controlled by servo valve sideshift right and servo valve sideshift left.

#### **Servo valve sideshift left**

Servo valve sideshift left controls pressure to the sideshift slide so that the sideshift slide opens and pressurises the sideshift cylinders.

Servo valve sideshift left is controlled electrically with Solenoid valve, sideshift left (Y6020) which is activated by Control unit attachment (D791-1). The servo valve directs servo pressure to the sideshift slide proportional to the control current to the solenoid valve.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.8 *ATTACH*, menu 8.

#### **Servo valve sideshift right**

Servo valve sideshift right controls pressure to the sideshift slide so that the sideshift slide opens and pressurises the sideshift cylinders.

Servo valve sideshift is controlled electrically with Solenoid valve, sideshift right (Y6021) which is activated by Control unit attachment (D791-1). The servo valve directs servo pressure to the sideshift slide proportional to the control current to the solenoid valve.

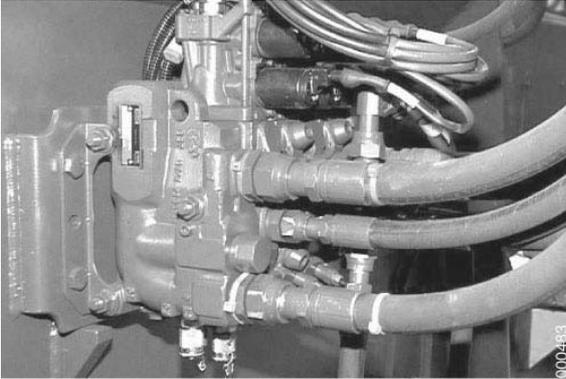
The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.8 *ATTACH*, menu 8.

## Control valve attachment, replacement

### NOTE

*Read the safety instructions for oil before working, see tab B Safety.*

- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the brake and hydraulic systems, see tab B Safety.
- 3 Mark up and detach the hydraulic hoses from the control valve.



### NOTE

*Plug all connections immediately to protect the hydraulic system from impurities.*

- 4 Mark up and detach the wiring from the control valve.
- 5 Remove the control valve.  
Remove the attaching bolts and lift away the valve. Place the valve on a clean, protected surface.
- 6 Transfer the connection adapters to the new control valve.

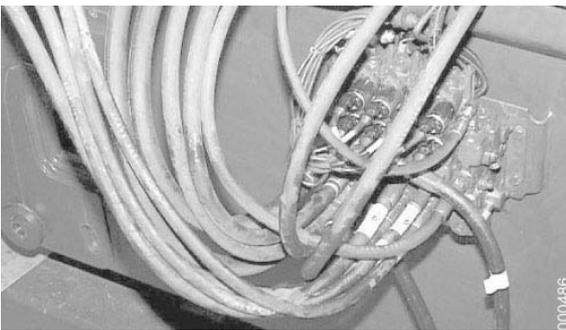
### NOTE

*Check that the O-rings are intact and correctly fitted.*

### NOTE

*Transfer one adapter at a time so that the marking is not mixed up.*

- 7 Mark up the servo valves on the new control valve.
- 8 Fit the valve.  
Lift the valve into place and fit the attaching bolts.
- 9 Connect the wiring to the control valve in accordance with the marking.
- 10 Connect the hydraulic hoses to the control valve in accordance with the marking.



### NOTE

*Check that the O-rings are intact and correctly fitted.*

- 11 Turn on the main electric power and start the engine.
- 12 Check that the valve's hydraulic connections are sealed.

- 13 Check that the attachment is working.

**!** CAUTION

**Air in the hydraulic system may cavitate and can result in product damage.**

**Activate the functions carefully and operate at the lowest possible speed a couple of times to avoid cavitation.**



- 14 Check the oil level in the hydraulic oil tank with the lift cylinders completely down and the extension cylinder completely in. The oil level should be at the top of the level glass. Top up as needed.

**!** CAUTION

**Overfilling of oil.**

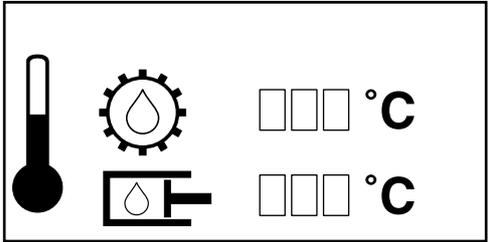
**Leakage and environmental damage.**

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

## Control valve attachment, checking hydraulic pressure

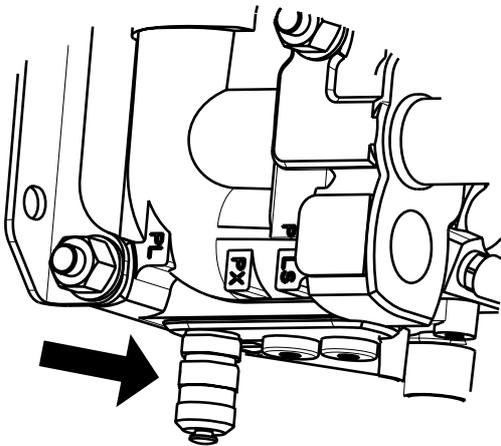
### NOTE

Read the instructions for oil before working, see tab *B Safety*.



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Operating menu hydraulic oil temperature



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Pressure check connection control valve attachment

- 1 Operate and warm up the machine so that the hydraulic oil is at operating temperature, at least 50 °C. As an alternative, operate until the cooling fan is activated.
- 2 Machine in service position, see tab *B Safety*.
- 3 Depressurise the brake and hydraulic systems, see tab *B Safety*.

- 4 Connect pressure gauge to pressure check connection PL on control valve attachment.
- 5 Start the engine and let it idle. Check the pressures in the attachment's different functions by letting each function go to its end-position, then read off the pressure gauge.

The pressures should be:

Function	Pressure
Sideshift	16.0 MPa
Spreading	12.0 MPa
Rotation	15.0 MPa
Tilt control	15.0 MPa
Levelling	15.5 MPa
Twistlocks	Same as feed pressure.
Overheight legs lowering	10.0 MPa
Lift legs, knee out/in	10.0 MPa
Lift legs, leg down/up	13.0 MPa
Lift legs, clamp	13.0 MPa

- 6 Depressurise the brake and hydraulic systems, see tab *B Safety*.
- 7 Remove the pressure gauge and fit the protective cap on the pressure check connection.

### 7.4.4 Shuttle valve

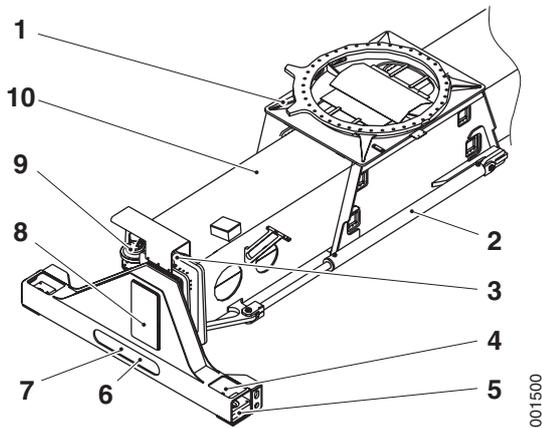
#### Shuttle valve, description

See section 10 *Common hydraulics*, group 10.5.3 *Shuttle valve*.

### 7.4.5 Sideshift cylinder

#### Sideshift cylinder, description

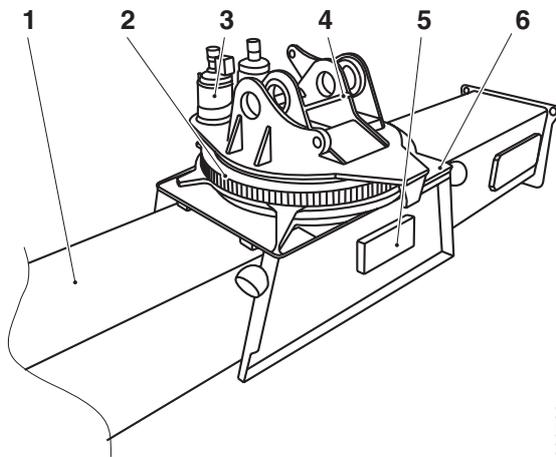
The sideshift cylinders are two inter-connected hydraulic cylinders that push the attachment's main beam sideways in relation to the sideshift frame. The sideshift cylinders are located along the front and back of the attachment and are used to centre the load's centre of gravity.



1. Sideshift frame
2. Sideshift cylinder
3. Position sensor spreading
4. Sensor alignment
5. Twistlock
6. Sensor twistlocks
7. Lock cylinder twistlocks
8. Spreader boom
9. Spreader motor
10. Main beam attachment

#### Hydraulic cylinders, repairing

See tab 10 *Common hydraulics*, group 10.7.1 *Hydraulic cylinders*.



1. Main beam
2. Ring gear
3. Rotation motor unit
4. Rotation yoke
5. Control valve attachment
6. Sideshift frame

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## 7.4.6 Sideshift frame

### Sideshift frame, description

The attachment is secured in the boom with the rotation yoke. The sideshift frame is located under the rotation yoke. The attachment's main beam is located in the sideshift frame. The main beam can be extended laterally in relation to the sideshift frame with two hydraulic cylinders. Inside the main beam are two spreader beams which can be extended in and out with a hydraulic motor.

The position of the attachment can be adjusted laterally by moving the main beam in relation to the sideshift frame. The main beam runs on slide plates in the sides and in the bottom. The sideshift cylinders secure the side position.

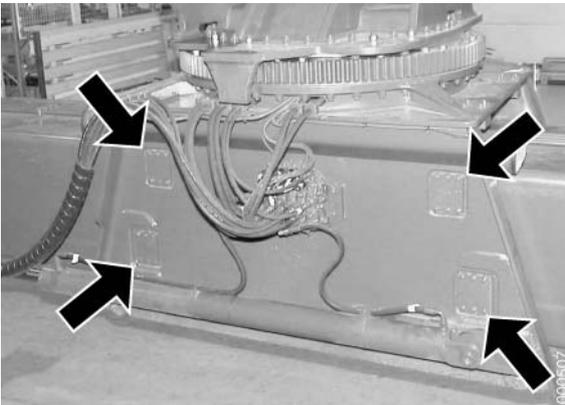
The sideshift frame is available in two versions:

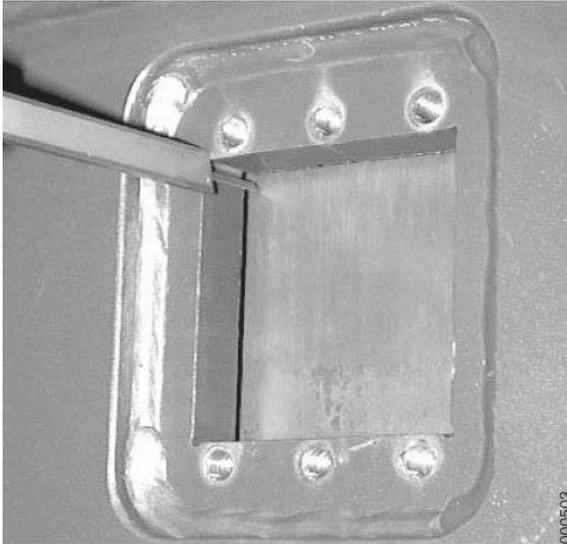
- Standard top lift. The sideshift frame allows the main beam to be levelled 5°. Sideshift 800 mm.
- Pile-slope top lift 

The sideshift frame is located in the rotation yoke with four hydraulic cylinders which mean that the levelling can be controlled for adaptation to angled containers. Sideshift 800 mm. See *Sideshift frame, description page 111*.

### Slide plates, sideshift frame, replacement

- 1 Loosen the cover plate's attaching bolt and remove the cover plate.
- 2 Remove the spacer plate and slide plate.
- 3 Repeat steps 1 - 3 on the other slide plates.

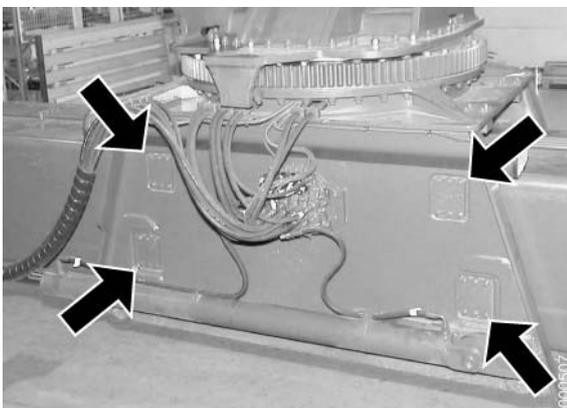




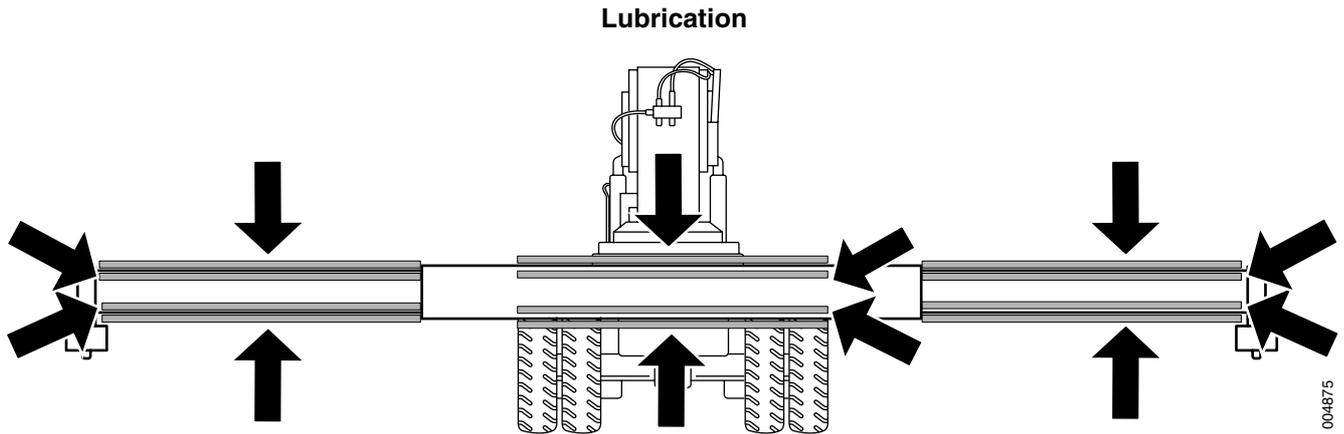
- 4 Measure the distance between the edge of the cover plate and the attachment's main beam slide surface on all slide plates.
- 5 Centre the boom so that the distance between the attachment's main beam and edge is the same on all slide plates.



- 6 Fit new a slide plate.
- 7 Check the slide plate's clearance by measuring the distance between slide plate and the edge for the cover plate. Clearance between the attachment's main beam and slide plate's should be **1 mm**.
- 8 Fit spacer plates until the distance is correct.



- 9 Fit the cover plate.
- 10 Repeat steps 7 - 10 on the other slide plates.

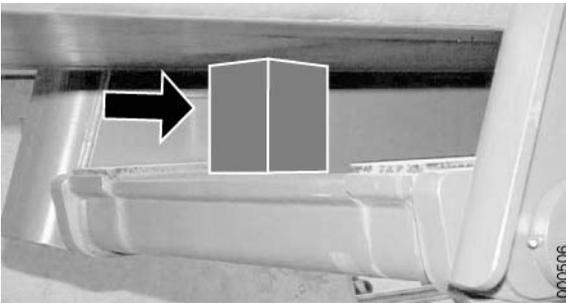


*Glide surfaces attachment*

- 11 Lubricate the glide surfaces on the attachment with white lubrication paste.
- 12 Run the sideshift completely from right to left approx. 10 times.
- 13 Wipe off excess lubrication paste by the slide plates and on the glide surfaces.

**Lower slide plates, sideshift frame, replacement**

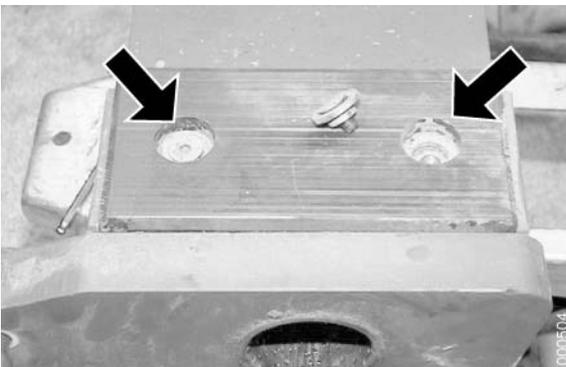
- 1 Place axle stands or similar under the attachment's spreader booms and lower the attachment on axle stands so that the sideshift frame's lower slide plates can be accessed.
- 2 Turn off the engine and the main electrical power.



**! DANGER**

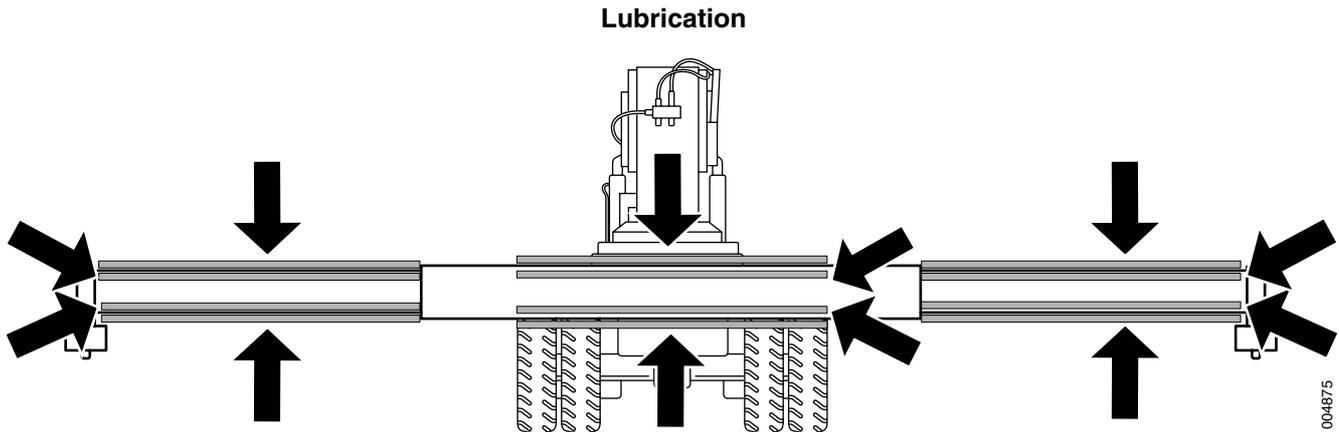
**Risk of crushing!**

**Fit spacers between crossmember and attachment main boom on both crossmembers.**



The illustration shows a detached crossmember

- 3 Remove the attaching bolts and remove the slide plates.
- 4 Fit new slide plates.
- 5 Remove the spacer.
- 6 Turn on the main electric power and start the engine.
- 7 Lift the attachment and remove the stands.



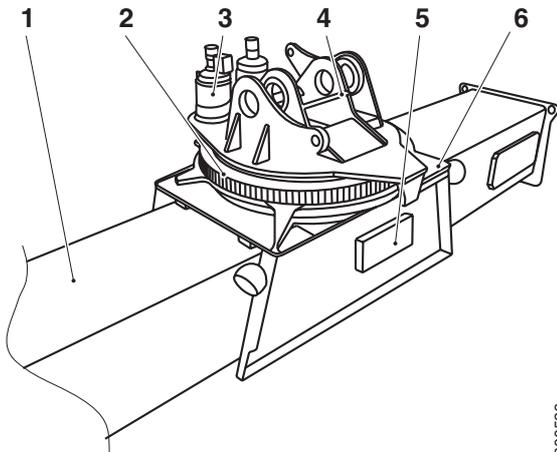
*Slide plates attachment*

- 8 Lubricate the glide surfaces on the attachment with white lubrication paste.
- 9 Run the sideshift completely from right to left approx. 10 times.
- 10 Wipe off excess lubrication paste by the slide plates and on the glide surfaces.

## 7.4.7 Main beam attachment

### Main beam attachment, description

Main beam attachment is located in the sideshift frame. Main beam contains equipment for spreading (spreader beams, hydraulic motor, chains, slide plates and sensors). On the attachment's main beam are also the control valves to the attachment's hydraulic functions.

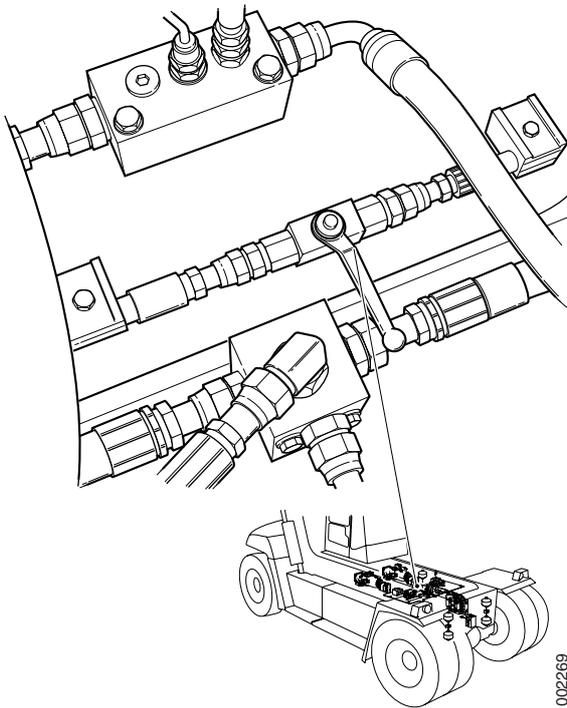


1. Main beam
2. Ring gear
3. Rotation motor unit
4. Rotation yoke
5. Control valve attachment
6. Sideshift frame

## 7.4.8 Unloading valve attachment

### Relief valve attachment, description

The attachment relief valve opens a connection between the attachment's pressure feed and tank. This is used to drain the pressure in the hoses for the attachment before working on the hydraulic system. The relief valve is located at the trailing edge of the lift beam in front of the transmission.



## 7.4.9 Pipes and hoses

### Pipes and hoses, description

See section 10 *Common hydraulics*, group 10.5.1 *Pipes and hoses*.



Pos	Explanation	Signal description	Reference
4	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens and sends load signal to hydraulic oil pumps.	-	<i>Valve block top lift hydraulics, description page 46</i> D3: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
5	The shuttle valve sends the strongest load signal to the hydraulic oil pumps if several functions are activated simultaneously.	-	Tab 10 <i>Common hydraulics</i> , group 10.5.3 <i>Shuttle valve</i>
6	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See pressure plate on left frame beam.	Tab 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
7	Control unit attachment (D791-1) activates Servo valve spreading out (Y6018) or Servo valve spreading in (Y6019).	I = 350–600 mA	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i> D7: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.13 <i>ATTACH</i> , menu 13 and 8.4.9.14 <i>ATTACH</i> , menu 14
8	Servo valve spreading out (Y6018) or Servo valve spreading in (Y6019) pressurizes the spreader slide in the attachment's control valve.	-	<i>Control valve attachment, description page 47</i> D7: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.13 <i>ATTACH</i> , menu 13 and 8.4.9.14 <i>ATTACH</i> , menu 14
9	The control valve's spreader spool changes position and directs pressure to the spreader motor.	-	<i>Control valve attachment, description page 47</i>
10	The motor valve block directs the pressure to the motor and prevents the motor from pumping (rotates faster than supplied pressure).	-	<i>Valve block positioning motor, description page 65</i>
11	The motor drives the chains that pull the spreader beams out or in.	-	<i>Positioning motor, description page 65</i>
12	Sensor, end-position 20'-40' (B769) sends voltage signal to Control unit attachment (D791-1).	Sensor directly opposite indicator plate: U 24 V	<i>Position sensor positioning, description page 78</i> D12: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.5 <i>ATTACH</i> , menu 5
13	Control unit attachment (D791-1) reduces control current to Servo valve spreading out (Y6018) or Servo valve spreading in (Y6019).	-	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i> D7: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.13 <i>ATTACH</i> , menu 13 and 8.4.9.14 <i>ATTACH</i> , menu 14
14	Servo valve spreading out (Y6018) or Servo valve spreading in (Y6019) reduces the pressure to the spreader slide in the attachment's control valve.	-	<i>Control valve attachment, description page 64</i> D7: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.13 <i>ATTACH</i> , menu 13 and 8.4.9.14 <i>ATTACH</i> , menu 14

Pos	Explanation	Signal description	Reference
15	The control valve's spreader spool changes position and reduces pressure to the spreader motor.	-	<i>Control valve attachment, description page 64</i>
16	Spreader motor speed decreases.	-	<i>Positioning motor, description page 65</i>

Hydraulic diagram top lift

Hydraulic diagram top lift, tilt lock and controllable tilt

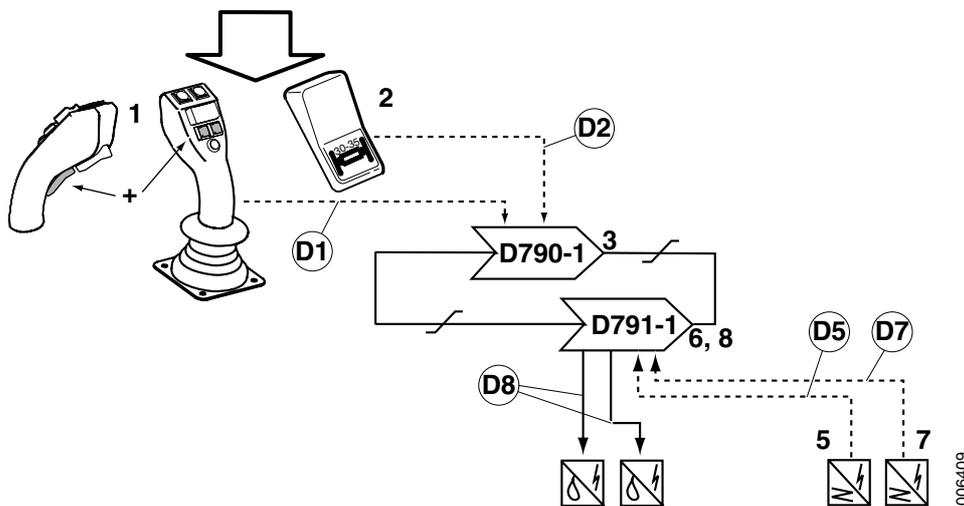
Hydraulic diagram combi attachment

Hydraulic diagram top lift, tilt lock, controllable tilt and hydraulic leveling

### Spreading 30' stop, function description



Condition	Reference value	Reference
Control switch	Disengaged	Tab 11 <i>Common electric</i> , group 11.5.1.4 <i>Manoeuvre switch voltage</i>
Twistlocks	Unlocked or by-pass activated	<i>Twistlocks, description page 119</i> Tab 8 <i>Control system</i> , group 8.2.2 <i>By-passing</i>
Overload system	Passive	Section 8 <i>Control and monitoring system</i> , group 8.2.1 <i>Overload system</i>



Pos	Explanation	Signal description	Reference
1	Switch stop at 30'-35' (S1004) sends voltage signal to Control unit cab (D790-1).	Switch in on position: Conn. 1: U = 0 V Conn 5: U = 24 V Switch in off position: Conn 1: U = 24 V Conn 5: U = 24 V	<i>Switch stop at 30' or 35', description page 10</i> D1: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.2 <i>ATTACH, menu 2</i>

Pos	Explanation	Signal description	Reference
2	Control lever (S815-T1.2 and S815-T4) sends voltage signal to Control unit cab (D790-1).	Spreading: $U_{S815-T4} = 24\text{ V}$ Out: $U_{S815-T1.2} = 24\text{ V}$ In: $U_{S815-T1.1} = 24\text{ V}$	<i>Control lever, description page 7</i> D2: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.2 <i>ATTACH</i> , menu 2
3	Control unit cab (D790-1) sends spreading 30' on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
4	Spreading is activated in the same way as the normal spreading steps 3–11.	-	<i>Spreading, function description page 58</i>
5	When spreading nears 30'-position Sensor, end-position 30' (B777-3) sends voltage signal to Control unit attachment (D791-1).	Sensor directly opposite indicator plate: $U = 24\text{ V}$	<i>Position sensor positioning, description page 78</i> D5: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.5 <i>ATTACH</i> , menu 5
6	Control unit attachment (D791-1) dampens the speed in the same way as the normal spreading steps 13–16.	-	<i>Spreading, function description page 58</i>
7	When spreading is in 30' position, Sensor end-position 20'-40' (Y769) sends voltage signal.	Sensor directly opposite indicator plate: $U = 24\text{ V}$	<i>Position sensor positioning, description page 78</i> D7: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.5 <i>ATTACH</i> , menu 5
8	Spreading is stopped by Control unit attachment (D791-1) cutting off the current to servo valve spreading out (Y6018) or servo valve spreading in (Y6019).	$U = 0\text{ V}$	<i>Control valve attachment, description page 64</i> D8: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.13 <i>ATTACH</i> , menu 13 and 8.4.9.14 <i>ATTACH</i> , menu 14

Hydraulic diagram top lift

Hydraulic diagram top lift, tilt lock and controllable tilt

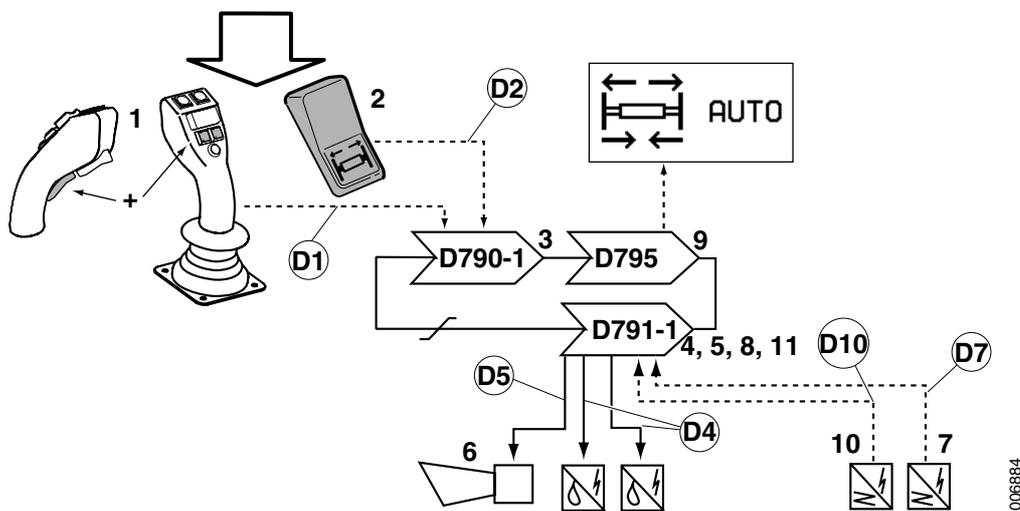
Hydraulic diagram combi attachment

Hydraulic diagram top lift, tilt lock, controllable tilt and hydraulic leveling

## Automatic spreading 20-40 foot, function description



Condition	Reference value	Reference
Control switch	Not activated	Tab 11 Common electric, group 11.5.1.4 Manoeuvre switch voltage
Twistlocks	Unlocked or by-pass activated	Twistlocks, function description page 112
Overload system	Passive	Tab 8 Control system, group 8.2.1.1 Mechanical overloading system
Doors	Closed	Tab 9 Frame, body, cab and accessories, group 9.10.2 Doors
Parking brake	Released	Tab 4 Brakes, group 4.5 Parking brake system



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Pos	Explanation	Signal description	Reference
1.	Control lever (S815-T1.2 and S815-T4) sends voltage signal to Control unit cab (D790-1).	Spreading: $U_{S815/T4} = 24\text{ V}$ Out: $U_{S815/T1.2} = 24\text{ V}$ In: $U_{S815/T1.1} = 24\text{ V}$	Control lever, description page 7 D1: Diagnostic menu, see tab 8 Control system, group 8.4.9.2 ATTACH, menu 2
2.	Switch automatic spreading 20'-40' (S199-2) sends voltage signal to Control unit cab (D790-1).	Switch in position on: $U_{S199-2/2} = 0\text{ V}$ $U_{S199-2/5} = 24\text{ V}$ Switch in position off: $U_{S199-2/2} = 24\text{ V}$ $U_{S199-2/5} = 24\text{ V}$	Switch automatic spreading, description page 9 D2: Diagnostic menu, see tab 8 Control system, group 8.4.9.4 ATTACH, menu 4
3.	Control unit cab (D790-1) sends "automatic spreading out" or "automatic spreading in" on the CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 Common electric, group 11.5.3.1 Control unit cab

Pos	Explanation	Signal description	Reference
4.	Control unit attachment (D791-1) activates spreading in the same way as the normal spreading steps 2 - 11.	-	<i>Spreading, function description page 58</i> D4: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.13 <i>ATTACH</i> , menu 13 and 8.4.9.14 <i>ATTACH</i> , menu 14
5.	Control unit attachment (D791-1) activates Buzzer automatic spreading (H9003).	Buzzer active: U = 24 V	<i>Buzzer automatic spreading 20'-40', description page 79</i> D5: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.15 <i>ATTACH</i> , menu 15
6.	Buzzer automatic spreading (H9003) generates acoustic warning signal.	Buzzer active: U = 24 V	<i>Buzzer automatic spreading 20'-40', description page 79</i> D5: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.15 <i>ATTACH</i> , menu 15
7. +	When spreading nears the 30'-position, Sensor, end-position 30' (B777-3) sends voltage signal to Control unit attachment (D791-1).	Sensor right in front of indicator plate: U = 24 V	<i>Position sensor positioning, description page 78</i> D7: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.5 <i>ATTACH</i> , menu 5
8.	Control unit attachment (D791-1) dampens spreading in the same way as the normal spreading position 13-16.	-	<i>Spreading, function description page 58</i>
9	When automatic spreading is active, Control unit KID (D795) activates event menu Automatic spreading.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>
10.	When spreading is in the 20'-position, 30'-position, or 40'-position sensor end-position 20'-40' (B769) sends voltage signal to Control unit attachment (D791-1).	Sensor right in front of indicator plate: U = 24 V	<i>Position sensor positioning, description page 78</i> D10: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.5 <i>ATTACH</i> , menu 5
11.	Control unit attachment (D791-1) cuts off control current to Servo valve spreading out (Y6018) or Servo valve spreading in (Y6019).	I = 0 mA	<i>Control valve attachment, description page 64</i> D4: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.13 <i>ATTACH</i> , menu 13 and 8.4.9.14 <i>ATTACH</i> , menu 14

Hydraulic diagram top lift

Hydraulic diagram top lift, tilt lock and controllable tilt

Hydraulic diagram combi attachment

Hydraulic diagram top lift, tilt lock, controllable tilt and hydraulic leveling

## 7.5.1 Hydraulic oil pump

### Hydraulic oil pump, general

See section 10 *Common hydraulics*, group 10.4.2 *Axial piston pump with variable displacement*.

## 7.5.2 Valve block top lift hydraulics

### Valve block top lift hydraulics, description

See *Valve block top lift hydraulics, description page 46*.

## 7.5.3 Control valve attachment

### Control valve attachment, description

The positioning is controlled by a separate section in the attachment's control valve. For a more detailed general description of the valve and component location, see *Control valve attachment, description page 47*.

### Positioning slide

The valve slide controls positioning direction and speed. The valve slide is controlled by servo valve positioning out and servo valve positioning in.

### Servo valve positioning out

Servo valve positioning out controls pressure to the positioning slide so that it opens and pressurises the positioning motor.

The servo valve is controlled electrically with Solenoid valve, positioning out (Y6018) which is activated by Control unit attachment (D791-1). The servo valve directs servo pressure to the positioning slide proportional to the control current to the solenoid valve.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.13 *ATTACH, menu 13*.

### Servo valve positioning in

Servo valve positioning in controls pressure to the positioning slide so that it opens and pressurises the positioning motor.

The servo valve is controlled electrically with Solenoid valve positioning in (Y6019) which is activated by Control unit, attachment (D791-1). The servo valve directs servo pressure to the positioning slide proportional to the control current to the solenoid valve.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.14 *ATTACH, menu 14*.

### Control valve attachment, replacement

See *Control valve attachment, replacement page 49*.

## 7.5.4 Shuttle valve

### Shuttle valve, description

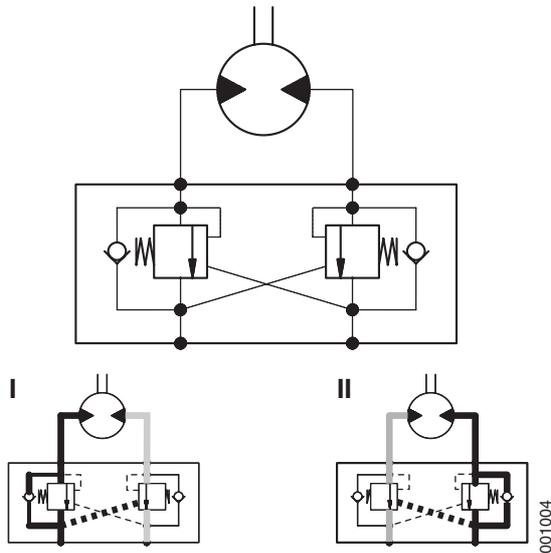
See section 10 *Common hydraulics*, group 10.5.3 *Shuttle valve*.

## 7.5.5 Valve block positioning motor

### Valve block positioning motor, description

Valve block positioning motor controls the direction of the oil to the positioning motor. The valve block is located on the positioning motor furthest out to the left on the front of the attachment's main beam.

The valve block maintains balance between feed and positioning speed. Balance means that the valve block prevents the motor from pumping oil i.e. rotating faster than the feed of oil permits. Valve block positioning contains over-centre valves which block the outlet if the pressure on the outlet side is higher than the pressure on the inlet side.



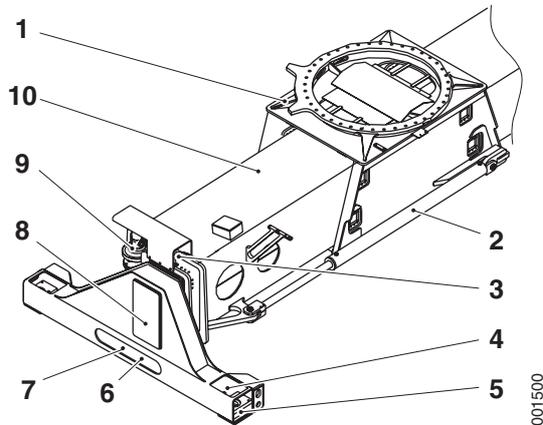
Hydraulic diagram valve block positioning motor

## 7.5.6 Positioning motor

### Positioning motor, description

The positioning motor pulls the positioning beams in and out in the attachment's main beam with two chains. The positioning motor is located furthest out to the left on the front of the attachment's main beam.

The hydraulic motor is built together with a planetary gear which reduces speed and reinforces the power of the motor. On the motor's hydraulic connections is a valve block with two over-centre valves which prevent the motor from being turned faster than the hydraulic pressure supplied.



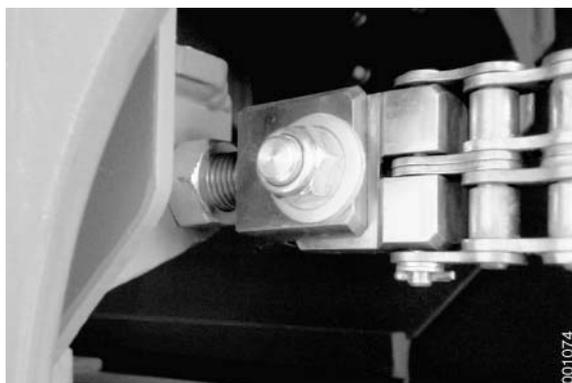
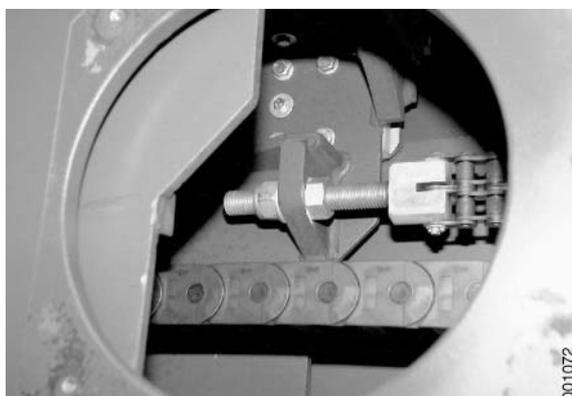
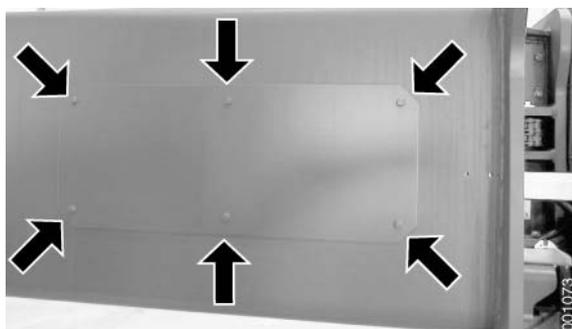
1. Sideshift frame
2. Sideshift cylinder
3. Position sensor positioning
4. Sensor alignment
5. Twistlock
6. Sensor twistlocks
7. Lock cylinder twistlocks
8. Positioning beam
9. Positioning motor
10. Main beam attachment

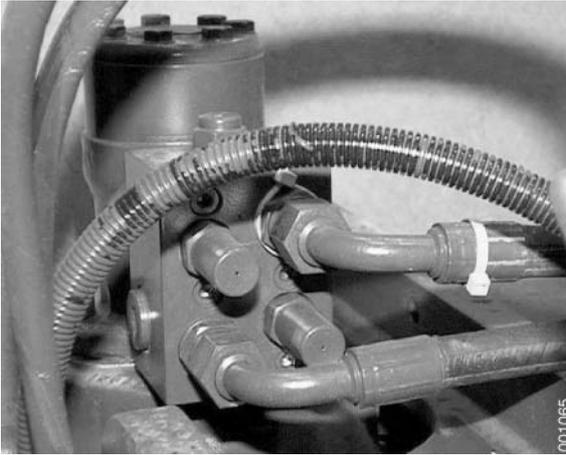
## Spreader motor, replacement

### NOTE

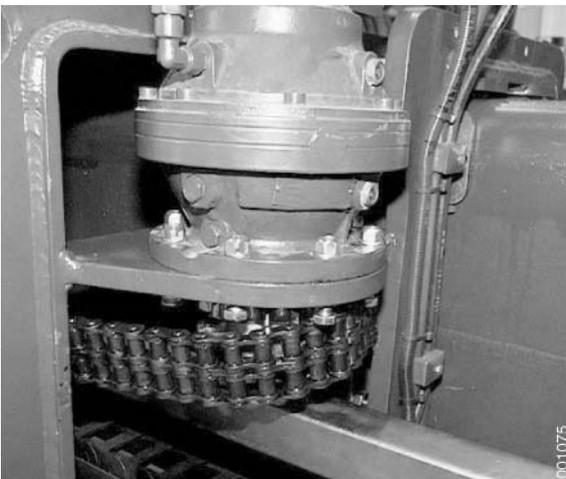
*Read the safety instructions for oil before working, see tab B Safety.*

- 1 Machine in service position, see tab B Safety.
- 2 Remove the cover plate on the left-hand side of the attachment's main beam.
- 3 Start the engine and run out the spreading until the chain tensioners become visible in the inspection holes.
- 4 Turn off the engine and turn the start key to position I.
- 5 Depressurize the brake and hydraulic systems, see tab B Safety.
- 6 Turn the start key to position 0 and turn off the main electric power.
- 7 Measure and note down the chain tensioner's position to regain the correct tension on the chain when installing.
- 8 Detach the chain tensioner on the motor side and release the chain from the tensioner.
- 9 Remove the protective plate over the spreader motor.





- 10 Mark up and disconnect the hydraulic hoses from the valve block for the spreader motor.



- 11 Remove the spreader motor unit.

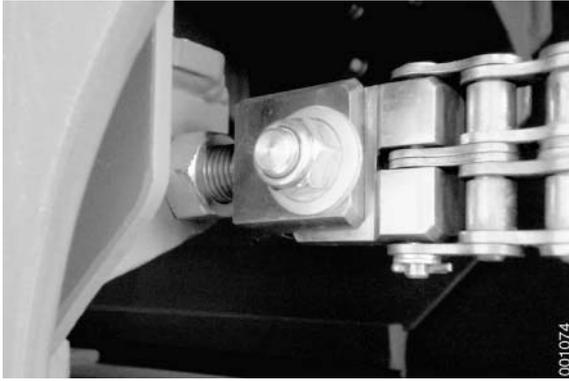


- 12 Transfer the valve block to the new motor unit.

## NOTE

*Check that the O-rings are intact and correctly fitted.*

- 13 Clean the contact surfaces between the planetary gear and the attachment's main beam.
- 14 Install the motor unit. Tighten the bolts crosswise in sequences with increasing torque to **117 Nm**.
- 15 Connect the hydraulic hoses to the valve block on the motor.



- 16 Connect the spreader chain to the chain tensioner. Check that the chain runs straight in the chain wheel on the hydraulic motor.
- 17 Tension the spreader chain to the same degree as before.
- 18 Turn on the main electric power and start the engine.
- 19 Check that the hydraulic connections seal tightly.
- 20 Check that spreading works.
- 21 Fit the protective plate over the motor.
- 22 Brush on Lubricating grease on the spreader chain.
- 23 Fit the cover plates to the attachment's main beam.
- 24 Check the oil level in the hydraulic oil tank with the lift cylinders completely down and the extension cylinder completely in. The oil level should be at the top of the level glass. Top up as needed.

### CAUTION

**Overfilling of oil.**

**Leakage and environmental damage.**

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

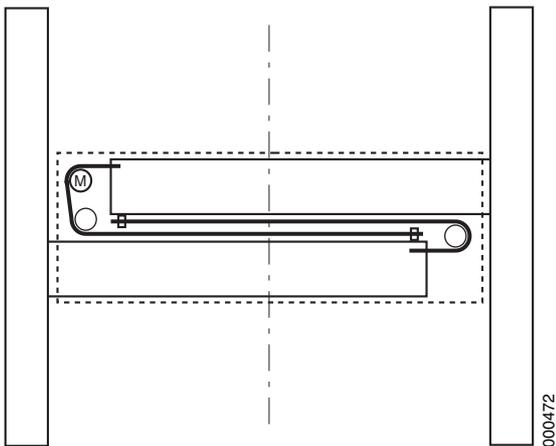
## 7.5.7 Positioning chains

### Spreader chains, description

The spreader chains pull the extension beams in and out from the attachment's main beam. The force from the spreader motor is transmitted to the extension beams via two chains. The chains run inside the attachment between the extension beams.

The chains are attached crosswise with one end attached to the bottom of one of the extension beams and the other along the side of the other extension beam.

Openings in the sides of the extension beams and the attachment's main beam make it possible to access the chains for maintenance.



Principle diagram spreader chains

### Positioning chains, checking

- 1 Before adjustment, the clearance between the slide plates and extension beams must be checked otherwise the chain's mountings will be damaged, see tab 7 *Load handling*, group 7.5.8 *Positioning beam*.
- 2 Start the engine and run in the positioning to the 20-foot position, and turn off the engine.
- 3 Check the C-C measurement between the twistlocks.

**C-C 20-foot:** 5853±3 mm

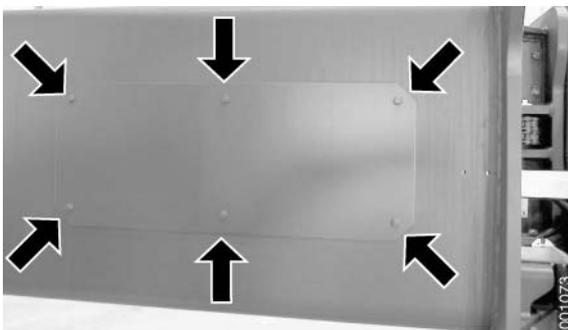
Check that both positioning beams run against the 20-foot stops and that the distance between positioning beam and the positioning motor's mounting is at least 3 mm.

- 4 If needed, adjust the distance by moving washers between the right and left 20-foot stop. The quantity of washers may not be changed.

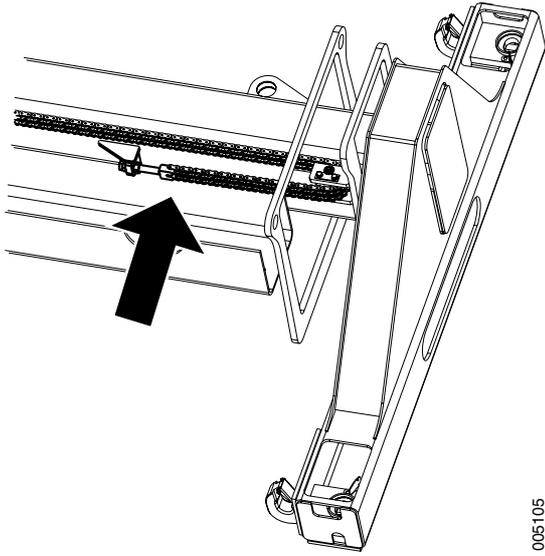
### NOTE

*Note the distance that the stop is adjusted.*

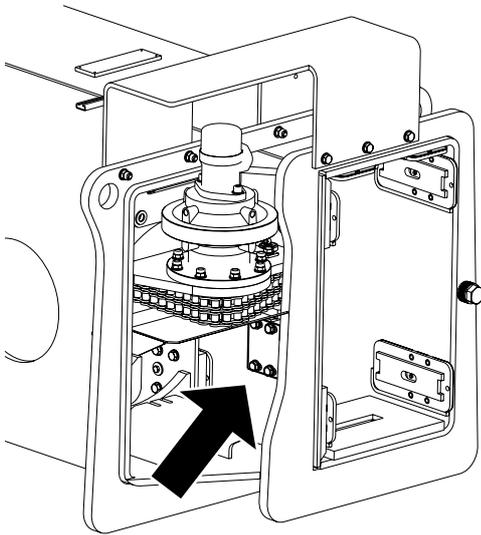
Run out the positioning slightly so that it is possible to move the washers.



- 5 Remove the cover plates on the attachment's main beam.



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- 6 If the 20-foot stops have been adjusted, the positioning chains should be adjusted equally (as much).

## NOTE

*Check the chain tensioner's vertical position so that the chain runs straight toward the chain wheel.*

- 7 Start the engine and run out the positioning to the 40-foot position, and turn off the engine.  
8 Check the C-C measurement between the twistlocks.

**C-C 40-foot:** 11985±3 mm

- 9 If needed, adjust the 40-foot stops.  
10 Start the engine and run in the positioning to the 40-foot position.  
11 Wait 2 minutes and then check the tension of the chains.

Measure how much the chain can be pushed in at the hole closest to the centre of the attachment. When the chain is pressed in with a force of **250 N** it should move **20–40 mm** from resting position.

- 12 If needed, adjust the tension of the chains.

Start the engine and run out the positioning until the chain tensioner is visible in the inspection hole. Adjust the chains.

## NOTE

*Adjust the chain max. 2 mm at a time on the chain tensioner.*

- 13 Repeat steps 9–11 until the chain tension is correct.

- 14 

If the machine is equipped with 30-foot or 35-foot stops: Start the engine and run out the positioning to the 30-foot or 35-foot position. Turn off the engine and check the C-C measurement between the twistlocks.

**C-C 30-foot:** 8918±3 mm

**C-C 35-foot:** 10488±3 mm

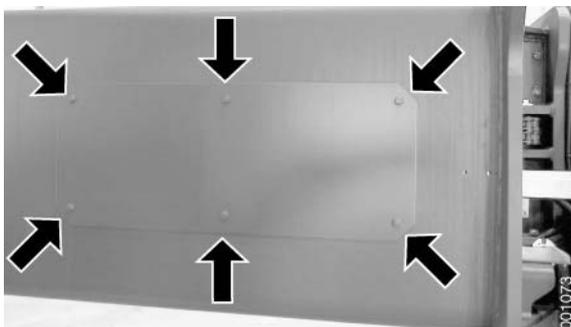
## IMPORTANT

**Check the distance at stop from both 20' and 40'.**

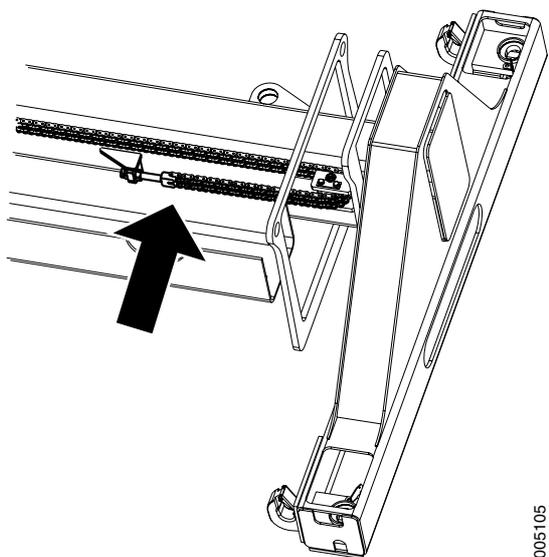
- 15 Brush lubrication grease on the positioning chain.  
16 Fit the cover plates to the attachment's main beam.

### Spreader chain, replacement

- 1 Park the machine with the attachment as far down as possible.
- 2 Remove the cover plates on the attachment's main beam.



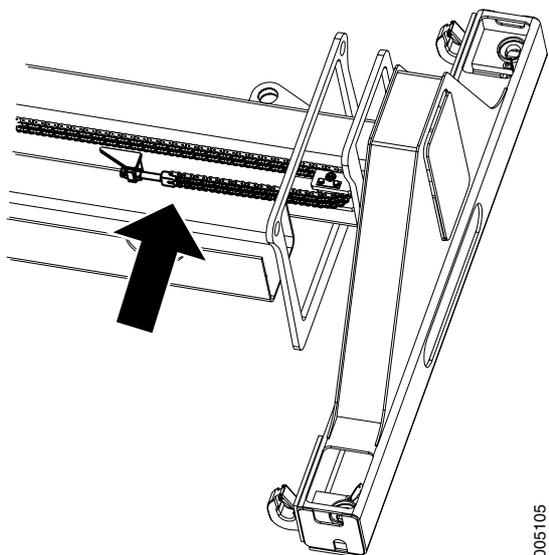
- 3 Start the engine and run out the spreading until the chain tensioners become visible in the inspection holes.
- 4 Turn off the engine and the main electrical power.



- 5 Detach the defective chain's chain tensioner and release the chain from the tensioner.

### NOTE

*Measure and note down the chain tensioner's position to regain the correct tension on the chain when installing.*



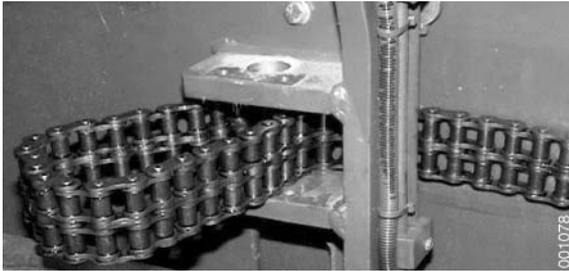


- 6 Remove the defective chain's chain wheel.

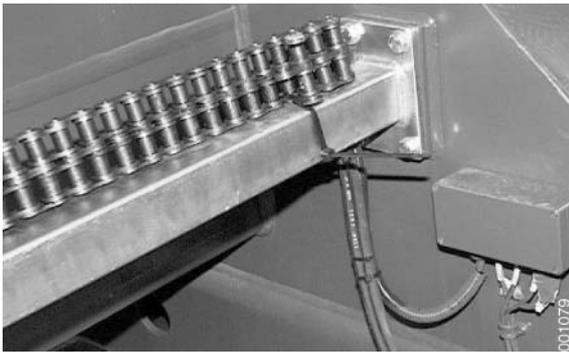
## NOTE

*Note down the position of the spacer ring.*

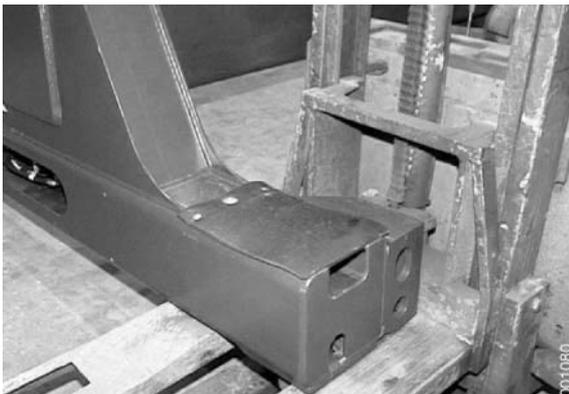
If the chain wheel on the motor side shall be removed then the spreader motor must first be removed, see *Spreader motor, replacement page 66*.



- 7 Pull the chain out through the hole for the chain wheel so that the chain runs along the spreader beam.



- 8 Secure the chain temporarily along the cable rack to prevent the chain from jamming.



- 9 Pull out the spreader beam.

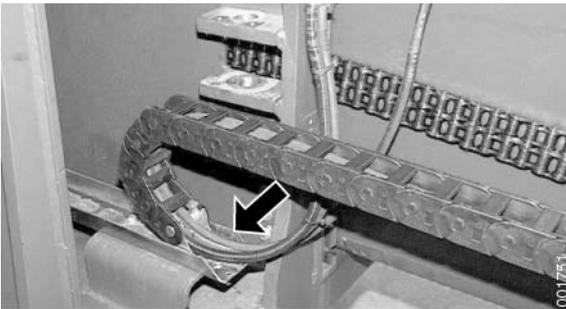
Use a machine or similar to pull out the spreader beam from the attachment's main beam. Stop when the spreader beam is near the 40-foot stop.

## NOTE

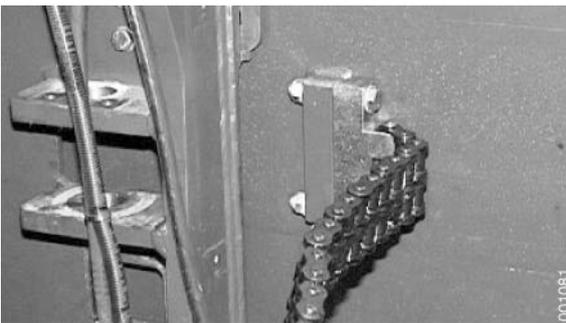
*Support the spreader beam so that bending stresses are minimized. If needed, remove the upper slide plates to reduce the resistance.*



- 10 Remove the boom stop from the attachment's main beam.
- 11 Remove the hydraulic hoses' clamping on the attachment's main beam.



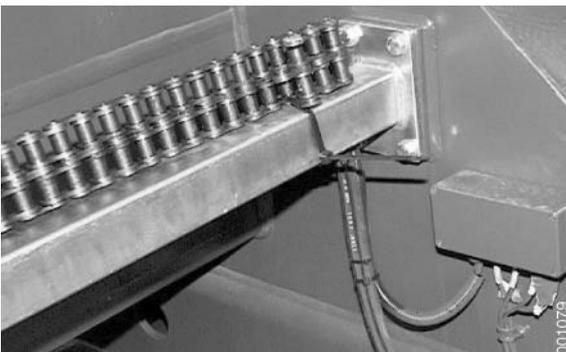
- 12 Disconnect the cable rack from the attachment's main beam. Support the cable rack so that it is not damaged.



- 13 Pull out the spreader beam until the chain's mounting is accessible.

- 14 Release the chain from the spreader beam and cable rack.

- 15 Connect the new chain to the spreader beam.

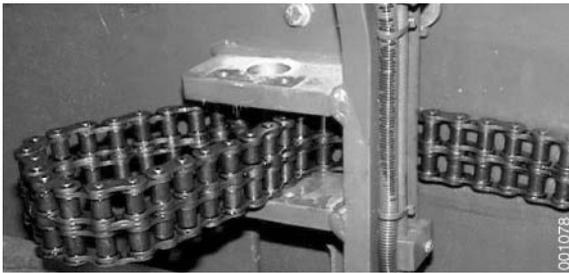


- 16 Secure the chain along the cable rack so that the chain runs straight along the spreader beam.

- 17 Brush on Lubricating grease on the chain.



- 18 Retract the spreader beam so that the extension stop can be fitted.
- 19 Fit the extension stop.
- 20 Connect the cable rack to the attachment's main beam.
- 21 Fit the hydraulic hoses' clamping on the attachment's main beam.
- 22 Push in the spreader beam until it is pressed in as far as the other. This is important for easier installation of the chains.



- 23 Release the chain from the cable rack and thread it through the chain wheel's hole.



- 24 Install the chain wheel. The spacer ring should be fitted on the underside of the chain wheel.

If the rotation motor was removed, install it, see *Spreader motor, replacement page 66*.

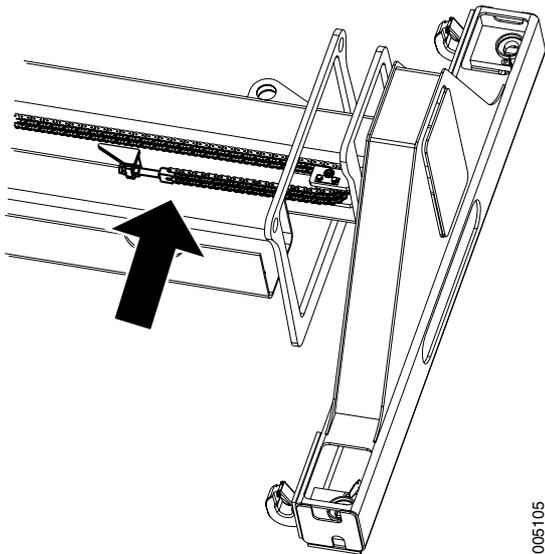
## NOTE

*Check that the chain runs straight into the chain wheels.*

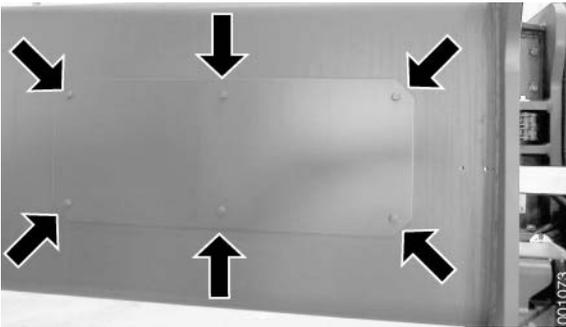
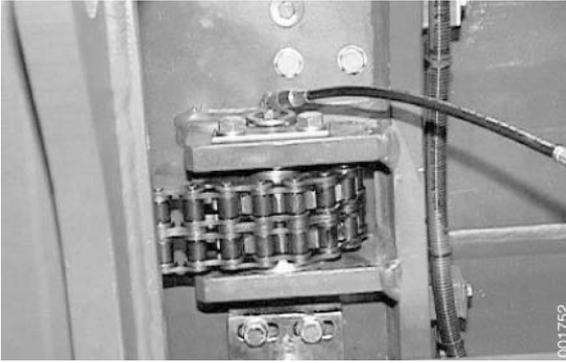
- 25 Connect the chain to the chain tensioner.

## NOTE

*Use a new split pin.*



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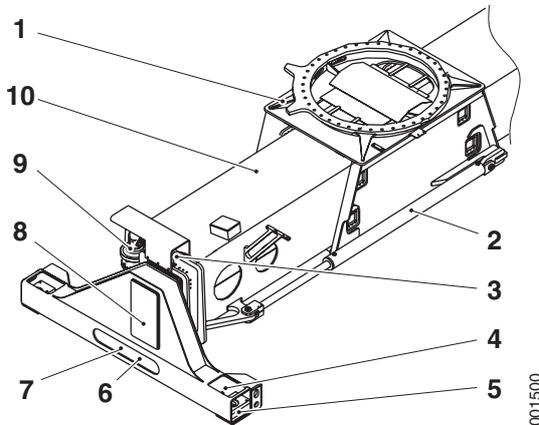
- 26 Lubricate the chain wheel's bearing with Lubricating grease.
- 27 Tension the spreader chain to the same measurements as before. Tighten the lock nut.
- 28 If the slide plates were removed, fit them.
- 29 Turn on the main electric power and start the engine.
- 30 Check that the spreading is working correctly.
- 31 Turn off the engine.
- 32 Check the chains' tension, see *Positioning chains, checking page 69*.
- 33 Fit the cover plates to the attachment's main beam.

### 7.5.8 Positioning beam

#### Positioning beam, description

The positioning beams are a part of the attachment which grips in the container. Two positioning beams run in the main beam. The positioning beams are retracted and extended with the positioning motor and the positioning chains.

There are twistlocks located in the positioning beam, see *Twistlocks, description page 119*.



- 1. Sideshift frame
- 2. Sideshift cylinder
- 3. Position sensor positioning
- 4. Sensor alignment
- 5. Twistlock
- 6. Sensor twistlocks
- 7. Lock cylinder twistlocks
- 8. Positioning beam
- 9. Positioning motor
- 10. Main beam attachment

### Slide plates, extension beams, changing

- 1 Machine in service position, see tab *B Safety*.
- 2 Take the strain off the slide plate in question.

The pressure can be removed from the slide plates by raising the outer edges of the extension beam or inserting wedges to alter the position of the extension beam in the attachment's main beam.



The illustration shows the inner slide plates in the attachment's main beam.

- 3 Remove the attaching bolts for the slide plate's bracket.
- 4 Remove the guide plate's guide pin.
- 5 Pull out the slide plate with spacer plate and bracket.



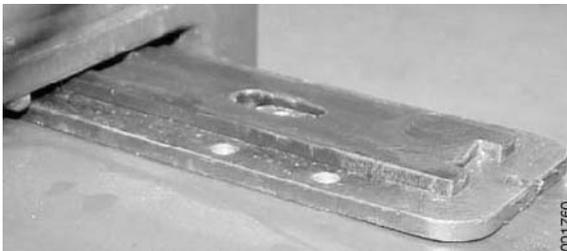
The illustration shows the inner slide plates in the attachment's main beam.

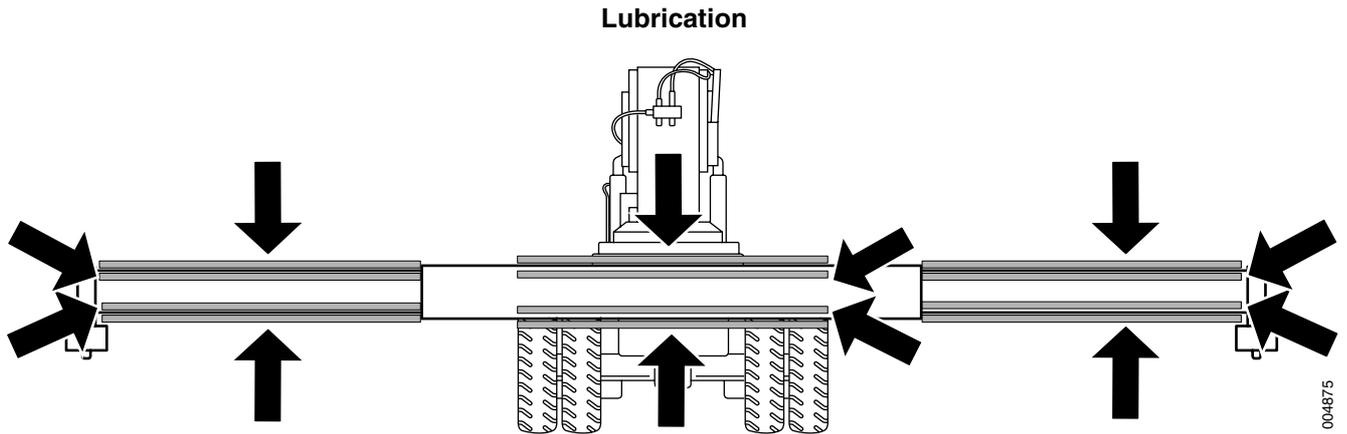
- 6 Fit the new slide plate in the correct position.

Check the clearance between the extension beam and slide plate. The clearance must be max. **1 mm** with all slide plates installed.

Use a spacer plate to adjust the clearance.

- 7 Fit the slide plate's bracket and guide pin.





- 8 Lubricate the glide surfaces on the attachment with white lubrication paste.
- 9 Run spreading completely in and out approx. 10 times and check the spreading function.
- 10 Wipe off excess lubrication paste by the slide plates and on the glide surfaces.
- 11 Try lifting a container and check the extension beams' clearance in the attachment's main beam.

## 7.5.9 Main beam attachment

### Main beam attachment, description

See *Main beam attachment, description* page 56.

## 7.5.10 Position sensor positioning

### Position sensor positioning, description

Position sensor positioning indicates the position of the positioning beams. The position sensors are used to control positioning so that twistlocks fit on the container. The position sensors are located under the protective plate on the top side of the attachment's main beam on the left side.

Sensor end-position (B769) indicates end-position for 20 and 40 foot containers. The sensor senses the end-positions of the positioning beams with two indicator plates on the top side of the positioning beam. The sensor is used to activate damping.

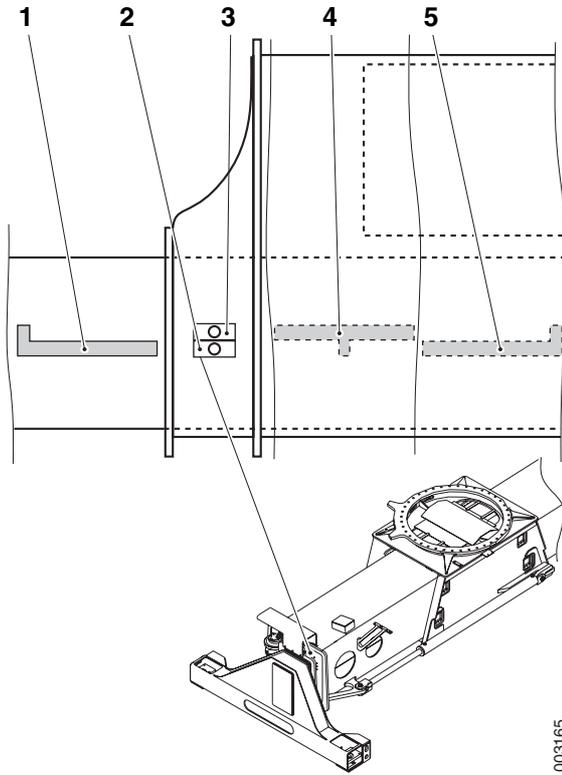


For the optional 30 foot stop an extra sensor is installed, Sensor position (B779), and two indicator plates. The sensor is used to activate 30 foot stop.

The sensors are supplied with voltage and send a 24 V signal to Control unit attachment (D791-1) when the raised parts of the indicator plates pass the sensor. On the positioning beam there are indicator plates mounted so that the sensors give a signal when the positioning unit passes the sensor. The indicator plates' and sensors' positions are adapted so that the distance between the spreaders becomes 20', (30') and 40'.

The signals can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.5 *ATTACH*, menu 5.

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1. Indicator plate 20'
2. Sensor damping 20' and 40', Stop 30'
3. Sensor damping 30' 
4. Indicator plate 30' or 35' 
5. Indicator plate 40'

### Position sensor, checking and adjustment

See *Position sensor, checking and adjustment* page 5.

## 7.5.11 Unloading valve attachment

### Relief valve attachment, description

See *Relief valve attachment, description* page 57.

## 7.5.12 Pipes and hoses

### Pipes and hoses, description

See section 10 *Common hydraulics*, group 10.5.1 *Pipes and hoses*.

### 7.5.13 Summer automatic positioning 20'-40'

#### Buzzer automatic spreading 20'-40', description



Buzzer automatic spreading 20'-40' (H9003) is located on the boom nose on machines equipped with automatic spreading 20'-40'. The buzzer is activated during automatic spreader movement.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.15 *ATTACH*, menu 15.



Pos	Explanation	Signal description	Reference
2	Control unit cab (D790-1) sends rotation clockwise or rotation counter-clockwise on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
3	Control unit cab (D790-1) sends rotation clockwise to stop or rotation counter-clockwise to stop on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
4	Control unit frame rear (D797-R) activates Solenoid valve, engagement of hydraulics for top lift (Y6003).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i> D4: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
5	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens and pressurizes valve block lift cylinder and sends load signal to hydraulic oil pumps.	-	<i>Valve block top lift hydraulics</i> , description page 46 D4: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
6	The shuttle valve sends the strongest load signal to hydraulic oil pump 2 if several functions are activated simultaneously.	-	Tab 10 <i>Common hydraulics</i> , group 10.5.3 <i>Shuttle valve</i>
7	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See pressure plate on left frame beam.	Tab 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
8	Control unit attachment (D791-1) activates Servo valve, rotation clockwise or Servo valve, rotation counter-clockwise.	I = 435–650 mA	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i> D8: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.11 <i>ATTACH</i> , menu 11 and <i>ATTACH</i> , menu 12
9	Servo valve rotation clockwise (Y6008) or Servo valve rotation counter-clockwise (Y6009) pressurizes rotation slide in control valve attachment.	-	<i>Control valve attachment</i> , description page 84 D8: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.11 <i>ATTACH</i> , menu 11 and <i>ATTACH</i> , menu 12
10	The rotation spool in control valve attachment changes position and directs pressure to Valve block hydraulic motor.	-	<i>Control valve attachment</i> , description page 84
11	Valve block hydraulic motor directs pressure to both motors.	-	<i>Valve block rotation motor</i> , description page 85
12	Hydraulic motors' disc brakes are released.	-	<i>Rotation motor unit</i> , description page 86
13	Hydraulic motors rotate the attachment.	-	<i>Rotation motor unit</i> , description page 86

Hydraulic diagram top lift

Hydraulic diagram top lift, tilt lock and controllable tilt

Hydraulic diagram combi attachment

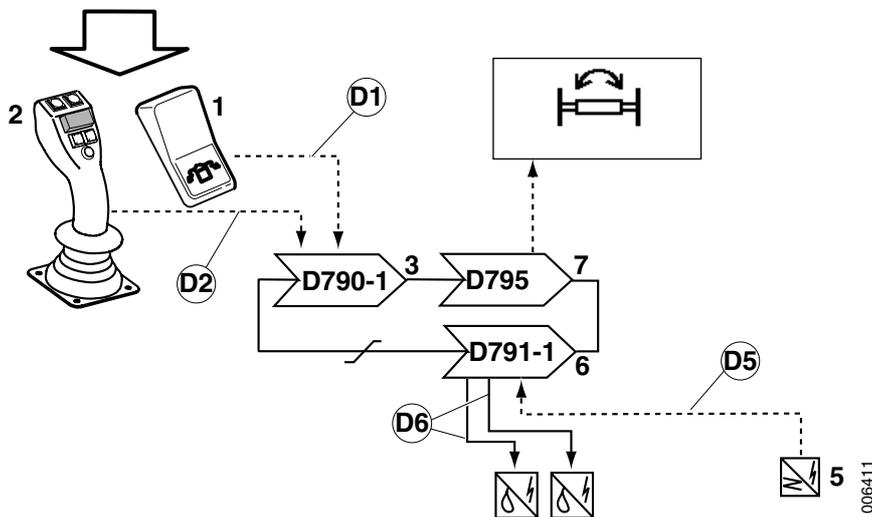
Hydraulic diagram top lift, tilt lock, controllable tilt and hydraulic leveling

### Rotation stop, function description



Rotation stop is used to avoid rotating the attachment into the boom in lifted position.

Condition	Reference value	Reference
Control switch	Disengaged	Tab 11 <i>Common electric</i> , group 11.5.1.4 <i>Manoeuvre switch voltage</i>
Overload system	Passive	Section 8 <i>Control and monitoring system</i> , group 8.2.1 <i>Overload system</i>



Pos	Explanation	Signal description	Reference
1	Switch rotation stop (S1014) sends voltage signal to Control unit cab (D790-1).	Switch in on position: $U_{S1014/1} = 0 \text{ V}$ $U_{S1014/5} = 24 \text{ V}$ Switch in off position: $U_{S1014/1} = 24 \text{ V}$ $U_{S1014/5} = 24 \text{ V}$	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i> D1: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.21 <i>ATTACH</i> , menu 21

Pos	Explanation	Signal description	Reference
2	Control lever (S815-P3) sends voltage signal proportional to lever movement to Control unit cab (D790-1).	Counter-clockwise: $U_{S815/P3} = 0.5\text{--}2.0\text{ V}$ Zero position: $U_{S815/P3} = 2.0\text{--}3.0\text{ V}$ Clockwise: $U_{S815/P3} = 3.0\text{--}4.5\text{ V}$ 0.5 V is the slowest rotation speed and 4.5 V is the fastest rotation speed. Lower voltages than 0.5 V and higher voltages than 4.5 V are used to detect malfunctions in cabling and controls.	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i> D2: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.1 <i>ATTACH</i> , menu 1
3	Control unit cab (D790-1) sends rotation clockwise to stop or rotation counter-clockwise to stop on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
4	Rotation is activated in the same way as the normal rotation steps 3–12.	-	<i>Rotation, function description page 80</i>
5	Sensor rotation stop (B7225) sends voltage signal to Control unit attachment (D791-1).	Sensor directly opposite indicator plate: $U = 24\text{ V}$	<i>Sensor rotation stop, description page 93</i> D5: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.21 <i>ATTACH</i> , menu 21
6	Rotation is stopped by Control unit attachment (D791-1) cutting off the current to servo valve rotation clockwise (Y6008) or servo valve rotation counter-clockwise (Y6009).	-	<i>Control valve attachment, description page 84</i> D6: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.11 <i>ATTACH</i> , menu 11 and <i>ATTACH</i> , menu 12
7	When the rotation stop has reached, Control unit KID (D795) activates event menu rotation stop.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>

Hydraulic diagram top lift

Hydraulic diagram top lift, tilt lock and controllable tilt

Hydraulic diagram combi attachment

Hydraulic diagram top lift, tilt lock, controllable tilt and hydraulic leveling

## 7.6.1 Hydraulic oil pump

### Hydraulic oil pump, general

See section 10 *Common hydraulics*, group 10.4.2 *Axial piston pump with variable displacement*.

## 7.6.2 Valve block top lift hydraulics

### Valve block top lift hydraulics, description

See *Valve block top lift hydraulics, description page 46*.

## 7.6.3 Control valve attachment

### Control valve attachment, description

Rotation is controlled by a separate section in the attachment's control valve. For a general description of the valve and component location, see *Control valve attachment, description page 47*.

#### Rotation slide

The valve slide controls rotation direction and speed. The valve slide is controlled by servo valve rotation clockwise and servo valve rotation anticlockwise.

#### Servo valve rotation clockwise

Servo valve rotation clockwise controls pressure to the rotation slide so that the rotation slide opens and pressurises the rotation motors.

Servo valve rotation clockwise is controlled electrically with Solenoid valve, rotation clockwise (Y6008) which is activated by Control unit attachment (D791-1). The servo valve directs servo pressure to the rotation slide proportional to the control current to the solenoid valve.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.11 *ATTACH*, menu 11.

#### Servo valve spreading counter-clockwise

Servo valve rotation anticlockwise controls pressure to the rotation slide so that the rotation slide opens and pressurises the rotation motors.

Servo valve rotation anticlockwise is controlled electrically with Solenoid valve, rotation anticlockwise (Y6009) which is activated by Control unit attachment (D791-1). The servo valve directs servo pressure to the rotation slide proportional to the control current to the solenoid valve.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.12 *ATTACH*, menu 12.

### Control valve attachment, replacement

See *Control valve attachment, replacement page 49*.

## 7.6.4 Shuttle valve

### Shuttle valve, description

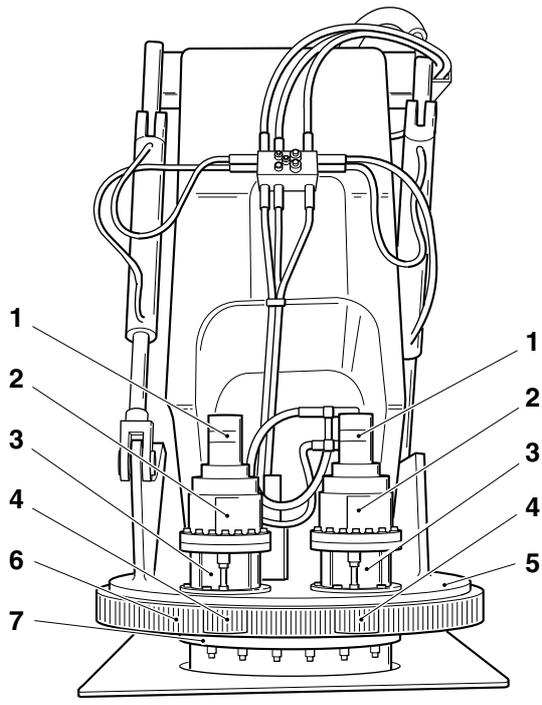
See section 10 *Common hydraulics*, group 10.5.3 *Shuttle valve*.

## 7.6.5 Valve block rotation motor

### Valve block rotation motor, description

Valve block rotation motor controls pressure to the rotation motors. The valve block is located on one of the rotation motors.

The valve block provides a controlled rotation by preventing the load from pulling away and provides faster rotation than the hydraulic motor. The valve block contains a shuttle valve and over-centre valves.



1. Hydraulic motor, rotation
2. Disc brake
3. Planetary gear
4. Gear wheel
5. Rotation yoke
6. Ring gear
7. Sideshift frame

## 7.6.6 Rotation motor unit

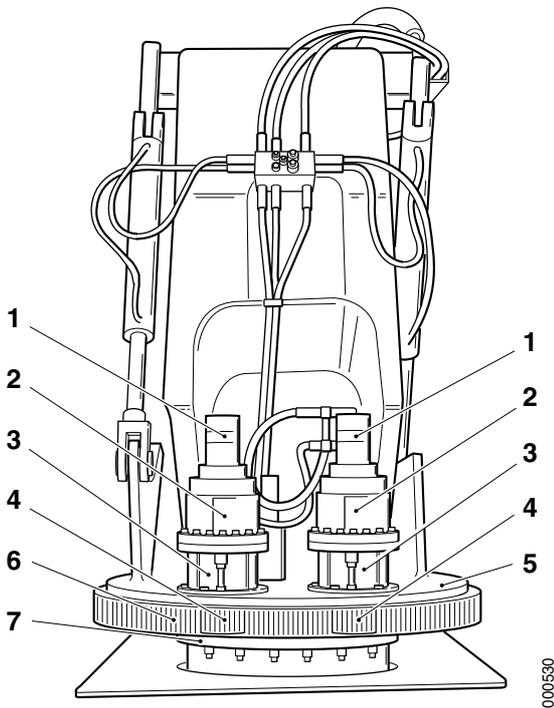
### Rotation motor unit, description

The rotation motors rotate the attachment in relation to the boom. The motors are located along the attachment's rotation yoke. The motors work against the ring gear between the rotation yoke and the sideshift frame. The rotation motor unit consists of hydraulic motor, disc brake and planetary gear which is built together to one unit.

The hydraulic motor is located on the disc brake housing. Between the motor and the discs is a gear wheel.

The disc brake prevents accidental rotation. The disc brake is applied with springs and is disengaged when the hydraulic pressure is built up to rotate the yoke.

The planetary gear reinforces the output in the motor and disc brake. The planetary gear changes the motor speed down so that the motor power is greater.



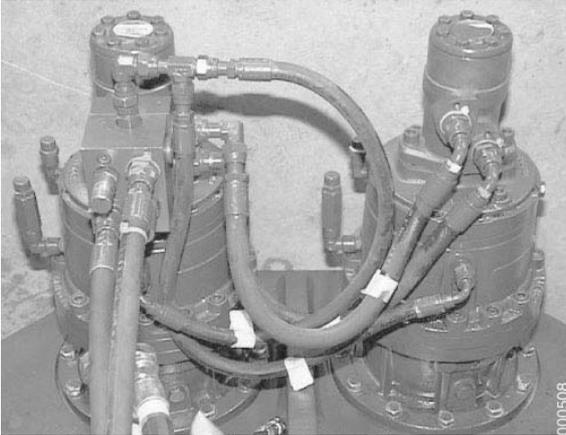
1. Hydraulic motor, rotation
2. Disc brake
3. Planetary gear
4. Gear wheel
5. Rotation yoke
6. Ring gear
7. Sideshift frame

## Rotation motor unit, changing

### NOTE

*Read the safety instructions for oil before working, see tab B Safety.*

- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the brake and hydraulic systems, see tab B Safety.
- 3 Mark up and detach the hydraulic hoses from the motor.

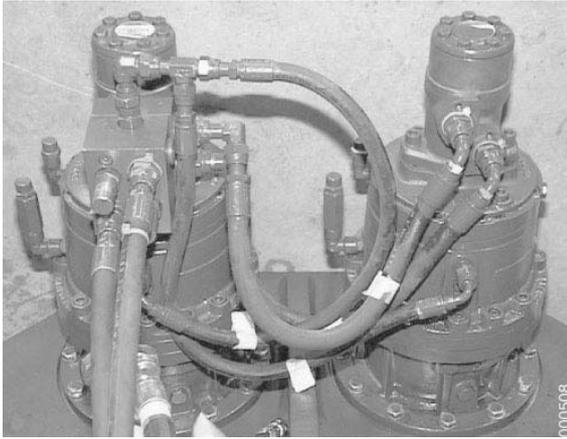


### NOTE

*Plug all connections immediately to protect the hydraulic system from impurities.*

- 4 Remove the hydraulic motor's attaching bolts.
- 5 Lift away the rotation motor unit. Place the motor unit so that gears and planet gear are not damaged.
- 6 Clean the contact surfaces on the motor unit and rotation yoke.
- 7 Lift the new motor unit into place.
- 8 Install the motor unit. Tighten the screws crosswise in sequences with increasing torque to **117 Nm**.





- 9 Connect the hydraulic hoses to the motor and brake in accordance with the marking.

### NOTE

*Check that the O-rings are intact and correctly fitted.*

- 10 Turn on the main electric power and start the engine.
  - 11 Check that the hydraulic connections seal tightly.
  - 12 Check that the rotation is working.
- 13 Check the oil level in the hydraulic oil tank with the lift cylinders completely down and the extension cylinder completely in. The oil level should be at the top of the level glass. Top up as needed.



### ⚠ CAUTION

**Overfilling of oil.**

**Leakage and environmental damage.**

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

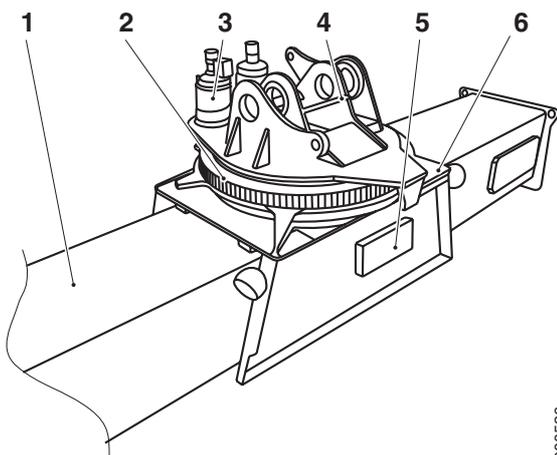
## 7.6.7 Rotation yoke

### Rotation yoke, description

The rotation yoke is a part of the attachment which connects the attachment to the boom. The rotation yoke is secured on the inner boom with two shafts which run in bearing equipped attaching lugs. In the bottom of the rotation yoke is the ring gear with lead-through bolts.

Using the rotation motors which act on the ring gear the remaining parts of the attachment can be rotated in relation to the lift boom.

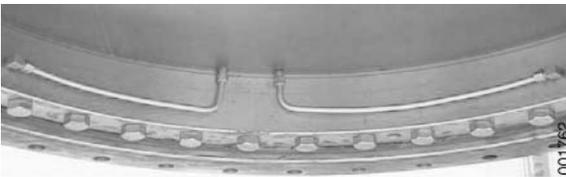
The rotation yoke's mounting in the lift boom facilitates longitudinal motion (so-called "tilt"). The oscillating motion is dampened by two hydraulic cylinders which are secured between the upper yoke and the upper edge on the inner boom.



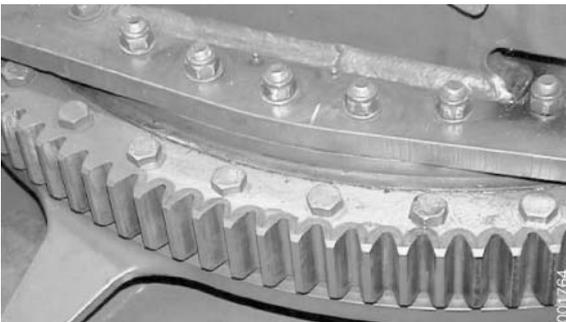
1. Main beam
2. Ring gear
3. Rotation motor unit
4. Rotation yoke
5. Control valve attachment
6. Sideshift frame

## Rotation yoke, replacement

- 1 Clean the attachment and boom nose.
- 2 Release the attachment from the boom.
- 3 Remove the rotation motors from the rotation yoke.
- 4 Fit the lifting equipment on the rotation yoke.



The illustration shows removed rotation yoke and ring gear.

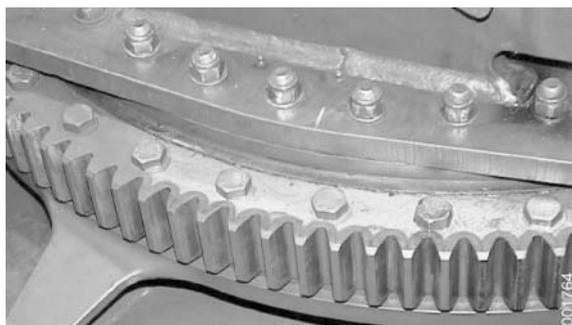


- 5 Remove the pipes for ring gear lubrication.
- 6 Remove the rotation yoke attaching bolts.
- 7 Lift away the rotation yoke.
- 8 Clean the contact surfaces on the ring gear.
- 9 Remove the plastic plugs and clean the threads and holes on the new rotation yoke, clean the contact surface against the ring gear.
- 10 Transfer parts to the new rotation yoke.
  - Grease cups
  - Mounting pins
- 11 Transfer the lifting equipment to the new rotation yoke.
- 12 Lift the new rotation yoke into place.

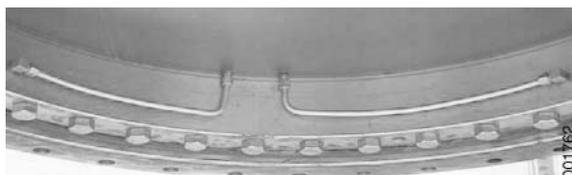
### NOTE

*Align the position against that of the ring gear so that the lubrication lines can be fitted.*

- 13 Grease the rotation yoke's mounting pins with grease, and place them in the rotation yoke.



- 14 Tighten the rotation yoke's attaching bolts with torque, **331 Nm**.



- 15 Install the pipes for the ring gear's lubrication lines.
- 16 Grease the ring gear.  
Rotate the yoke while greasing it so that the grease is distributed evenly.
- 17 Rotate the yoke so that it is straight.
- 18 Install the rotation motors. See *Rotation yoke, description page 88*.

## NOTE

*If necessary, rotate the rotation yoke so that the rotation motor's gear wheel fits against the ring gear.*

- 19 Connect the attachment to the boom.
- 20 Start the motor and check that the rotation is working.
- 21 Clean the attachment.
- 22 Check the oil level in the hydraulic oil tank with the lift cylinders completely down and the extension cylinder completely in. The oil level should be at the top of the level glass. Top up as needed.



## CAUTION

**Overfilling of oil.**

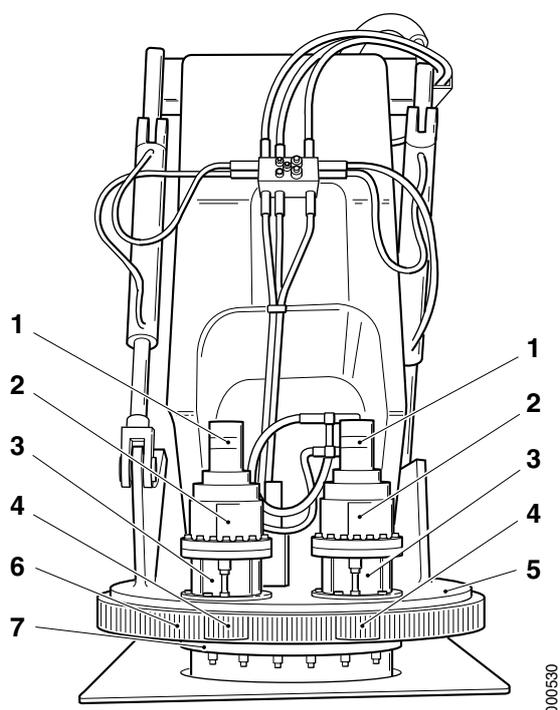
**Leakage and environmental damage.**

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

## 7.6.8 Ring gear

### Ring gear, description

The ring gear is the joint between the rotation yoke and the sideshift frame. The ring gear consists of gear wheel, bearings and mounting parts. The unit is bolted into the rotation yoke and sideshift frame.



1. Hydraulic motor, rotation
2. Disc brake
3. Planetary gear
4. Gear wheel
5. Rotation yoke
6. Ring gear
7. Sideshift frame

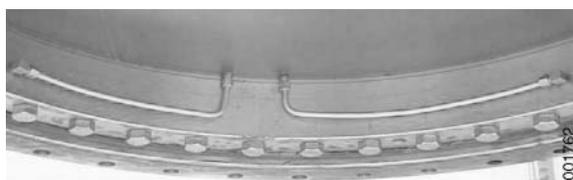
### Ring gear, changing

- 1 Remove the rotation yoke, see *Rotation yoke, replacement page 89*.
- 2 Remove the lubricating pipes from the ring gear.

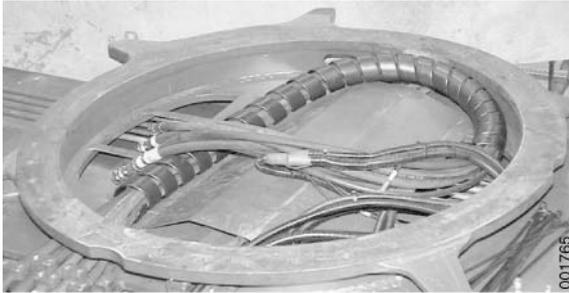
### NOTE

*Note down the locations of the lubricating pipes to facilitate fitting.*

- 3 Remove the attaching bolts between the ring gear and the sideshift frame.
- 4 Lift away the ring gear.



The illustration shows removed rotation yoke and ring gear.

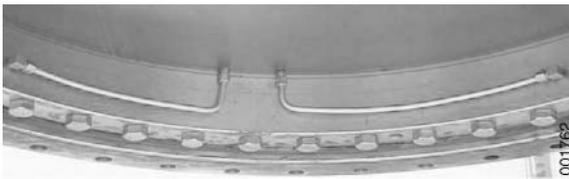


- 5 Clean the contact surfaces on the sideshift frame and ring gear.
- 6 Lift the new ring gear into place.

### NOTE

*Rotate it so that the connections for the lubricating pipes are in the same positions as before.*

- 7 Lubricate the inner attaching bolts with Lubricating grease and install them. Tighten the screws crosswise in sequences with increasing torque to **331 Nm**.
- 8 Fit the rotation yoke, see *Rotation yoke, replacement page 89*.
- 9 Fit the lubricating pipes to the ring gear.
- 10 Lubricate the ring gear with Lubricating grease.
- 11 Start the motor and check the function of the rotation.



The illustration shows removed rotation yoke and ring gear.



- 12 Check the oil level in the hydraulic oil tank with the lift cylinders completely down and the extension cylinder completely in. The oil level should be at the top of the level glass. Top up as needed.



## CAUTION

**Overfilling of oil.**

**Leakage and environmental damage.**

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

### 7.6.9 Sideshift frame

#### Sideshift frame, description

See *Sideshift frame, description page 53*.

## 7.6.10 Sensor rotation stop

### Sensor rotation stop, description



Sensor rotation stop (B7225) indicates when rotation is 25° from the middle position and is used to activate rotation stop. The sensor is located on a bracket on the left side of the rotation yoke and senses 25° towards the rotation yoke's mechanical stop.

The sensors are supplied with voltage and send 24 V signal to Control unit attachment (D791-1) when the raised parts pass the sensor.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.21 *ATTACH*, menu 21.

### Position sensor, checking and adjustment

See *Position sensor, checking and adjustment page 5*.

## 7.6.11 Unloading valve attachment

### Relief valve attachment, description

See *Relief valve attachment, description page 57*.

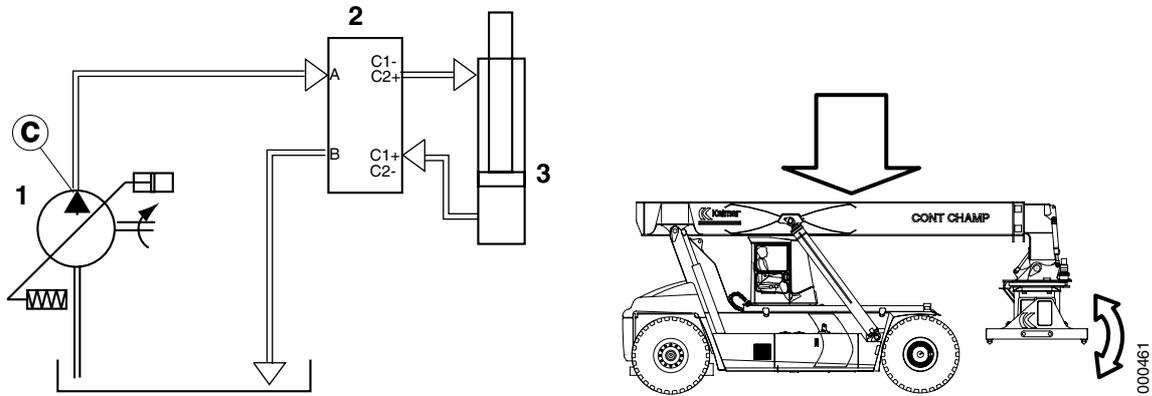
## 7.6.12 Pipes and hoses

### Pipes and hoses, description

See section 10 *Common hydraulics*, group 10.5.1 *Pipes and hoses*.

## 7.7 Tilt

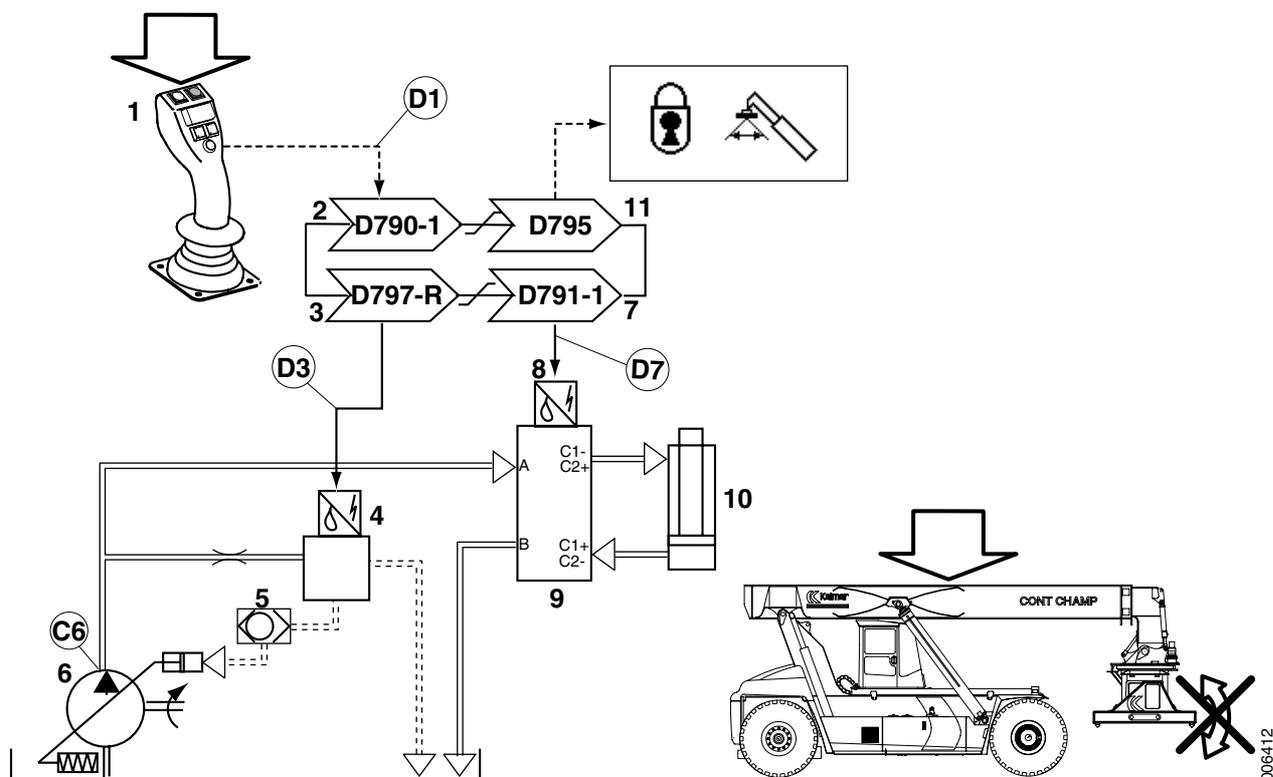
### Tilt damping, function description



Pos	Explanation	Signal description	Reference
1	Hydraulic oil pump 2 pumps oil.	See pressure plate on left frame beam.	Tab 10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement
2	Damping block tilt distributes oil to the tilt cylinders.	-	Damping block tilt, description page 100
3	The tilt cylinders dampen the attachment's movements.	-	Tilt cylinder, description page 103

Hydraulic diagram top lift

## Tilt lock, function description



006412

Pos	Explanation	Signal description	Reference
1	Control lever (S815-T3.1) sends voltage signal proportional to lever movement to Control unit cab (D790-1).	$U_{S815-T3.1} = 24 \text{ V}$	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i> D1: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.4 <i>ATTACH</i> , menu 4
2	Control unit cab (D790-1) sends tilt lock on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
3	Control unit frame rear (D797-R) activates Solenoid valve, engagement of hydraulics for top lift (Y6003).	$U = 24 \text{ V}$	<i>Valve block top lift hydraulics</i> , description page 46 D3: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
4	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens and pressurizes valve block lift cylinder and sends load signal to hydraulic oil pumps.	-	<i>Valve block top lift hydraulics</i> , description page 46 D3: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
5	The shuttle valve sends the strongest load signal to the hydraulic oil pumps if several functions are activated simultaneously.	-	Tab 10 <i>Common hydraulics</i> , group 10.5.3 <i>Shuttle valve</i>

Pos	Explanation	Signal description	Reference
6	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See pressure plate on left frame beam.	Tab 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
7	Control unit attachment (D791-1) activates Servo valve, tilt lock (Y6012).	Float mode: U = 24 V Lock mode: U = 0 V	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i> D7: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.15 <i>ATTACH</i> , menu 15
8	Servo valve tilt lock (Y6012) pressurizes the lock valve in the attachment's control valve.	-	<i>Lock valve tilt, description page 102</i> D7: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.15 <i>ATTACH</i> , menu 15
9	The lock valve changes position and blocks the connections to the tilt cylinders.	-	<i>Lock valve tilt, description page 102</i>
10	The tilt cylinders lock the attachment's angle.	-	<i>Tilt cylinder, description page 103</i>
11	When tilt lock is activated, Control unit KID (D795) shows event menu tilt lock. When tilt lock is activated the machine's speed is limited to max. 5 km/h.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>

Hydraulic diagram top lift, tilt lock and controllable tilt

Hydraulic diagram combi attachment

Hydraulic diagram top lift, tilt lock, controllable tilt and hydraulic leveling



Pos	Explanation	Signal description	Reference
4	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens and pressurizes valve block lift cylinder and sends load signal to hydraulic oil pumps.	-	<i>Valve block top lift hydraulics, description page 46</i> D3: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
5	The shuttle valve sends the strongest load signal to the hydraulic oil pumps if several functions are activated simultaneously.	-	Tab 10 <i>Common hydraulics</i> , group 10.5.3 <i>Shuttle valve</i>
6	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See pressure plate on left frame beam.	Tab 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
7	Control unit attachment option (D791-2) activates Servo valve, tilt out (6010) or Servo valve, tilt in (Y6011).  <div style="border: 1px solid black; padding: 2px; display: inline-block;">+</div> Machine with lift legs Control unit attachment right leg pair (D791-4) activates Servo valve, tilt out (6010) or Servo valve, tilt in (Y6011).	I = 400–650 mA	Tab 11 <i>Common electric</i> , group 11.5.3.6 <i>Control unit attachment option</i> or tab 11 <i>Common electric</i> , group 11.5.3.8 <i>Control unit attachment right legs</i> D8: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.16 <i>ATTACH</i> , menu 16 and <i>ATTACH</i> , menu 17
8	Servo valve, tilt out (Y6010) or Servo valve, tilt in (Y6011) pressurizes the tilt slide in the attachment's control valve.	-	<i>Control valve attachment, description page 102</i> D8: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.16 <i>ATTACH</i> , menu 16 and <i>ATTACH</i> , menu 17
9	The control valve's tilt spool changes position and pressurizes the damping block.	-	<i>Control valve attachment, description page 102</i>
10	Control unit attachment (D791-1) activates Servo valve, tilt lock (Y6012).	Float mode: U = 24 V Lock mode: U = 0 V	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i> D10: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.15 <i>ATTACH</i> , menu 15
11	Servo valve tilt lock (Y6012) pressurizes the lock valve in the attachment's control valve.	-	<i>Lock valve tilt, description page 102</i> D10: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.15 <i>ATTACH</i> , menu 15
12	The lock valve changes position and leads oil crosswise to the tilt cylinders.	-	<i>Damping block tilt, description page 100</i>
13	The tilt cylinders change the attachment's angle.	-	<i>Tilt cylinder, description page 103</i>

Hydraulic diagram top lift, tilt lock and controllable tilt

Hydraulic diagram combi attachment

Hydraulic diagram top lift, tilt lock, controllable tilt and hydraulic leveling

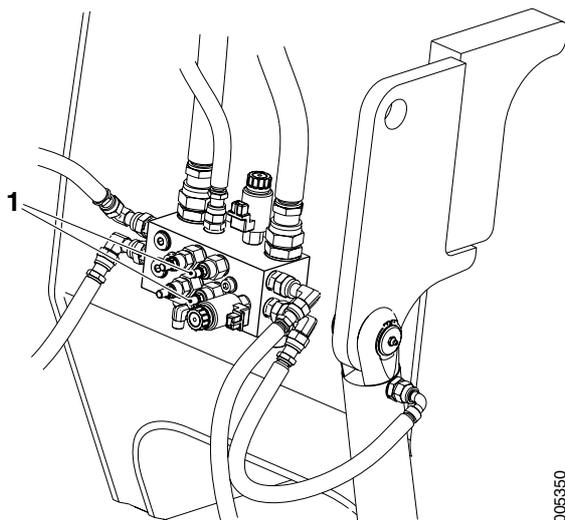
## Tilt damping, adjusting

### NOTE

Read the safety instructions for oil before working, see tab B Safety.

### NOTE

The tilt damping may have to be adjusted after run-in due to mechanical tolerances.



1. Adjusting screws

005350

- 1 Engine at idle.
- 2 Lift the boom without load and check that the attachment hangs horizontally during the whole lifting movement.
- 3 Adjust tilt damping as needed by adjusting the screws on the damping block. Adjust both screws equally.  
Clockwise: increase damping.  
Counter-clockwise: reduce damping.
- 4 Lift a loaded container, test-run and brake, check that the container does not swing uncontrollably. If needed, adjust the damping acc. to step 3.
- 5 Start the machine and check that the function is satisfactory.

## 7.7.1 Hydraulic oil pump

### Hydraulic oil pump, general

See section 10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement.

## 7.7.2 Valve block top lift hydraulics

### Valve block top lift hydraulics, description

See Valve block top lift hydraulics, description page 46.

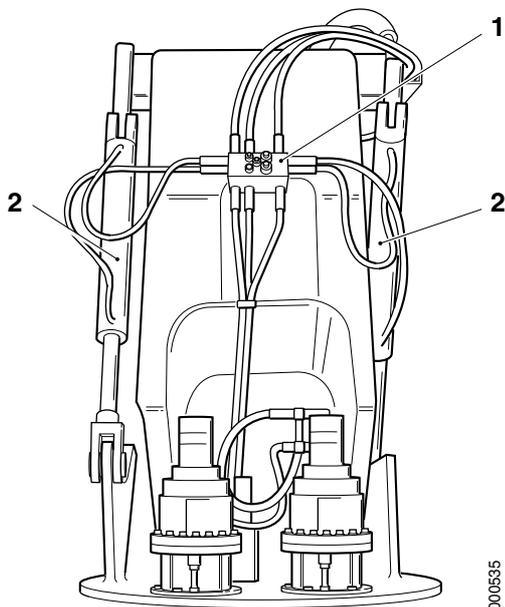
### 7.7.3 Damping block tilt

#### Damping block tilt, description

The damping block contains restrictions which create resistance to the tilt cylinder's movements which in turn dampen the attachment's oscillations. The damping block is located in the centre of the boom nose.

The damping block is supplied with oil via the return from the attachment's control valve. The feed means that the cylinders are always filled with oil. Tuned restrictions mean that the feed does not affect the tilting. The constant feed means that the tilt cylinders do not need bleeding after work on tilting.

The damping block contains two shock valves which protect the valve against surges.



1. Damping block
2. Tilt cylinder

#### Damping block tilt, replacement

##### NOTE

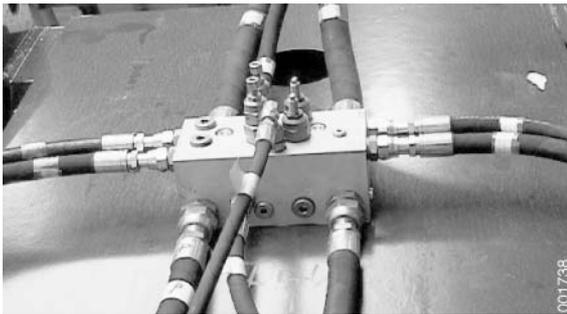
*Read the safety instructions for oil before working, see tab B Safety.*

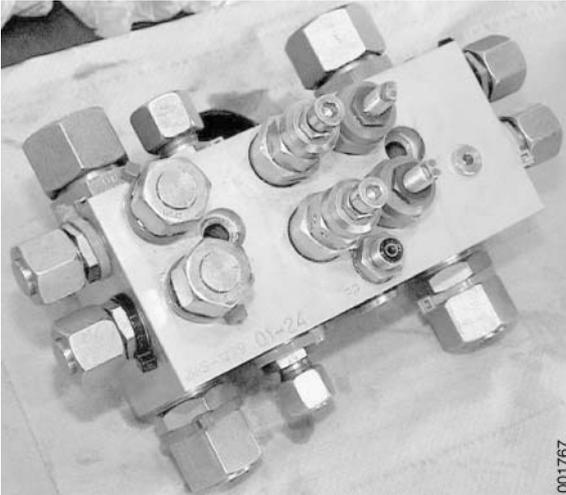
- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the brake and hydraulic systems, see tab B Safety.
- 3 Mark up and detach the hydraulic hoses from the valve block.

##### NOTE

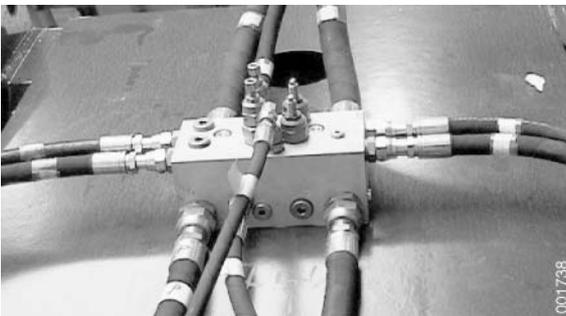
*Plug all connections immediately to protect the hydraulic system from impurities.*

- 4 Remove the valve block from the boom.





The illustration shows the damping block with controllable tilt.



- 5 Transfer the connection adapters to the new valve. Transfer one adapter at a time so that the marking is not mixed up.

### NOTE

*Check that the O-rings are intact and correctly fitted.*

- 6 Fit a new valve block to the boom nose.

- 7 Connect the hydraulic hoses to the damping block in accordance with the marking.

### NOTE

*Check that the O-rings are intact and correctly fitted.*

- 8 Start the machine and check seal integrity and function. Check both tilt and attachment functions.

- 9 Check the oil level in the hydraulic oil tank with the lift cylinders completely down and the extension cylinder completely in. The oil level should be at the top of the level glass. Top up as needed.

## CAUTION

**Overfilling of oil.**

**Leakage and environmental damage.**

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

## 7.7.4 Lock valve tilt

### Lock valve tilt, description



On machines with tilt lock, there are two solenoid valves on the damping block's return lines. When the solenoid valves are activated the connection between the cylinders is blocked and locks the tilt position. The lock valves are located on the damping block.

Solenoid valve tilt (Y6012) is supplied with voltage by Control unit attachment option (D791-2) when tilt lock is not activated.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.15 *ATTACH*, menu 15.

## 7.7.5 Control valve attachment

### Control valve attachment, description



Controllable tilt is controlled by a separate section in the attachment's control valve. For a general description of the valve and component location, see *Control valve attachment, description page 47*.

#### Tilt slide

The valve slide controls direction and speed of attachment tilting.

The valve slide is controlled by servo valve tilt in and servo valve tilt out.

#### Servo valve tilt out

Servo valve tilt out controls pressure to the tilt slide so that the tilt slide opens and pressurises the tilt cylinders.

Servo valve tilt out is controlled electrically with Solenoid valve, tilt out (Y6010) which is activated by Control unit attachment option (D791-2). The servo valve directs servo pressure to the tilt slide proportional to the control current to the solenoid valve.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.16 *ATTACH*, menu 16.

#### Servo valve tilt in

Servo valve tilt in controls pressure to the tilt slide so that the tilt slide opens and pressurises the tilt cylinders.

Servo valve tilt in is controlled electrically with Solenoid valve, tilt in (Y6011) which is activated by Control unit attachment option (D791-2). The servo valve directs servo pressure to the tilt slide proportional to the control current to the solenoid valve.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.17 *ATTACH*, menu 17.

### Control valve attachment, replacement

See *Control valve attachment, replacement page 49*.

## 7.7.6 Shuttle valve

### Shuttle valve, description

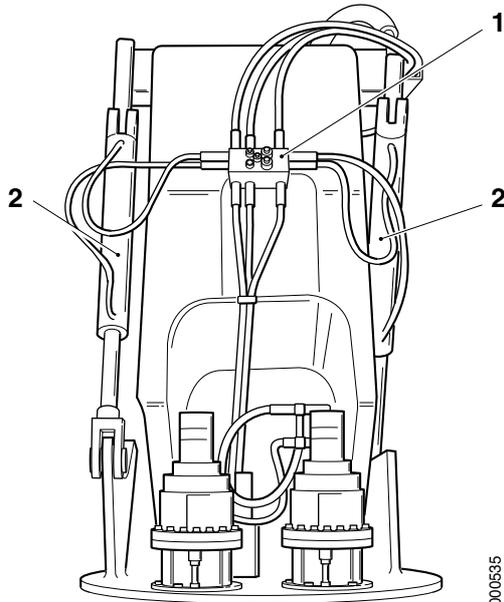
See section 10 *Common hydraulics*, group 10.5.3 *Shuttle valve*.

## 7.7.7 Tilt cylinder

### Tilt cylinder, description

The tilt cylinders are located between the inner boom's front edge and the rotation yoke's upper section. The two cylinders are positioned diagonally and can therefore effectively dampen or control tilt motion.

The piston rod bracket is welded to the piston rod, which is threaded in the piston head and locked with a lock bolt. The cylinder head is threaded in the cylinder pipe.



000535

1. Damping block
2. Tilt cylinder

### Hydraulic cylinders, repairing

See tab 10 *Common hydraulics*, group 10.7.1 *Hydraulic cylinders*.

## 7.7.8 Lift boom

### Lift boom, general

See *Lift boom*, description page 30.

## 7.7.9 Rotation yoke

### Rotation yoke, general

See *Rotation yoke*, description page 88.

## 7.7.10 Unloading valve attachment

### Relief valve attachment, description

See *Relief valve attachment*, description page 57.

## 7.7.11 Pipes and hoses

### Pipes and hoses, description

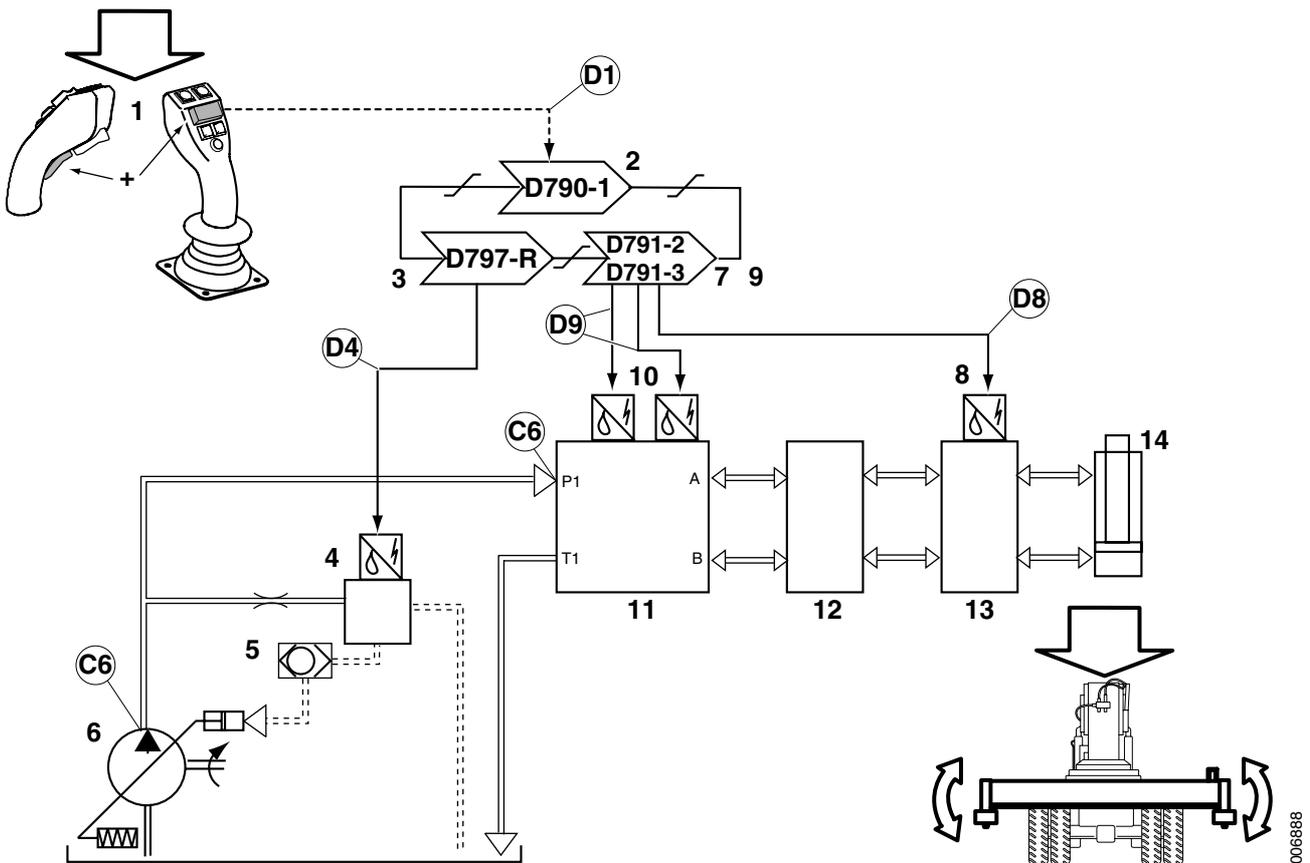
See section 10 *Common hydraulics*, group 10.5.1 *Pipes and hoses*.

## 7.8 Levelling

### Hydraulic levelling, function description



Condition	Reference value	Reference
Control switch	Disengaged	Tab 11 Common electric, group 11.5.1.4 Manoeuvre switch voltage
Overload system	Passive	Section 8 Control and monitoring system, group 8.2.1 Overload system



Pos	Explanation	Signal description	Reference
1	Control lever (S815-P3) sends voltage signal proportional to lever movement, at the same time as Control lever (S815-T4) sends voltage to Control unit cab (D790-1).	Levelling right: $U_{S815/P3} = 0.5-2.0 \text{ V}$ Zero position: $U_{S815/P3} = 2.0-3.0 \text{ V}$ Levelling left: $U_{S815/P3} = 3.0-4.5 \text{ V}$ $U_{S815/T4} = 24 \text{ V}$	Tab 9 Frame, body, cab and accessories, group 9.1 Controls and instrumentation D1: Diagnostic menu, see tab 8 Control system, group 8.4.9.1 ATTACH, menu 1
2	Control unit cab (D790-1) sends levelling left or levelling right on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 Common electric, group 11.5.3.1 Control unit cab

Pos	Explanation	Signal description	Reference
3	Control unit frame rear (D797-R) activates Solenoid valve, engagement of hydraulics for top lift (Y6003).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i> D4: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
4	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens connection between the pumps and the attachment's control valve.	-	<i>Valve block top lift hydraulics</i> , description page 46 D4: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
5	The shuttle valve sends the strongest load signal to the hydraulic oil pumps if several functions are activated simultaneously.	-	Tab 10 <i>Common hydraulics</i> , group 10.5.3 <i>Shuttle valve</i>
6	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See pressure plate on left frame beam.	Tab 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
7	Control unit attachment option (D791-2) or activates Solenoid valve levelling (Y6034).  Machine with combi attachment Control unit attachment left legs (D791-3) activates Solenoid valve levelling (Y6034).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.6 <i>Control unit attachment option</i> or tab 11 <i>Common electric</i> , group 11.5.3.7 <i>Control unit attachment left legs</i> D8: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.18 <i>ATTACH</i> , menu 18
8	Solenoid valve levelling opens connection to levelling cylinders in Valve block levelling cylinders.	-	<i>Valve block levelling cylinders</i> , description page 110
9	Control unit attachment option (D791-2) or Control unit attachment left legs (D791-3) activates Servo valve levelling right (Y6035) or Servo valve levelling left (Y6036).	I = 400–650 mA	Tab 11 <i>Common electric</i> , group 11.5.3.6 <i>Control unit attachment option</i> or tab 11 <i>Common electric</i> , group 11.5.3.7 <i>Control unit attachment left legs</i> D9: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.19 <i>ATTACH</i> , menu 19 and <i>ATTACH</i> , menu 20
10	Servo valve levelling right (Y6035) or Servo valve levelling left (Y6036) act on the levelling slide in control valve attachment.	-	<i>Control valve attachment</i> , description page 108 D9: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.19 <i>ATTACH</i> , menu 19 and <i>ATTACH</i> , menu 20
11	The control valve's levelling spool changes position and pressurizes the over-centre valve levelling.	-	<i>Control valve attachment</i> , description page 108
12	The over-centre valve opens and leads the pressure to valve block levelling cylinders.	-	<i>Over-centre valve leveling</i> , description page 109
13	Valve block levelling cylinders leads the pressure on to levelling cylinders.	-	<i>Valve block levelling cylinders</i> , description page 110



Pos	Explanation	Signal description	Reference
2	Control unit cab (D790-1) sends levelling lock on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
3	Control unit frame rear (D797-R) activates Solenoid valve, engagement of hydraulics for top lift (Y6003).	U = 24 V	<i>Valve block top lift hydraulics, description page 46</i> D4: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
4	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens connection between the pumps and the attachment's control valve.	-	<i>Valve block top lift hydraulics, description page 46</i> D4: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
5	The shuttle valve sends the strongest load signal to the hydraulic oil pumps if several functions are activated simultaneously.	-	Tab 10 <i>Common hydraulics</i> , group 10.5.3 <i>Shuttle valve</i>
6	The hydraulic oil pumps pump oil from the hydraulic oil tank.	See pressure plate on left frame beam.	Tab 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
7	Control unit attachment option (D791-2) cuts off activation Solenoid valve levelling (Y6034).   Machine with combi attachment. Control unit attachment left legs (D791-3) cuts off activation Solenoid valve levelling (Y6034).	U = 0 V	<i>Valve block levelling cylinders, description page 110</i> D8: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.18 <i>ATTACH</i> , menu 18
8	Solenoid valve levelling (Y6034) blocks connections to levelling cylinders in valve block levelling cylinders.	-	<i>Valve block levelling cylinders, description page 110</i> D8: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.9.18 <i>ATTACH</i> , menu 18
9	The levelling cylinders change the attachment's angle.	-	<i>Levelling cylinders, description page 110</i>
10	When tilt lock is activated, event menu shows tilt lock.  When levelling lock is activated the machine's speed is limited to max. 5 km/h.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>

Hydraulic diagram combi attachment

Hydraulic diagram top lift, tilt lock, controllable tilt and hydraulic levelling

## 7.8.1 Hydraulic oil pump

### Hydraulic oil pump, general

See section 10 *Common hydraulics*, group 10.4.2 *Axial piston pump with variable displacement*.

## 7.8.2 Valve block top lift hydraulics

### Valve block top lift hydraulics, description

See *Valve block top lift hydraulics, description page 46*.

## 7.8.3 Control valve attachment

### Control valve attachment, description

Hydraulic levelling is controlled by a separate section in the control valve attachment. For a general description of the valve and component location, see *Control valve attachment, description page 47*.

#### Levelling slide

The valve slide controls direction and speed of attachment levelling.

The valve slide is controlled by servo valve levelling right (Y6035) and servo valve levelling left (Y6034).

#### Servo valve levelling right

Servo levelling right controls pressure to the levelling slide so that it opens and pressurises the levelling cylinders.

Servo valve levelling right is controlled electrically with Solenoid valve, levelling right (Y6035) which is activated by Control unit attachment option (D791-2). The servo valve directs servo pressure to the tilt slide proportional to the control current to the solenoid valve.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.19 *ATTACH, menu 19*.

#### Servo valve levelling left

Servo levelling left controls pressure to the levelling slide so that it opens and pressurises the levelling cylinders.

Servo valve levelling left is controlled electrically with Solenoid valve levelling left (Y6036) which is activated by Control unit, attachment (D791-2). The servo valve directs servo pressure to the tilt slide proportional to the control current to the solenoid valve.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.20 *ATTACH, menu 20*.

#### Passive levelling

The servo valves open a connection to the tank, in addition, hydraulic oil can flow between right and left-hand side levelling cylinders, from piston sides to rod sides, in accordance with inclination.

### Active levelling

Levelling is monitored by the sequence valves in valve block levelling cylinder, which close when the feed pressure is high enough to set all cylinders in bottom position. Following which, hydraulic oil is fed to the rod sides on one side's cylinders and the side lifts. When levelling, the other side will thus always be in its lowest position. This always gives maximal levelling travel.

### Control valve attachment, replacement

See *Control valve attachment, replacement* page 49.

## 7.8.4 Shuttle valve

### Shuttle valve, description

See section 10 *Common hydraulics*, group 10.5.3 *Shuttle valve*.

## 7.8.5 Over-centre valve levelling

### Over-centre valve levelling, description

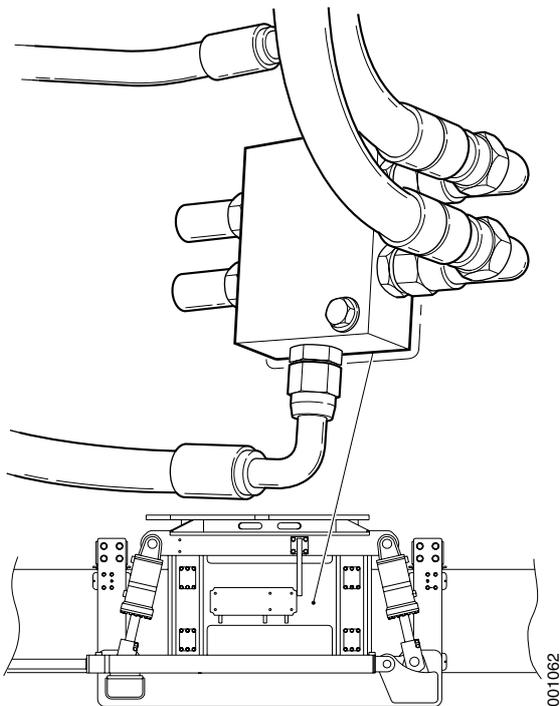
The over-centre valve makes sure that the leveling cylinders are run out completely. The valve is located to the right of the attachment control valve on the sideshift frame's trailing edge under Valve block levelling cylinders.

### Passive levelling

The over-centre valves allow flow of hydraulic oil between right and left leveling cylinders, from piston sides to rod sides, all according to angle.

### Active levelling

The over-centre valves close when the feed pressure is high enough to put all leveling cylinders in bottom position. Then, hydraulic oil is supplied through the leveling cylinder valve block to the rod sides on one side's (right or left) cylinders and the side lifts. When leveling, the other side will thus always be in its lowest position. This always gives maximal leveling travel.



## 7.8.6 Valve block levelling cylinders

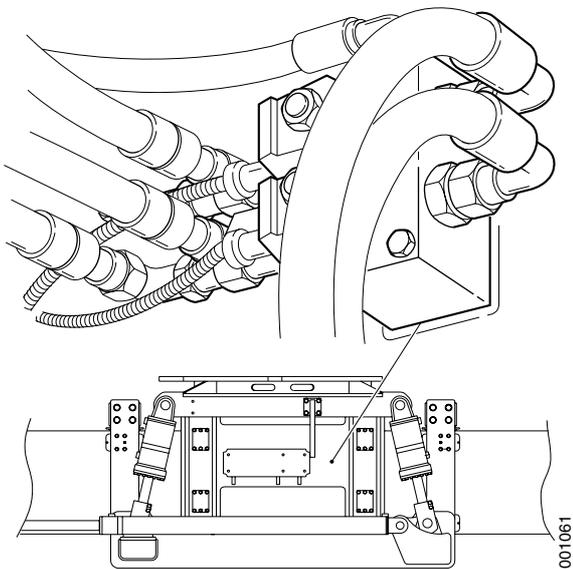
### Valve block levelling cylinders, description

The valve block for levelling cylinders leads pressure from the attachment control valve to the levelling cylinders. The valve block contains lock valves that block levelling when levelling lock is activated or if the machine loses electrical power. The valve is located to the right of the attachment control valve on the sideshift frame's trailing edge above the over-centre valve levelling.

### Lock valve

The lock valve is opened by Solenoid valve levelling (Y6034). When the lock valve is closed the oil is blocked to and from the levelling cylinders, and levelling is blocked. Solenoid valve levelling (Y6034) is supplied with voltage by Control unit attachment option (D791-2) or Control unit attachment right leg pair (D791-4).

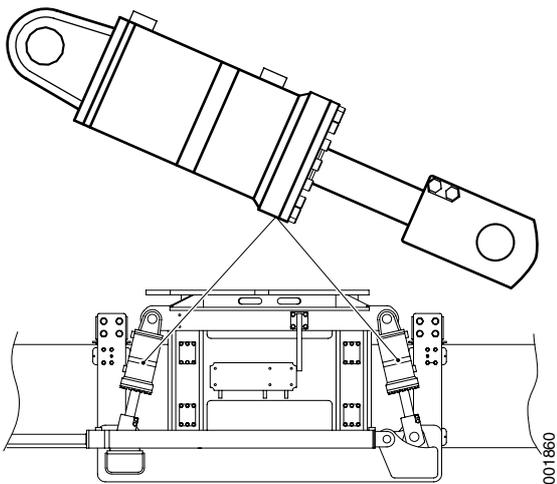
The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.18 *ATTACH*, menu 18.



## 7.8.7 Levelling cylinders

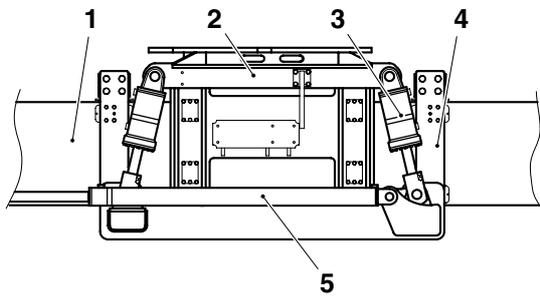
### Levelling cylinders, description

On machines with hydraulic levelling there are four hydraulic cylinders between the sideshift frame's parts, see *Sideshift frame, description* page 111.



### Hydraulic cylinders, repairing

See tab 10 *Common hydraulics*, group 10.7.1 *Hydraulic cylinders*.



001832

1. Main beam attachment
2. Sideshift frame upper section
3. Levelling cylinder
4. Sideshift frame lower section
5. Sideshift cylinder

## 7.8.8 Sideshift frame

### Sideshift frame, description

The sideshift frame is available in two different versions, see *Sideshift frame, description page 53*.

### Mechanical levelling

The sideshift frame is larger than the attachment's main beam. The main beam can move freely between the slide plates. This allows approx. 5° levelling.

### Hydraulic levelling

The sideshift frame is split in two. There are four levelling cylinders between the two sections, see *Levelling cylinders, description page 110*. The outer section is secured in the rotation yoke via the ring gear. The inner part holds the attachment's main beam. The main beam slides on slide plates. The hydraulic cylinders' stroke makes levelling of the main beam possible, approx. 5°. With hydraulically controlled levelling, the angle of the main beam attachment can be controlled with the control lever.

## 7.8.9 Unloading valve attachment

### Relief valve attachment, description

See *Relief valve attachment, description page 57*.

## 7.8.10 Pipes and hoses

### Pipes and hoses, description

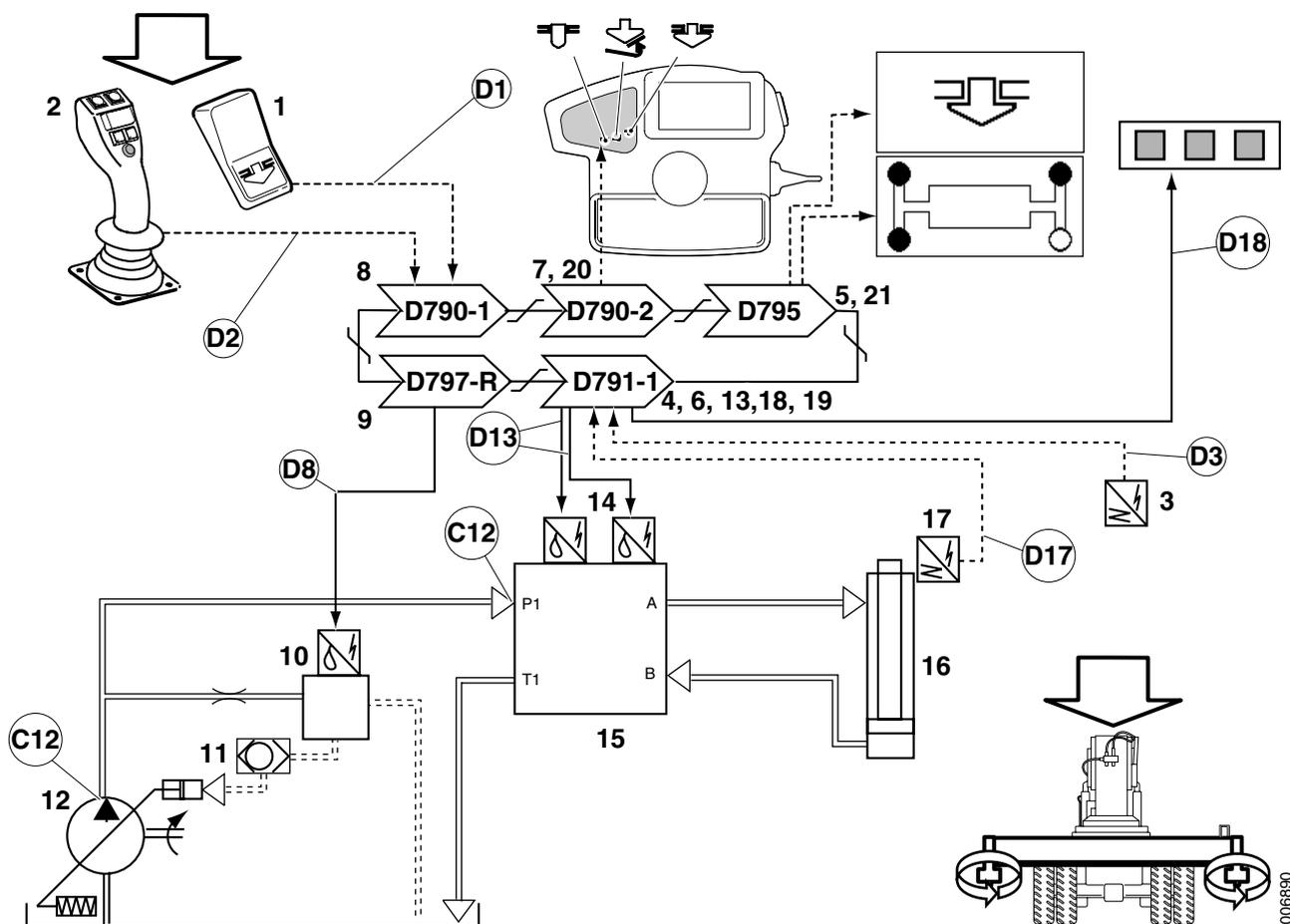
See section 10 *Common hydraulics*, group 10.5.1 *Pipes and hoses*.

## 7.9 Load carrying

### 7.9.1 Twistlocks

#### Twistlocks, function description

Condition	Reference value	Reference
Control switch	Disengaged	Tab 11 Common electric, group 11.5.1.4 Manoeuvre switch voltage
Alignment	Full alignment or by-pass activated	Tab 9 Frame, body, cab and accessories, group 9.1 Controls and instrumentation Tab 8 Control system, group 8.2.2 By-passing
Overload system	Passive	Section 8 Control and monitoring system, group 8.2.1 Overload system



Pos	Explanation	Signal description	Reference
1	Switch lock twistlocks (S1003) (automatic position) sends voltage signal to Control unit cab (D790-1).	U = 24 V	Tab 9 Frame, body, cab and accessories, group 9.1 Controls and instrumentation D1: Diagnostic menu, see section 8 Control and monitoring system, group 8.4.9.3 ATTACH, menu 3

Pos	Explanation	Signal description	Reference
2	Control lever (S815-T2) sends voltage signal to Control unit cab (D790-1) to open twistlocks.  If Switch, lock twistlocks (S1003) is in manual position no signal is needed from control lever to open twistlock.	$U_{S815/T2} = 24 \text{ V}$	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i>  D2: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.9.3 <i>ATTACH</i> , menu 3
3	Sensor alignment left front (7202L), Sensor alignment right front (7202R), Sensor alignment left rear (Y7203L) and Sensor alignment right rear (Y7203R) send voltage signals to Control unit attachment Control unit attachment (D791).	Sensor directly opposite indicator plate: $U = 24 \text{ V}$	<i>Sensor alignment, description page 120</i>  D3: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.9.6 <i>ATTACH</i> , menu 6
4	Control unit attachment (D791) sends alignment on the CAN bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i>
5	Control unit KID (D795) activates event menu alignment.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>
6	Control unit attachment (D791) activates the indicator light for alignment on the boom's light panel.	$U = 24 \text{ V}$	D18: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.9.10 <i>ATTACH</i> , menu 10
7	Control unit KIT (D790-2) activates the indicator light for alignment on the cab's light panel.	-	Tab 11 <i>Common electric</i> , group 11.5.3.11 <i>Control unit KIT</i>
8	Control unit cab (D790-1) sends open twistlocks or lock twistlocks on the CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
9	Control unit frame rear (D797-R) activates Solenoid valve, engagement of hydraulics for top lift (Y6003).	$U = 24 \text{ V}$	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i>  D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
10	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens and pressurizes valve block lift cylinder and sends load signal to hydraulic oil pump 2.	-	<i>Valve block top lift hydraulics, description page 46</i>  D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
11	The shuttle valve sends the strongest load signal to the hydraulic oil pumps if several functions are activated simultaneously.	-	Tab 10 <i>Common hydraulics</i> , group 10.5.3 <i>Shuttle valve</i>
12	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See pressure plate on left frame beam.	Tab 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>

Pos	Explanation	Signal description	Reference
13	Control unit attachment (D791) activates Servo valve open twistlocks (Y6039) or Servo valve lock twistlocks (Y6040).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i> D12: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.9.9 <i>ATTACH</i> , menu 9
14	Servo valve open twistlocks (Y6039) or Servo valve lock twistlocks (Y6040) pressurizes the twistlock slide with servo pressure.	-	<i>Control valve attachment, description page 117</i> D12: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.9.9 <i>ATTACH</i> , menu 9
15	The control valve's twistlock spool changes position and pressurizes the lock cylinders.	-	<i>Control valve attachment, description page 117</i>
16	The lock cylinders rotate the twistlocks.	-	<i>Lock cylinder, description page 118</i>
17	Sensor unlocked twistlocks (B7204) or Sensor locked twistlocks (B7205) sends signal to Control unit attachment (D791).	Sensor directly opposite indicator plate: U = 24 V	<i>Sensor twistlocks, description page 121</i> D16: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.9.7 <i>ATTACH</i> , menu 7
18	Control unit attachment (D791) supplies voltage to Indicator light unlocked twistlocks (H562) or Indicator light locked twistlocks (H563) on the boom's light panel.	U = 24 V	D18: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.9.10 <i>ATTACH</i> , menu 10
19	Control unit attachment (D791) sends information about twistlocks unlocked or twistlocks locked on the CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i>
20	Control unit KIT (D790-2) supplies voltage to Indicator light unlocked twistlocks or Indicator light locked twistlocks on the cab's light panel.	-	Tab 11 <i>Common electric</i> , group 11.5.3.11 <i>Control unit KIT</i>
21	Control unit KID (D795) activates event menu twistlocks.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>

Hydraulic diagram top lift

Hydraulic diagram top lift, tilt lock and controllable tilt

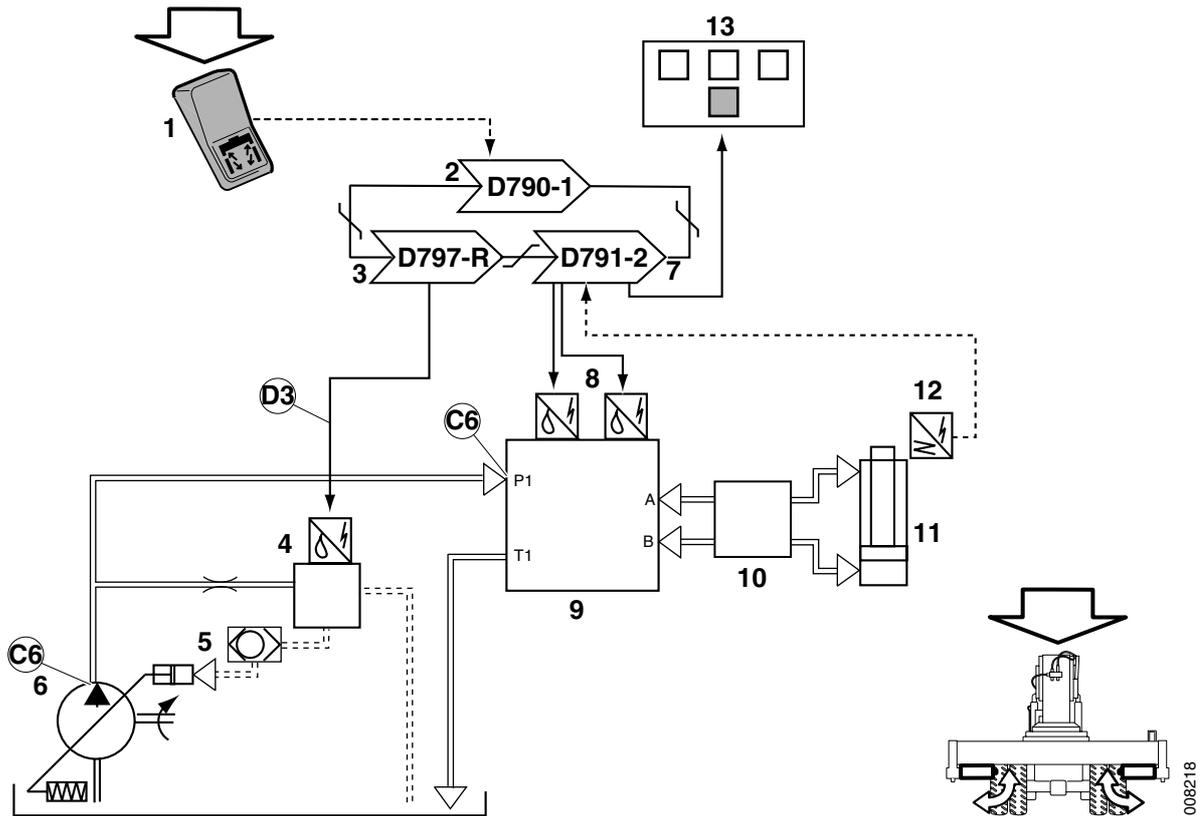
Hydraulic diagram combi attachment

Hydraulic diagram top lift, tilt lock, controllable tilt and hydraulic leveling

**Overheight-legs, function description**



Condition	Reference value	Reference
Control switch	Not activated	Tab 11 Common electric, group 11.5.1.4 Manoeuvre switch voltage
Overload system	Passive	Tab 8 Control system, group 8.2.1.1 Mechanical overloading system
Twistlocks	Open	Twistlocks, function description page 112



Pos	Explanation	Signal description	Reference
1.	Switch overheight legs (S1031) sends voltage signal to Control unit cab (D790-1).	U = 24 V	Tab 9 Frame, body, cab and accessories, group 9.1 Controls and instrumentation
2.	Control unit cab (D790-1) sends message lower Overheight-legs on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 Common electric, group 11.5.3.1 Control unit cab
3.	Control unit frame rear (D797-R) activates Solenoid valve, engagement of hydraulics for top lift (Y6003).	U = 24 V	Valve block top lift hydraulics, description page 46 D3: Diagnostic menu, see tab 8 Control system, group 8.4.5.6 HYD, menu 6

Pos	Explanation	Signal description	Reference
4.	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens and pressurizes valve block top lift hydraulics and sends load signal to hydraulic oil pump 2.	-	<i>Valve block top lift hydraulics, description page 46</i>
5.	The shuttle valve and sends the strongest load signal to hydraulic oil pump 2 if several functions are activated simultaneously.	-	<i>Tab 10 Common hydraulics, group 10.5.3 Shuttle valve</i>
6.	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See pressure plate on left frame beam.	<i>Tab 10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement</i>
7.	Control unit attachment option (D791-2) activates Servo valve overheight-legs up (Y6070) or Servo valve overheight-legs down (Y6071).	U = 24 V	<i>Control valve attachment, description page 117</i>
8.	Servo valve overheight-legs up (Y6070) or Servo valve overheight-legs down (Y6071) pressurizes over-centre valve overheight-legs.	U = 24 V	<i>Control valve attachment, description page 117</i>
9.	Over-centre valve opens and pressurizes hydraulic cylinder overheight-legs.	-	<i>Over-centre valve (product alternative Overheight-legs) page 122</i>
10.	Hydraulic cylinder overheight-legs lowers the overheight legs.	-	<i>Hydraulic cylinder overheight-legs page 122</i>
11.	Sensor overheight-legs up left (B7231-L) or Sensor overheight-legs up right (B7231-R) sends voltage signal to Control unit attachment option (D791-2).	Sensor right in front of indicator plate: U = 24 V	<i>Sensor overheight-legs page 123</i>
12.	Control unit attachment option (D791-2) activates Indicator light overheight-legs up (H5001).	Overheight-legs up: U = 24 V Overheight-legs down: U = 0 V	<i>Tab 11 Common electric, group 11.5.3.6 Control unit attachment option</i>
13.	Indicator light overheight-legs up (H5001) is on when the legs are completely raised.	Overheight-legs up: U = 24 V Overheight-legs down: U = 0 V	<i>Tab 9 Frame, body, cab and accessories, group 9.1 Controls and instrumentation</i>

### 7.9.1.1 Hydraulic oil pump

#### Hydraulic oil pump, general

See section 10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement.

### 7.9.1.2 Valve block top lift hydraulics

#### Valve block top lift hydraulics, description

See *Valve block top lift hydraulics, description page 46*.

### 7.9.1.3 Control valve attachment

#### Control valve attachment, description

Twistlocks are controlled by a separate section in the attachment's control valve. For a general description of the valve and component location, see *Control valve attachment, description page 47*.

#### Twistlocks slide, description

The valve slide controls direction and the lock cylinder.

The valve slide is controlled by two servo valves, lock twistlocks and open twistlocks.

#### Servo valve lock twistlocks, description

Servo valve lock twistlocks controls pressure to the twistlocks slide so that the twistlocks slide opens and pressurises the lock cylinders.

Servo valve lock twistlocks is controlled electrically with Solenoid valve lock twistlocks (Y6040) which is activated by Control unit, attachment (D791-1). The servo valve directs servo pressure to the twistlocks slide proportional to the control current to the solenoid valve.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.9 *ATTACH*, menu 9.

#### Servo valve open twistlocks, description

Servo valve open twistlocks controls pressure to the twistlocks slide so that the twistlocks slide opens and pressurises the lock cylinders.

Servo valve open twistlocks is controlled electrically with Solenoid valve open twistlocks (Y6041) which is activated by Control unit, attachment (D791-1). The servo valve directs servo pressure to the twistlocks slide proportional to the control current to the solenoid valve.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.9 *ATTACH*, menu 9.

#### Control valve attachment, replacement

See *Control valve attachment, replacement page 49*.

### 7.9.1.4 Shuttle valve

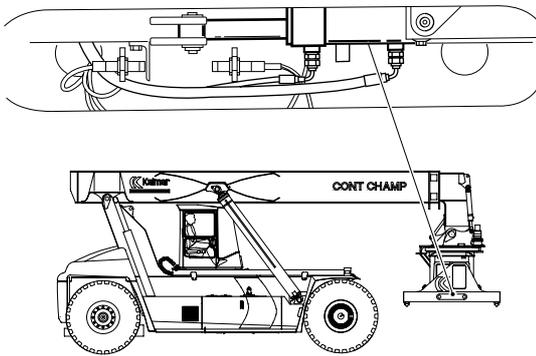
#### Shuttle valve, description

See section 10 *Common hydraulics*, group 10.5.3 *Shuttle valve*.

### 7.9.1.5 Lock cylinder

#### Lock cylinder, description

The lock cylinder turns the lock mechanism to rotate twistlocks. Two lock cylinders, one in the right-hand and one in the left-hand spreader beam turn the lock mechanism. The lock cylinders are located in the centre of the spreader beam's longitudinal section.



#### Hydraulic cylinders, repairing

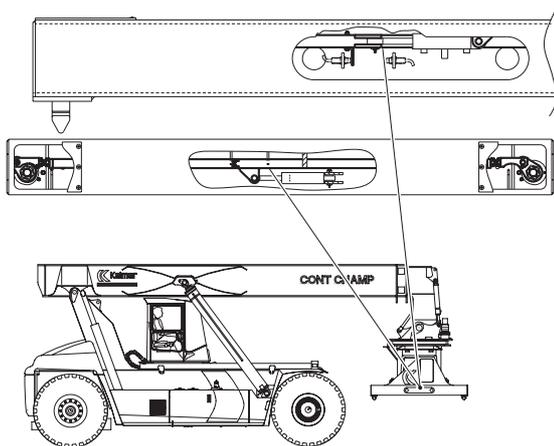
See tab 10 *Common hydraulics*, group 10.7.1 *Hydraulic cylinders*.

### 7.9.1.6 Lock mechanism

#### Lock mechanism, description

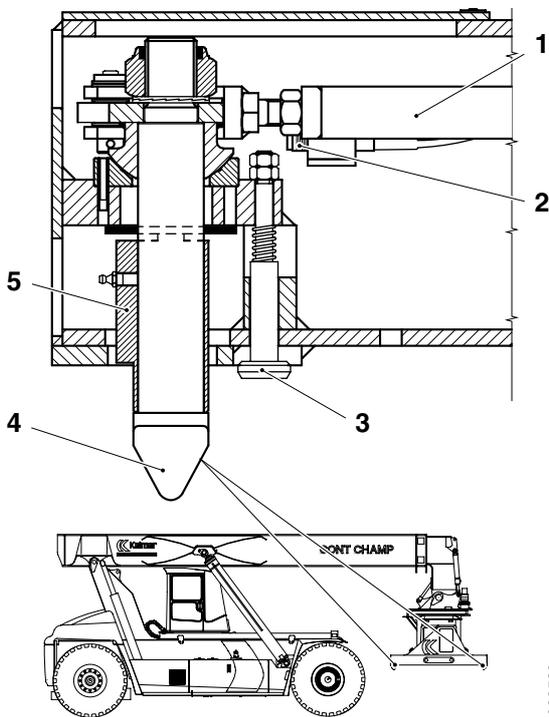
The lock mechanism transfers the lock cylinders' output to the twistlocks. Two lock mechanisms, one in the right-hand and one in the left-hand spreader beam act on the twistlocks. The lock mechanism runs in the spreader beam's longitudinal section between the twistlocks.

The lock mechanism consists of a rod with linkages in the end. The rod is secured in the levers which turn the twistlocks. There is an attaching lug for the lock cylinder in the centre of the rod.



### 7.9.1.7 Twistlocks

#### Twistlocks, description



1. Lock mechanism
2. Sensor alignment
3. Alignment pin
4. Lift pin
5. Lock guide

## WARNING

**Dropped load.**

**Fatal danger!**

**Twistlocks hold the load during load handling and therefore it is very important that twistlocks are checked according to instructions and are replaced at the slightest sign of damage or wear.**

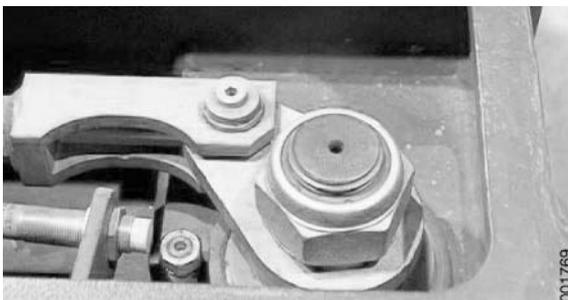
Twistlocks secure the load and are located in the corners of the spreader beam's longitudinal part.

Twistlocks are manufactured according to international standards in high-strength steel. The lift pins are marked with serial numbers.

Twistlocks are connected in pairs via a link system to a hydraulic cylinder which in turn is controlled via a section in the attachment's control valve. Inductive sensors send signals when twistlocks are locked and unlocked, respectively.

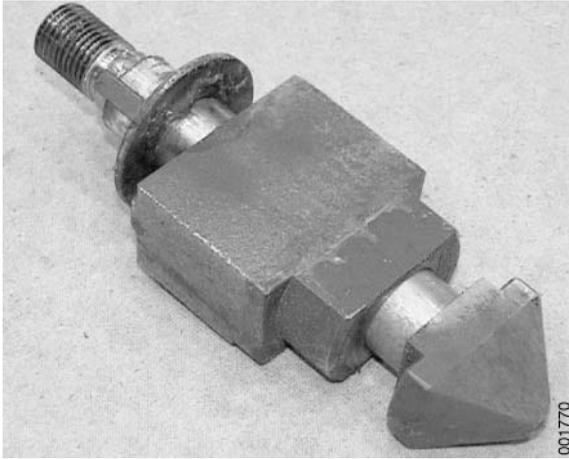
#### Twistlock, replacement

- 1 Machine in service position, see tab *B Safety*.
- 2 Depressurize the brake and hydraulic systems, see tab *B Safety*.
- 3 Clean the twistlocks and the surrounding area.
- 4 Undo the centre nut for the twistlocks.
- 5 Tap the nut so that the lift pin releases from the wedge.
- 6 Hold the lift pin while the centre nut is removed.



## WARNING

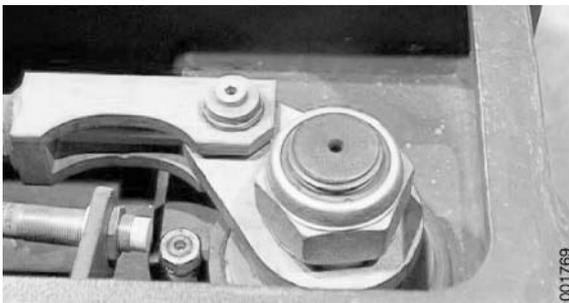
**Twistlocks are heavy. Risk of crushing, product damage.**



- 7 Remove the centre nut and lift away the twistlock.
- 8 Place a new lift pin in the guide pin. Grease the lift pin with Lubricating grease.
- 9 Place the lift pin in the guide pin in the extension beam. Place the guide pin so that the grease cup is accessible through the holes in the extension beam.

## NOTE

*Do not forget the washer between the extension beam and the guide pin.*



- 10 Fit the wedge, bearings, lever, **new lock washers** and **new lock nuts** on the lock pin.  
Brush on Lubricating grease on the parts before installing.
- 11 Check the positions of the parts and that the twistlock can move.
- 12 Tighten the lock nuts with torque, **300 Nm**.
- 13 Grease the guide pin, lever, and bearing with Lubricating grease.
- 14 Check that the twistlock mechanism can move.
- 15 Turn on the main electric power and start the machine.
- 16 Check that the twistlock is working.

## 7.9.1.8 Sensor alignment

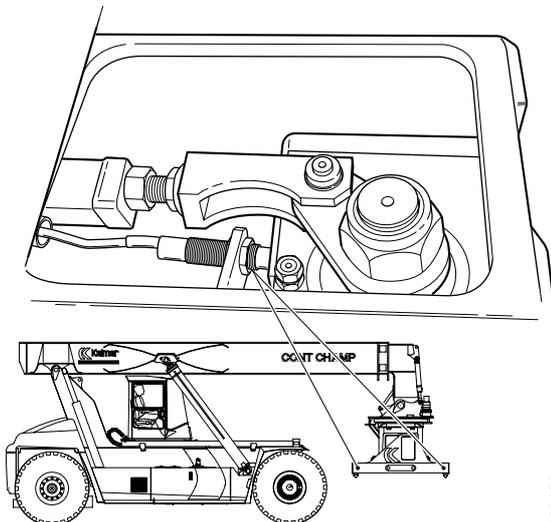
### Sensor alignment, description

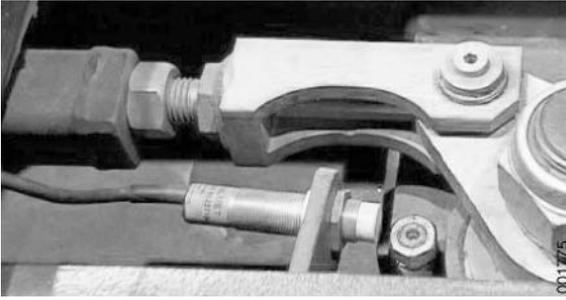
The sensor for alignment senses when the attachment has contact with the container. Four inductive position sensors, one at each twistlock located in the corners of the spreader beam's longitudinal section, are used to indicate alignment.

The sensor senses the position of a spring pin which is pressed in when the attachment has contact up against the container. The sensor is located over the pin. The position of the sensor can be adjusted so that it gives a signal when the pin is pressed in and the head is level with the spreader beam's lower edge. The clearance between the attachment and the container's corner boxes results in the sensors stop sending signals when the attachment is lifted.

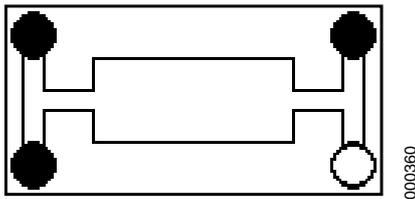
The sensors are supplied with voltage and send a 24 V signal to Control unit attachment (D791) when the indicator pin is pressed in.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.6 *ATTACH*, menu 6.





The illustration shows older versions of sensor mounting.



Event menu alignment

### Sensor alignment, checking

- 1 Machine in service position, see tab *B Safety*.
- 2 Check that the indicator pins in the corner boxes can move up and down freely. The indicator pins must spring down when they are not loaded.
- 3 Check that the sensor is free of damage and dirt.
- 4 Start the machine.
- 5 Lower the attachment onto a container and check that all twistlocks indicate alignment, filled circles in event menu alignment, and that the indicator lamp alignment comes on.
- 6 Lift the attachment slightly so that the alignment just disappears (unfilled circles in event menu alignment or indicator lamp alignment goes out).
- 7 Check how large a movement on the indicator pins is required to detect alignment. The movement must be 3–4 mm.
- 8 If necessary, adjust the position of the sensor, see *Position sensor, checking and adjustment page 5*.

### Position sensor, checking and adjustment

See *Position sensor, checking and adjustment page 5*.

## 7.9.1.9 Sensor twistlocks

### Sensor twistlocks, description

The twistlocks sensors sense when twistlocks are locked and unlocked, respectively. Four inductive position sensors, two in each spreader beam, sense the position of the lock mechanism. The sensors are located by the lock cylinder in the middle of the spreader beam's longitudinal section.

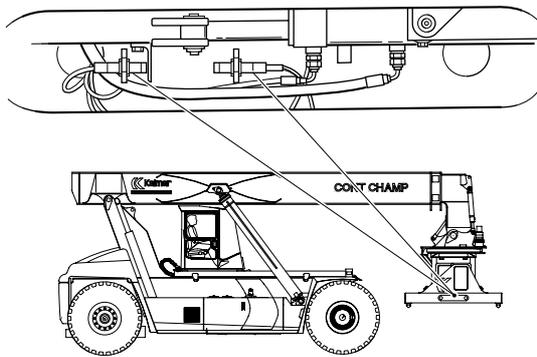
Both sides function in the same way independent of each other. On the lock mechanism by the lock cylinder there is an indicator plate. When the lock mechanism is in position for the twistlocks to be locked one of the sensors sends a signal to Control unit, attachment Control unit attachment (D791). When the lock mechanism is in position for the twistlocks to be unlocked the other sensor sends a signal to Control unit, attachment Control unit attachment (D791). If the lock mechanism remains in intermediate position then no signals are sent.

The sensors are supplied with voltage and send a 24 V signal to Control unit attachment (D791) when the indicator plate is in front of the sensor.

The signal can be checked from the diagnostic menu, see section *8 Control and monitoring system, group 8.4.9.7 ATTACH, menu 7*.

### Position sensor, checking and adjustment

See *Position sensor, checking and adjustment page 5*.



001452

### 7.9.1.10 Unloading valve attachment

#### Relief valve attachment, description

See *Relief valve attachment, description page 57.*

### 7.9.1.11 Pipes and hoses

#### Pipes and hoses, description

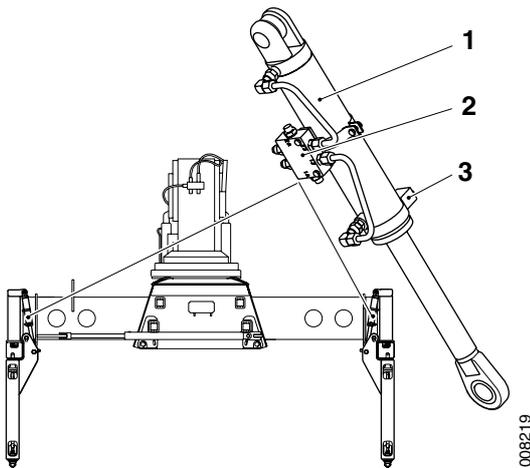
See section *10 Common hydraulics, group 10.5.1 Pipes and hoses.*

### 7.9.1.12 Overcentervalue

#### Over-centre valve (product alternative Overheight-legs)



The over-centre valve prevents the overheight-legs from lowering by their dead weight.



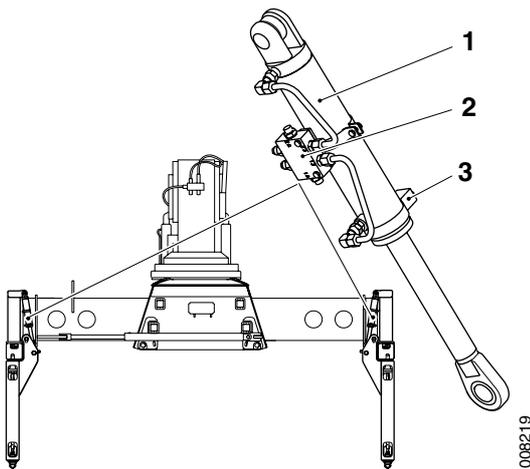
1. Hydraulic cylinder overheight-legs
2. Over-centre valve overheight-legs
3. Sensor overheight-legs up (B7231-L and B7231-R)

### 7.9.1.13 Hydraulic cylinder overheight legs

#### Hydraulic cylinder overheight-legs



The hydraulic cylinder lowers the overheight-legs. The hydraulic cylinder is controlled by a separate section in control valve attachment, see *Control valve attachment, description page 64.*



1. Hydraulic cylinder overheight-legs
2. Over-centre valve overheight-legs
3. Sensor overheight-legs up (B7231-L and B7231-R)

#### Hydraulic cylinders, repairing

See tab *10 Common hydraulics, group 10.7.1 Hydraulic cylinders.*

### 7.9.1.14 Sensor overheight legs

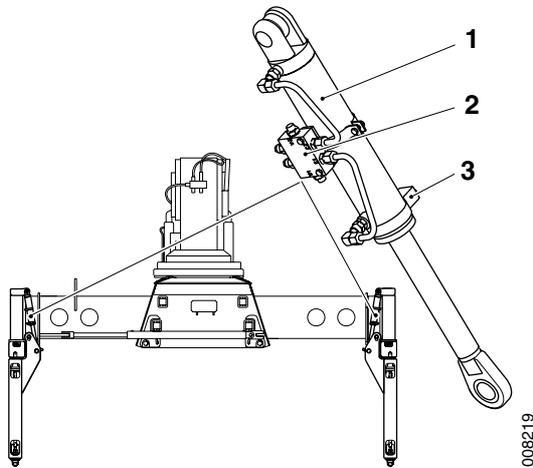
#### Sensor overheight-legs



Sensor overheight-legs up senses when the legs are completely raised.

Sensor overheight-legs up left (B7231-L) senses the position of the left leg pair and sends voltage signal to Control unit attachment option (D791-2) when the leg pair is completely raised.

Sensor overheight-legs up right (B7231-R) senses the position of the right leg pair and sends voltage signal to Control unit attachment option (D791-2) when the leg pair is completely raised.



1. Hydraulic cylinder overheight-legs
2. Over-centre valve overheight-legs
3. Sensor overheight-legs up (B7231-L and B7231-R)

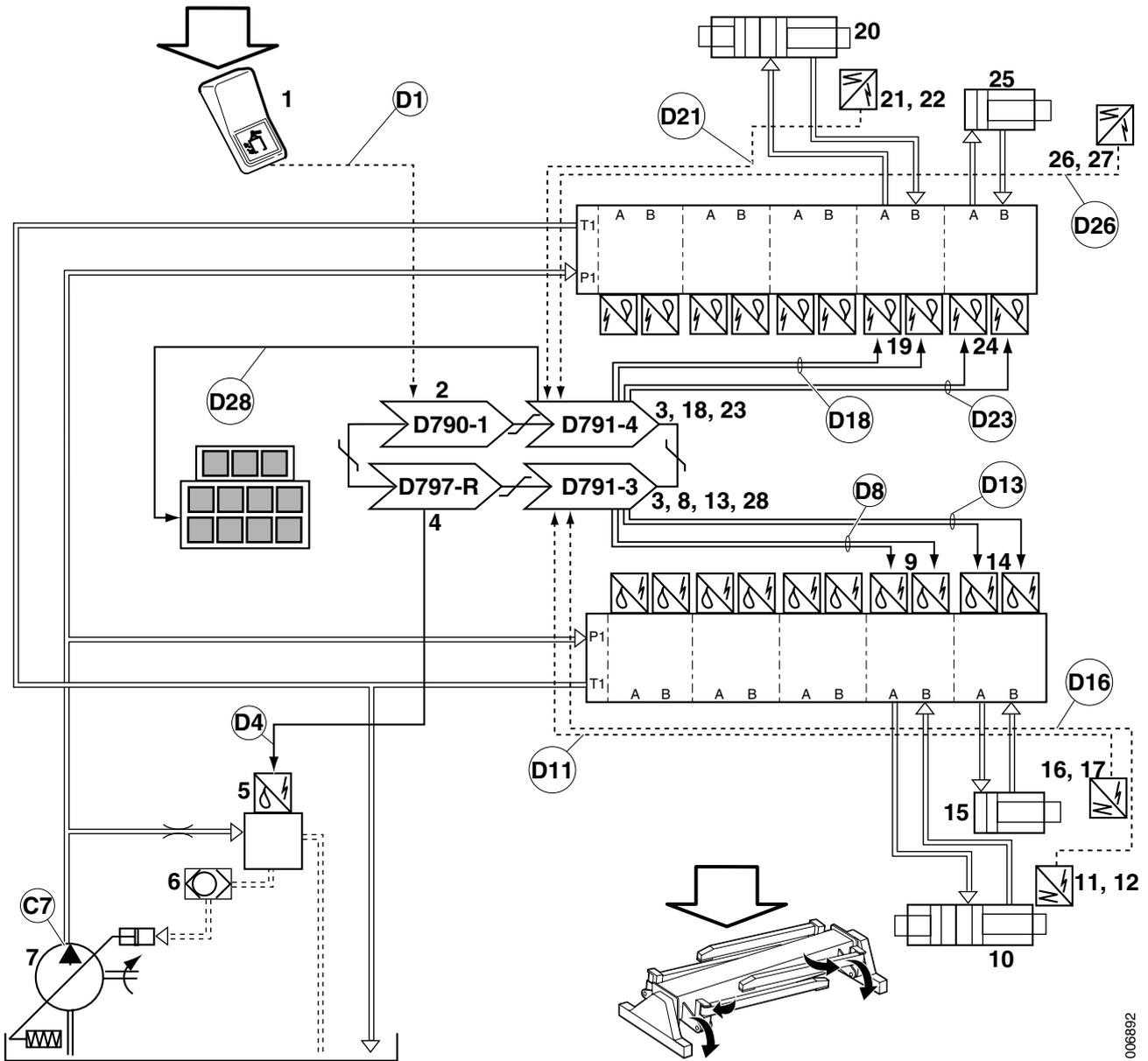
#### Position sensor, checking and adjustment

See *Position sensor, checking and adjustment* page 5.

### 7.9.2 Lift legs

#### Raising/lowering of front lift legs, function description

Condition	Reference value	Reference
Control switch	Disengaged	Tab 11 Common electric, group 11.5.1.4 Manoeuvre switch voltage



006892

Pos	Explanation	Signal description	Reference
1	Switch lowering front legs (S1006) sends a voltage signal to Control unit cab (D790-1).	U = 24 V	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i> D1: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 1
2	Control unit cab (D790-1) sends front lift legs down or up on the CAN bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
3	Control unit attachment left legs (D791-3) and Control unit attachment right leg pair (D791-4) send activate top hydraulics on the CAN bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.7 <i>Control unit attachment left legs</i> and tab 11 <i>Common electric</i> , group 11.5.3.8 <i>Control unit attachment right legs</i>
4	Control unit frame rear (D797-R) activates Solenoid valve, engagement of hydraulics for top lift (Y6003).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i> D4: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
5	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens and pressurizes valve block lift cylinder and sends load signal to hydraulic oil pump 2.	-	<i>Valve block top lift hydraulics</i> , description page 46 D4: Diagnostic menu, see tab 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
6	The shuttle valve sends the strongest load signal to the hydraulic oil pumps if several functions are activated simultaneously.	-	Tab 10 <i>Common hydraulics</i> , group 10.5.3 <i>Shuttle valve</i>
7	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See pressure plate on left frame beam.	Tab 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
8	Control unit attachment left legs (D791-3) activates Solenoid valve front knee out left (Y6056L).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.7 <i>Control unit attachment left legs</i> D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 10
9	Solenoid valve front knee out left (Y6056L) pressurizes Hydraulic cylinder knee left front.	-	<i>Control valve lift legs</i> , description page 141 D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 10
10	Hydraulic cylinder knee left front lowers Knee left front.	-	<i>Hydraulic cylinder knee/clamp</i> , description page 146
11	Sensor front knee left (B7217L) sends voltage signal to Control unit attachment left legs (D791-3) when the knee is actuated.	U = 24 V	<i>Sensor knee</i> , description page 147 D11: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 4

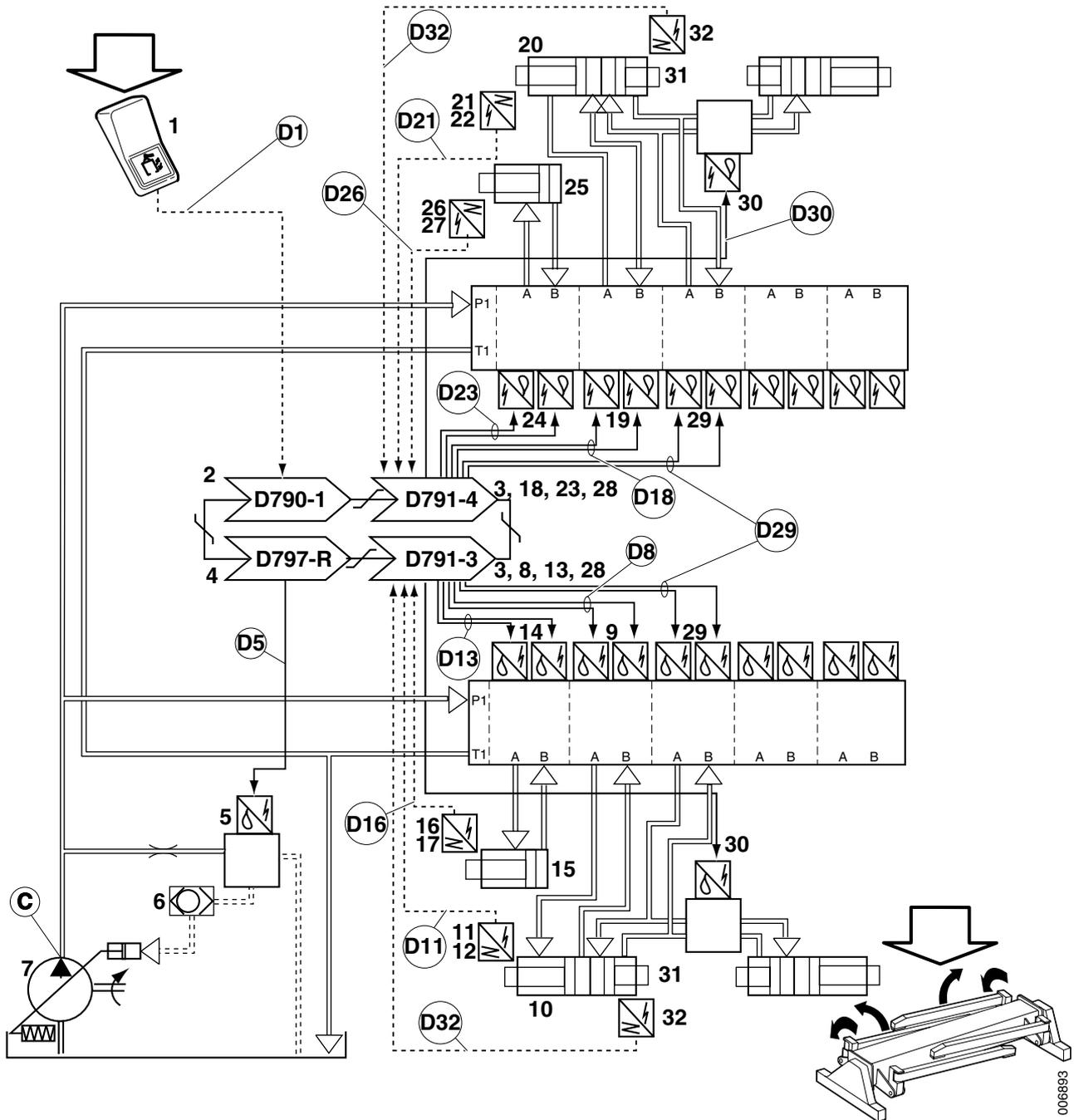
Pos	Explanation	Signal description	Reference
12	Sensor front knee left (B7217L) stops sending signal to Control unit attachment left legs (D791-3).	U = 0 V	<i>Sensor knee, description page 147</i> D12: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 COMBI, menu 4
13	Control unit attachment left legs (D791-3) activates Solenoid valve front leg down left (Y6013L) when Sensor front knee left (B7217L) stops sending signal.	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.7 <i>Control unit attachment left legs</i> D13: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 COMBI, menu 10
14	Solenoid valve front leg down left (Y6013L) pressurizes Hydraulic cylinder leg left front.	-	<i>Control valve lift legs, description page 141</i> D13: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 COMBI, menu 10
15	Hydraulic cylinder leg left front lowers leg left front.	-	<i>Hydraulic cylinder leg, description page 149</i>
16	Sensor front leg left (B7219L) sends a signal to Control unit attachment left legs (D791-3) when the leg is actuated.	U = 24 V	<i>Sensor lift leg, description page 149</i> D16: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 COMBI, menu 4
17	Sensor front leg left (B7219L) stops sending a signal to Control unit attachment left legs (D791-3).	U = 0 V	<i>Sensor lift leg, description page 149</i> D16: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 COMBI, menu 4
18	Control unit attachment right leg pair (D791-4) activates Solenoid valve front knee out right (Y6056R) when Sensor front leg left (B7219L) stops sending signal.	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.8 <i>Control unit attachment right legs</i> D18: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 COMBI, menu 10
19	Solenoid valve front knee out right (Y6056R) pressurizes Hydraulic cylinder knee right front.	-	<i>Control valve lift legs, description page 141</i> D18: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 COMBI, menu 10
20	Hydraulic cylinder knee right front lowers Knee right front.	-	<i>Hydraulic cylinder knee/clamp, description page 146</i>
21	Sensor front knee right (B7217R) sends voltage signal to Control unit attachment right leg pair (D791-4) when the knee is actuated.	U = 24 V	<i>Sensor knee, description page 147</i> D21: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 COMBI, menu 4

Pos	Explanation	Signal description	Reference
22	Sensor front knee right (B7217L) stops sending signal to Control unit attachment right leg pair (D791-4).	U = 0 V	<i>Sensor knee, description page 147</i> D21: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 COMBI, menu 4
23	Control unit attachment right leg pair (D791-4) activates Solenoid valve front leg down right (Y6013R) when Sensor front knee right (B7217R) stops sending signal.	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.8 <i>Control unit attachment right legs</i> D23: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 COMBI, menu 10
24	Solenoid valve front leg down right (Y6013R) pressurizes Hydraulic cylinder leg right front.	-	<i>Control valve lift legs, description page 141</i>
25	Hydraulic cylinder leg right front lowers leg right front.	-	<i>Hydraulic cylinder leg, description page 149</i>
26	Sensor front leg right (B7219R) sends voltage signal to Control unit attachment right leg pair (D791-4) when the leg is lowered.	U = 24 V	<i>Sensor lift leg, description page 149</i> D26: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 COMBI, menu 4
27	Sensor front leg right (B7219R) stops sending signal to Control unit attachment right leg pair (D791-4) when the leg has reached end-position.	U = 0 V	<i>Sensor lift leg, description page 149</i> D26: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 COMBI, menu 4
28	Control unit attachment right leg pair (D791-4) activate Indicator light front leg down (H580).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.8 <i>Control unit attachment right legs</i> D28: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 COMBI, menu 9
29	When the switch is released, activation of all solenoid valves stops. The solenoid valves remain activated even after completed movement in order that it should be possible to complete the movement if the button is released when the lift leg is in a middle position.		

Hydraulic diagram combi attachment

Raising/lowering of rear lift legs, function description

Condition	Reference value	Reference
Control switch	Disengaged	Tab 11 Common electric, group 11.5.1.4 Manoeuvre switch voltage



006893

Pos	Explanation	Signal description	Reference
1	Switch rear legs (S1007) sends voltage signal to Control unit cab (D790-1).	U = 24 V	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i> D1: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 1
2	Control unit cab (D790-1) sends rear lift legs down or up on the CAN bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
3	Control unit attachment left legs (D791-3) and Control unit attachment right leg pair (D791-4) send activate top hydraulics on the CAN bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.7 <i>Control unit attachment left legs</i> and tab 11 <i>Common electric</i> , group 11.5.3.8 <i>Control unit attachment right legs</i>
4	Control unit frame rear (D797-R) activates Solenoid valve, engagement of hydraulics for top lift (Y6003).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i> D5: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
5	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens and pressurizes valve block lift cylinder and sends load signal to hydraulic oil pump 2.	-	<i>Valve block top lift hydraulics</i> , description page 46 D5: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
6	The shuttle valve sends the strongest load signal to the hydraulic oil pumps if several functions are activated simultaneously.	-	Tab 10 <i>Common hydraulics</i> , group 10.5.3 <i>Shuttle valve</i>
7	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See pressure plate on left frame beam.	Tab 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
8	Control unit attachment left legs (D791-3) activates Solenoid valve rear knee out left (Y6058L).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.7 <i>Control unit attachment left legs</i> D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 12
9	Solenoid valve rear knee out left (Y6058L) pressurizes Hydraulic cylinder knee left rear.	-	<i>Control valve lift legs</i> , description page 141 D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 12
10	Hydraulic cylinder knee left rear lowers knee left rear.	-	<i>Hydraulic cylinder knee/clamp</i> , description page 146

Pos	Explanation	Signal description	Reference
11	Sensor rear knee left (B7218L) sends voltage signal to Control unit attachment left legs (D791-3) when the knee is actuated.	U = 24 V	<i>Sensor knee, description page 147</i> D11: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI, menu 5</i>
12	Sensor rear knee left (B7218L) stops sending a signal to Control unit attachment left legs (D791-3).	U = 0 V	<i>Sensor knee, description page 147</i> D11: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI, menu 5</i>
13	Control unit attachment left legs (D791-3) activates Solenoid valve rear leg down left (Y6014L) when Sensor rear knee left (B7218L) stops sending signal.	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.7 <i>Control unit attachment left legs</i> D13: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI, menu 12</i>
14	Solenoid valve rear leg down left (Y6014L) pressurizes Hydraulic cylinder leg left rear.	-	<i>Control valve lift legs, description page 141</i> D13: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI, menu 12</i>
15	Hydraulic cylinder leg left rear lowers leg left rear.	-	<i>Hydraulic cylinder leg, description page 149</i>
16	Sensor rear leg left (B7220L) sends voltage signal to Control unit attachment left legs (D791-3) when the leg is actuated.	U = 24 V	<i>Sensor lift leg, description page 149</i> D16: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI, menu 5</i>
17	Sensor rear leg left (B7220L) stops sending signal to Control unit attachment left legs (D791-3) when Sensor rear leg left (B7220L) stops sending signal.	U = 0 V	<i>Sensor lift leg, description page 149</i> D16: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI, menu 5</i>
18	Control unit attachment right leg pair (D791-4) activates Solenoid valve rear knee out right (Y6058R).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.8 <i>Control unit attachment right legs</i> D18: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI, menu 12</i>
19	Solenoid valve rear knee out right (Y6058R) pressurizes Hydraulic cylinder knee right rear.	-	<i>Control valve lift legs, description page 141</i> D18: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI, menu 12</i>
20	Hydraulic cylinder knee/ right rear lowers Knee right rear.	-	<i>Hydraulic cylinder knee/clamp, description page 146</i>
21	Sensor rear knee right (B7218R) sends voltage signal to Control unit attachment right leg pair (D791-4) when the knee is actuated.	U = 24 V	<i>Sensor knee, description page 147</i> D21: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI, menu 5</i>

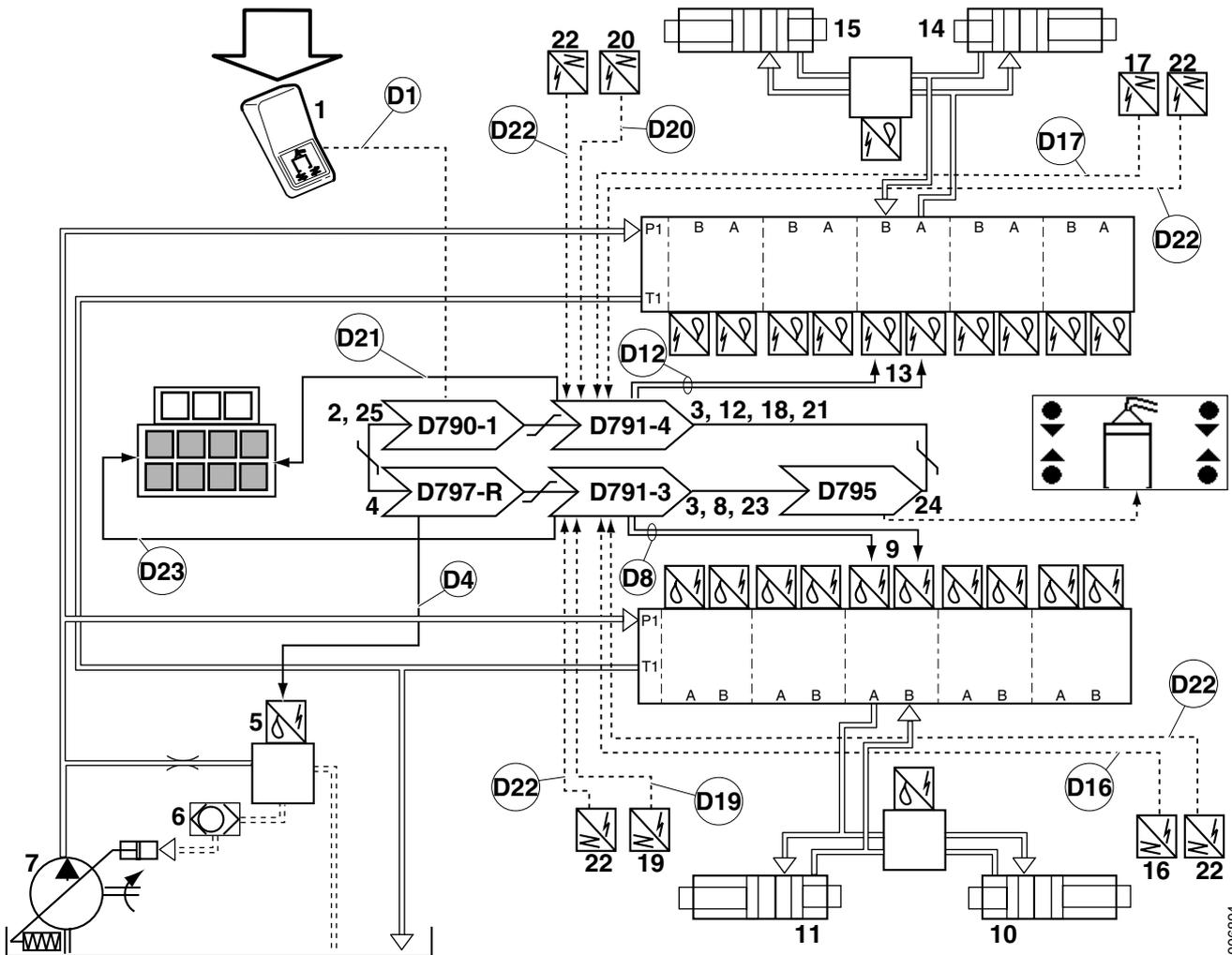
Pos	Explanation	Signal description	Reference
22	Sensor rear knee right (B7218R) stops sending a signal to Control unit attachment right leg pair (D791-4) when the knee reaches its end position.	U = 0 V	<i>Sensor knee, description page 147</i> D21: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 5
23	Control unit attachment right leg pair (D791-4) activates Solenoid valve rear leg out right (Y6014R) when Sensor rear knee right (B7218R) stops sending signal.	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.8 <i>Control unit attachment right legs</i> D23: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 12
24	Solenoid valve rear leg down right (Y6014R) pressurizes Hydraulic cylinder leg right rear.	-	<i>Control valve lift legs, description page 141</i> D23: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 12
25	Hydraulic cylinder leg right rear lowers leg right rear.	-	<i>Hydraulic cylinder leg, description page 149</i>
26	Sensor rear leg right (B7220R) sends voltage signal to Control unit attachment right leg pair (D791-4) when the leg is actuated.	U = 24 V	<i>Sensor lift leg, description page 149</i> D26: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 5
27	Sensor rear leg right (B7220R) stops sending a signal to Control unit attachment right leg pair (D791-4).	U = 0 V	<i>Sensor lift leg, description page 149</i> D26: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 5
28	When both rear lift legs are completely lowered Control unit attachment left legs (D791-3) activates Solenoid valve operating position left (Y6053L) and Solenoid valve clamping shut left (Y6054L).  At the same time Control unit attachment right leg pair (D791-4) activates Solenoid valve operating position right (Y6053R) and Solenoid valve clamping right (Y6054R).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.7 <i>Control unit attachment left legs</i> and tab 11 <i>Common electric</i> , group 11.5.3.8 <i>Control unit attachment right legs</i> D29: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 15 and 8.4.11.1 <i>COMBI</i> , menu 16
29	Solenoid valve operating position left (Y6053L) closes the connection between control valve and hydraulic cylinder clamping left front.  Solenoid valve operating position right (Y6053R) closes the connection between control valve and hydraulic cylinder clamping right front.	-	<i>Control valve lift legs, description page 141</i> D29: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 15 and 8.4.11.1 <i>COMBI</i> , menu 16

<b>Pos</b>	<b>Explanation</b>	<b>Signal description</b>	<b>Reference</b>
30	Solenoid valve clamping left (Y6054L) pressurizes hydraulic cylinder clamp left rear.  Solenoid valve clamping right (Y6054R) pressurizes hydraulic cylinder clamp right rear.	-	<i>Control valve lift legs, description page 141</i>  D30: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 15
31	Hydraulic cylinder clamp presses knee down and thus presses the rear lift legs forward.	-	<i>Hydraulic cylinder knee/clamp, description page 146</i>
32	Sensor operating position left (B7212L) sends voltage signal to Control unit attachment left legs (D791-3) and Sensor operating position right B7212R) sends voltage signal to Control unit attachment right leg pair (D791-4) when the leg pair is in operating position.	Sensor right in front of indicator plate: U = 24 V	<i>Sensor operating position, description page 146</i>  D32: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 6
33	When the switch is released, activation of all solenoid valves stops. The solenoid valves remain activated even after completed movement in order that it should be possible to complete the movement if the button is released when any lift leg is in a middle position.		

Hydraulic diagram combi attachment

**Clamp with left legs, function description**

Condition	Reference value	Reference
Control switch	Disengaged	Tab 11 <i>Common electric</i> , group 11.5.1.4 <i>Manoeuvre switch voltage</i>
Lift legs	Lowered	<i>Raising/lowering of front lift legs</i> , function description page 124 <i>Raising/lowering of rear lift legs</i> , function description page 128



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Pos	Explanation	Signal description	Reference
1	Switch clamp/release leg (S1008) sends voltage signal to Control unit, cab (D790-1).	U = 24 V	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i> D1: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 1
2	Control unit cab (D790-1) sends clamp or release leg on the CAN bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>

Pos	Explanation	Signal description	Reference
3	Control unit attachment left legs (D791-3) and Control unit attachment right leg pair (D791-4) send activate top hydraulics on the CAN bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.7 <i>Control unit attachment left legs</i> and tab 11 <i>Common electric</i> , group 11.5.3.8 <i>Control unit attachment right legs</i>
4	Control unit frame rear (D797-R) activates Solenoid valve, engagement of hydraulics for top lift (Y6003).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i> D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
5	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens and pressurizes valve block lift cylinder and sends load signal to hydraulic oil pump 2.	-	<i>Valve block top lift hydraulics, description page 46</i> D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
6	The shuttle valve sends the strongest load signal to the hydraulic oil pumps if several functions are activated simultaneously.	-	Tab 10 <i>Common hydraulics</i> , group 10.5.3 <i>Shuttle valve</i>
7	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See pressure plate on left frame beam.	Tab 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
8	Control unit attachment left legs (D791-3) activates Solenoid valve clamping left (Y6054L) or Solenoid valve clamping release left (Y6055L).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.7 <i>Control unit attachment left legs</i> D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 15
9	Solenoid valve clamping left (Y6054L) or Solenoid valve clamping release left (Y6055L) pressurizes Hydraulic cylinder clamping left front and Hydraulic cylinder clamping left rear.	-	<i>Control valve lift legs, description page 141</i> D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 15
10	Hydraulic cylinder knee and clamp left front act on knee left front so that left lift legs clamp shut or release.	-	<i>Hydraulic cylinder knee/clamp, description page 146</i>
11	Hydraulic cylinder knee and clamp left rear act on knee left rear so that left lift legs clamp shut or release.	-	<i>Hydraulic cylinder knee/clamp, description page 146</i>
12	Control unit attachment right leg pair (D791-4) activates Solenoid valve clamping right (Y6054R) or Solenoid valve clamping release right (Y6055R).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.8 <i>Control unit attachment right legs</i> D12: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 15

Pos	Explanation	Signal description	Reference
13	Solenoid valve clamping left (Y6054L) or Solenoid valve clamping release left (Y6055L) pressurizes Hydraulic cylinder clamping left front and Hydraulic cylinder clamping left rear.	-	<i>Control valve lift legs, description page 141</i> D12: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 15
14	Hydraulic cylinder knee and clamp right front act on knee left front so that left lift legs clamp shut or release.	-	<i>Hydraulic cylinder knee/clamp, description page 146</i>
15	Hydraulic cylinder knee and clamp right rear act on knee left rear so that left lift legs clamp shut or release.	-	<i>Hydraulic cylinder knee/clamp, description page 146</i>
16	Sensor clamping position front leg left (B7215L) sends voltage signal to Control unit attachment left legs (D791-3).	U = 24 V	<i>Sensor clamping position, description page 152</i> D16: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 2
17	Sensor clamping position front leg right (B7215R) sends voltage signal to Control unit attachment right leg pair (D791-4).	U = 24 V	<i>Sensor clamping position, description page 152</i> D17: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 2
18	Control unit attachment right leg pair (D791-4) activate Indicator light clamping position front legs (H578).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.8 <i>Control unit attachment right legs</i> D21: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 8
19	Sensor clamping position rear leg left (B7216L) sends voltage signal to Control unit attachment left legs (D791-3).	U = 24 V	<i>Sensor clamping position, description page 152</i> D19: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 2
20	Sensor clamping position rear leg right (B7216R) sends voltage signal to Control unit attachment right leg pair (D791-4).	U = 24 V	<i>Sensor clamping position, description page 152</i> D20: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 2
21	Control unit attachment right leg pair (D791-4) activates Indicator light clamping position rear legs (H579).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.8 <i>Control unit attachment right legs</i> D21: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 8

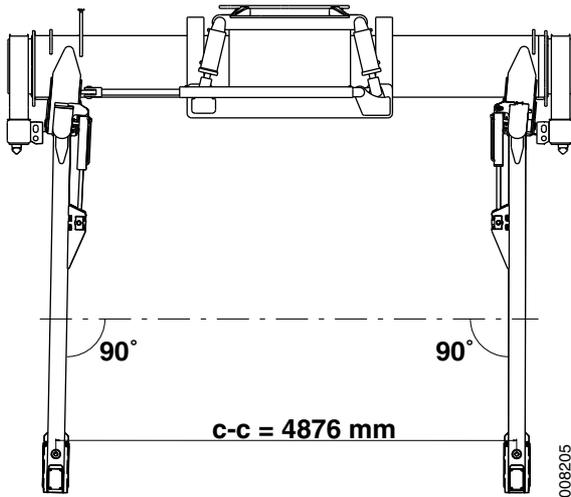
Pos	Explanation	Signal description	Reference
22	When lift is started Sensor alignment front leg left (B7213L) and Sensor alignment rear leg left (B7214L) send signal to Control unit attachment left legs (D791-3). Sensor alignment front leg right (B7213R) and Sensor alignment rear leg right (B7214R) send signal to Control unit attachment right leg pair (D791-4).  If it takes longer than 4 seconds between the first sensor's signal until all sensors send signals, the lift function is blocked.	U = 24 V	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i>  D22: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 3
23	Control unit attachment left legs (D791-3) activates the indicator light for alignment for the lift leg in question.	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.7 <i>Control unit attachment left legs</i>  D23: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 7
24	Control unit KID (D795) activates event menu alignment bottom lift.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>
25	When more than two sensors indicate alignment or clamping position, speed limitation is activated.	Checked by control and monitoring system, error shown with error code.	Tab 8 <i>Control system</i> , group 8.2.5 <i>Speed limitation</i>

Hydraulic diagram combi attachment

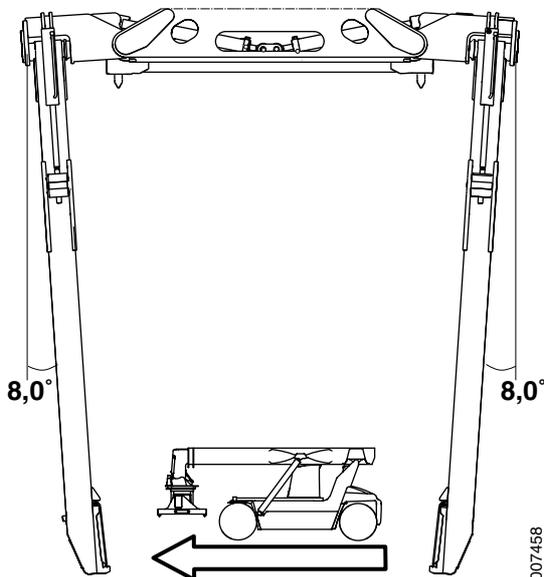
### Lift legs, checking and adjusting

If needed, the lift legs may have to be operated manually step by step with the diagnostic menu Extra\Combi menu 17, see tab 8 *Control system*, group 8.4.11.1 *COMBI*.

- 1 Start key in position I.
- 2 Check that all sensors have voltage. The light-emitting diode on the sensor should be lit when the sensor indicates.
- 3 Check the distance between all sensors and their shoulder, the distance should be  $4\pm 1$  mm when the sensor is directly opposite the lug.  
  
Sensor knee and Sensor leg should only be active during the movement, not in both end-positions.
- 4 Check that the attachment hangs vertically, adjust with the tilt function as needed.
- 5 Lower all legs completely.



Attachment seen from the front



Clamping position, max. retracted legs

- 6 Check that the legs are vertical in the lateral direction.
- 7 If needed, adjust the position of the lowering cylinder's rod mounting by turning the piston rod.

After adjusting, the shoulders for sensors may have to be fine-tuned.

## NOTE

*Loosen the lock nuts at the piston head before adjusting.*

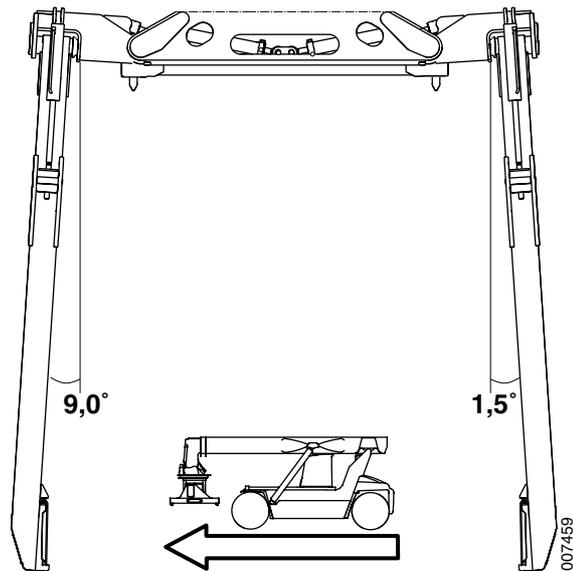
- 8 Check the c-c measurement between right and left lift leg, the measurement should be approx. 4876 mm at the lower part of the legs.

- 9 Run the lift legs to clamping position.
- 10 Check that the lift legs lean 8.0° against each other in the longitudinal direction.
- 11 If needed, adjust the position of the clamping cylinder's rod mounting by turning the piston rod.

After adjusting, the shoulders for sensor knee may have to be fine-tuned.

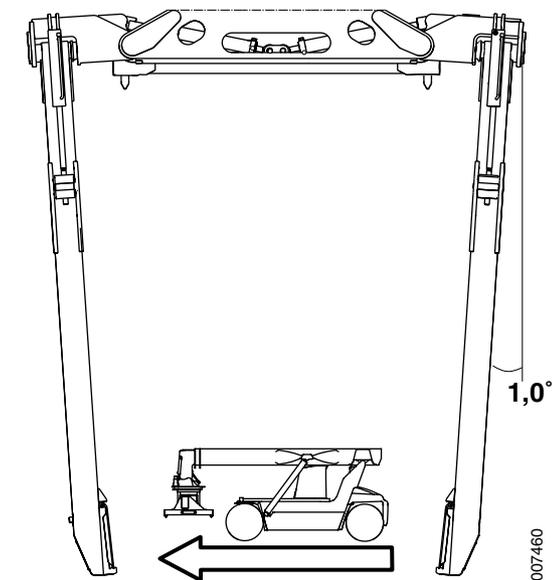
## NOTE

*Loosen the lock bolts in the piston head before adjusting.*



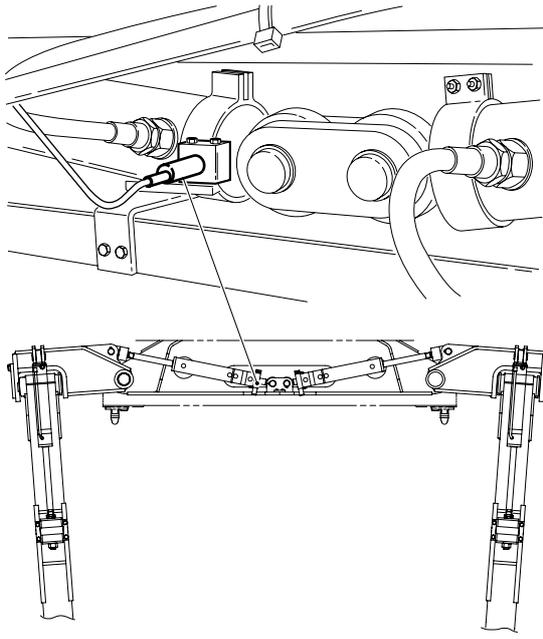
Clamping position, max. extended legs

- 12 Run the legs apart from clamping position.
- 13 Check that the rear lift legs lean 1.5° outward (backward).
- 14 Check that the front lift legs lean 9.0° outward (forward).



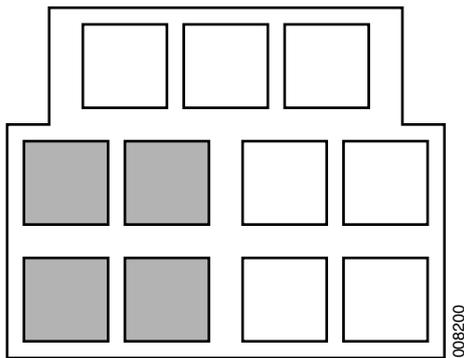
Operating position, rear legs

- 15 Press at the top on the rear lowering button, the rear lift legs should go to operating position. (Run apart the clamping position to go back to end-position to enable testing of operating position again.)
- 16 Check that the lift legs stop at 1.0° inward (forward).



Sensor operating position

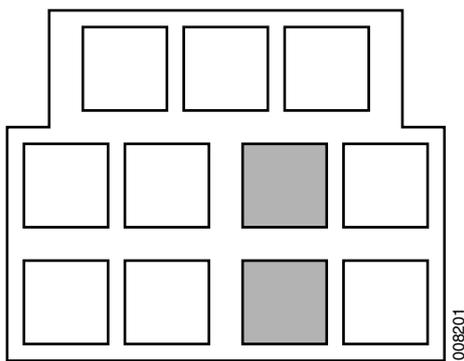
- 17 Adjust the position by moving sensor clamping position side-ways.



Indicator lights alignment

- 18 Press in the alignment lug on one lift leg at a time and check that each indicator light alignment works.

If the light does not come on when the lug is pressed in, check the bulb and Sensor alignment, see *Sensor alignment, description page 151*.

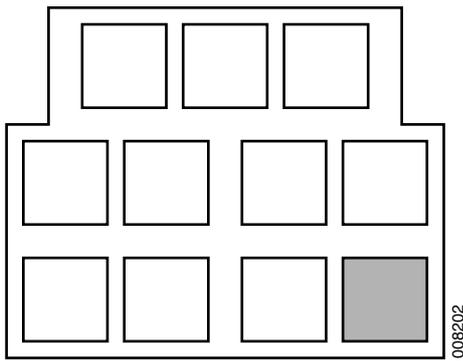


Indicator lights clamping position

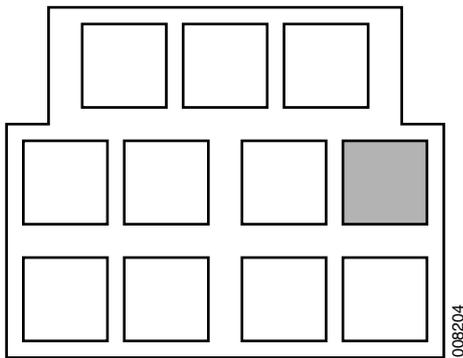
- 19 Press in the alignment surfaces on the front and rear lift legs, respectively, and check that indicator light alignment clamping position for each leg pair works.

When both alignment surfaces are pressed in, the indicator light for clamping position front and rear should be on.

If the light does not come on when the alignment surfaces are pressed in, check the bulb and Sensor clamping position, see *Sensor clamping position, description page 152*.



Indicator light front legs down



Indicator light front legs up

20 Check that indicator light front legs lowered is on when the front lift legs are lowered.

21 Run up the front lift legs and check that Indicator light front legs lowered goes off when the legs are raised and that Indicator light front legs up is on when the front legs are completely raised.

22 Check that the work lights on the attachment switches between lighting of twistlocks and lighting of lift legs on right and left side when the rear lift legs are raised and lowered on each side.

### 7.9.2.1 Hydraulic oil pump

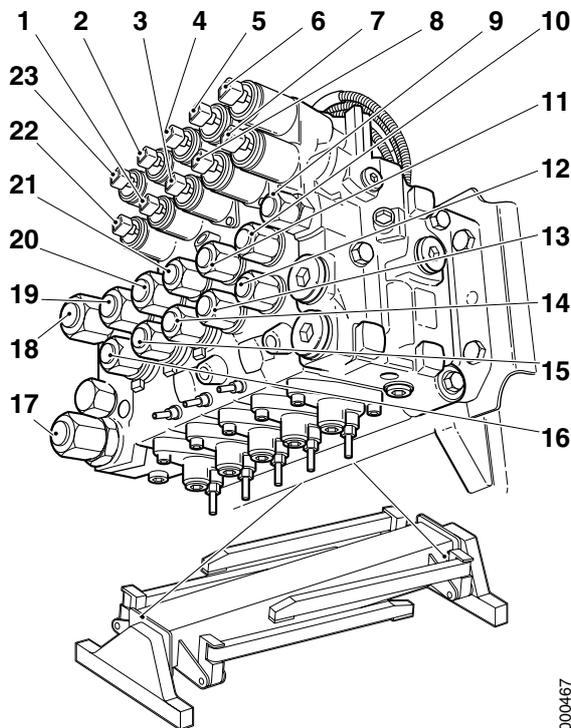
#### Hydraulic oil pump, general

See section 10 *Common hydraulics*, group 10.4.2 *Axial piston pump with variable displacement*.

### 7.9.2.2 Valve block top lift hydraulics

#### Valve block top lift hydraulics, description

See *Valve block top lift hydraulics, description page 46*.



1. Solenoid valve, rear knee out (Y6058)
2. Solenoid valve, rear knee in (Y6059)
3. Solenoid valve, clamping (Y6054)
4. Solenoid valve, clamping release (Y6055)
5. Solenoid valve, front knee in (Y6057)
6. Solenoid valve, front leg up (Y6060)
7. Solenoid valve, front leg down (Y6013)
8. Solenoid valve, front knee out (Y6056)
9. Drain to tank
10. Connection, hydraulic cylinder for front leg
11. Connection, hydraulic cylinder for front knee
12. Connection, hydraulic cylinder for front leg
13. Connection, hydraulic cylinder for front knee
14. Connection, hydraulic cylinder for clamping
15. Connection, hydraulic cylinder for rear knee
16. Connection, hydraulic cylinder for rear leg
17. Feed from hydraulic oil pumps
18. Tank return (through filter)
19. Connection, hydraulic cylinder for rear leg
20. Connection, hydraulic cylinder for rear knee
21. Connection, hydraulic cylinder for clamping
22. Solenoid valve, rear leg down (Y6014)
23. Solenoid valve, rear leg up (Y6061)

### 7.9.2.3 Control valve lift legs

#### Control valve lift legs, description

The lift legs are controlled by two control valves: one for left pair of legs and one for right pair of legs. The control valves are controlled by separate control units, Control unit attachment left legs (D791-3) and Control unit attachment right leg pair (D791-4). The control valves are located crosswise (left front and right rear, respectively) on the bracket for the knee on the attachment's main beam.

The control valves are identical and have five sections each:

- Raising/lowering of front knee
- Raising/lowering of front leg
- Raising/lowering of rear knee
- Raising/lowering of rear leg
- Clamping position

The control valve is an electro-hydraulically controlled, proportional and pressure compensated direction valve. Electrically controlled pressure reducing valves convert electrical current to servo pressure. The servo pressure controls the spring centred valve slides which control pressure and flow for the function in question. The valve slide has a flow limit in order that several functions can be activated simultaneously.

#### Valve slide front knee

The valve slide controls the direction and speed of front knee lowering by controlling the hydraulic pressure to hydraulic cylinder knee and clamp.

The valve slide is controlled by servo valve front knee out and servo valve front knee in.

#### Servo valve front knee out

Servo valve front knee out, controls servo pressure to valve slide front knee so that it controls oil pressure for front knee out.

Servo valve front knee is controlled electrically with Solenoid valve front knee out (Y6056) which is activated by Control unit attachment left legs (D791-3) or Control unit attachment right leg pair (D791-4), depending on if it is the right or left leg.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.1 COMBI, menu 10.

#### Servo valve front knee in

Servo valve front knee in, controls servo pressure to valve slide front knee so that it controls oil pressure for front knee in.

Servo valve front knee is controlled electrically with Solenoid valve front knee in (Y6057) which is activated by Control unit attachment left legs (D791-3) or Control unit attachment right leg pair (D791-4), depending on if it is the right or left leg.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.1 COMBI, menu 11.

**Valve slide front leg**

The valve slide controls the direction and speed of front leg lowering by controlling the hydraulic pressure to hydraulic cylinder leg.

The valve slide is controlled by servo valve front leg down and servo valve front leg out.

**Servo valve front leg down**

Servo valve front leg down, controls servo pressure to valve slide front leg so that it controls oil pressure leg lowering.

Servo valve front leg is controlled electrically with Solenoid valve front leg down (Y6013) which is activated by Control unit attachment left legs (D791-3) or Control unit attachment right leg pair (D791-4), depending on if it is the right or left leg.

The signal can be checked from the diagnostic menu, see section *8 Control and monitoring system*, group *8.4.11.1 COMBI*, menu *10*.

**Servo valve front leg up**

Servo valve front leg up, controls servo pressure to valve slide front leg so that it controls oil pressure for leg raising.

Servo valve front leg is controlled electrically with Solenoid valve front leg up (Y6060) which is activated by Control unit attachment left legs (D791-3) or Control unit attachment right leg pair (D791-4), depending on if it is the right or left leg.

The signal can be checked from the diagnostic menu, see section *8 Control and monitoring system*, group *8.4.11.1 COMBI*, menu *11*.

**Valve slide clamping**

Valve slide clamping controls the direction and speed of clamping with the leg pair by controlling the hydraulic pressure to hydraulic cylinder knee and clamp.

The valve slide is controlled by servo valve clamping and servo valve clamping release.

**Servo valve clamping**

Servo valve clamping, controls servo pressure to valve slide clamping so that it controls oil pressure for clamping.

Servo valve clamping is controlled electrically with Solenoid valve clamping (Y6054) which is activated by Control unit attachment left legs (D791-3) or Control unit attachment right leg pair (D791-4), depending on if it is the right or left pair of legs.

The signal can be checked from the diagnostic menu, see section *8 Control and monitoring system*, group *8.4.11.1 COMBI*, menu *15*.

### **Servo valve clamping release**

Servo valve clamping release, controls servo pressure to valve slide clamping position so that it controls oil pressure for clamping release.

Servo valve clamping release is controlled electrically with Solenoid valve clamping release (Y6055) which is activated by Control unit attachment left legs (D791-3) or Control unit attachment right leg pair (D791-4), depending on if it is the right or left pair of legs.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.1 *COMBI*, menu 15.

### **Valve slide rear knee**

The valve slide controls the direction and speed of rear knee lowering by controlling the hydraulic pressure to hydraulic cylinder knee and clamp.

The valve slide is controlled by servo valve rear knee out and servo valve rear knee in.

### **Servo valve rear knee out**

Servo valve rear knee out, controls servo pressure to valve slide rear knee so that it controls oil pressure for knee out.

Servo valve rear knee out is controlled electrically with Solenoid valve rear knee out (Y6058) which is activated by Control unit attachment left legs (D791-3) or Control unit attachment right leg pair (D791-4), depending on if it is the right or left knee.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.1 *COMBI*, menu 12.

### **Servo valve rear knee in**

Servo valve rear knee in, controls servo pressure to valve slide knee so that it controls oil pressure for knee in.

Servo valve rear knee in is controlled electrically with Solenoid valve rear knee in (Y6059) which is activated by Control unit attachment left legs (D791-3) or Control unit attachment right leg pair (D791-4), depending on if it is the right or left knee.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.1 *COMBI*, menu 13.

### **Valve slide rear leg**

The valve slide controls the direction and speed of rear leg lowering by controlling the hydraulic pressure to hydraulic cylinder leg.

The valve slide is controlled by servo valve rear leg down and servo valve rear leg out.

**Servo valve rear leg down**

Servo valve rear leg down, controls servo pressure to valve slide front leg so that it controls oil pressure leg lowering.

Servo valve rear leg down is controlled electrically with Solenoid valve rear leg down (Y6014) which is activated by Control unit attachment left legs (D791-3) or Control unit attachment right leg pair (D791-4), depending on if it is the right or left leg.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.1 COMBI, menu 12.

**Servo valve rear leg up**

Servo valve rear leg up, controls servo pressure to valve slide rear leg so that it controls oil pressure for leg raising.

Servo valve rear leg up is controlled electrically with Solenoid valve rear leg up (Y6061) which is activated by Control unit attachment left legs (D791-3) or Control unit attachment right leg pair (D791-4), depending on if it is the right or left leg.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.1 COMBI, menu 13.

**Control valve attachment, replacement**

See *Control valve attachment, replacement* page 49.

**7.9.2.4 Shuttle valve****Shuttle valve, description**

See section 10 *Common hydraulics*, group 10.5.3 *Shuttle valve*.

### 7.9.2.5 Valve drive position

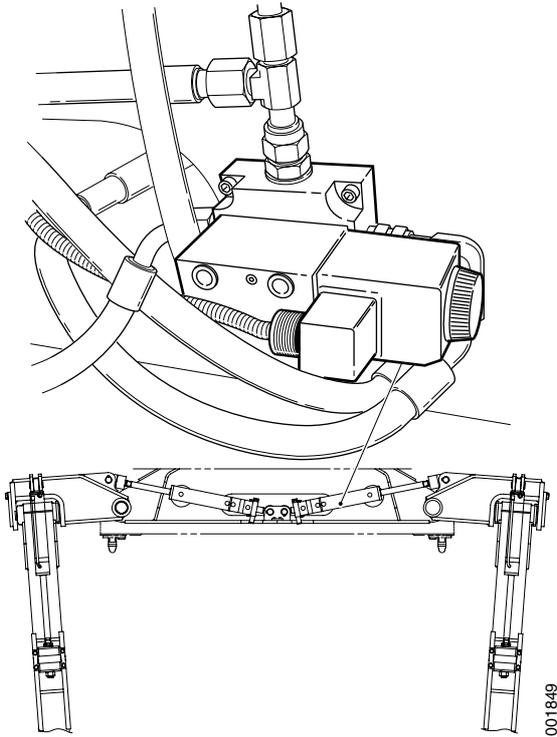
#### Valve operating position, description

The valve for operating position cuts off the pressure to the front clamping hydraulic cylinder. The valve is located on the attachment's main beam by the hydraulic cylinder knee and clamp.

When the valve is activated, it cuts the hydraulic connection between Control valve attachment lift legs and hydraulic cylinder knee and clamp front. This results in only the rear lift leg being angled forward.

Solenoid valve operating position (Y6053L/R) is activated by Control unit attachment left legs (D791-3) or Control unit attachment right leg pair (D791-4) depending on whether it is the right or left leg.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.1 *COMBI*, menu 16.



### 7.9.2.6 Main beam attachment

#### Main beam attachment, description

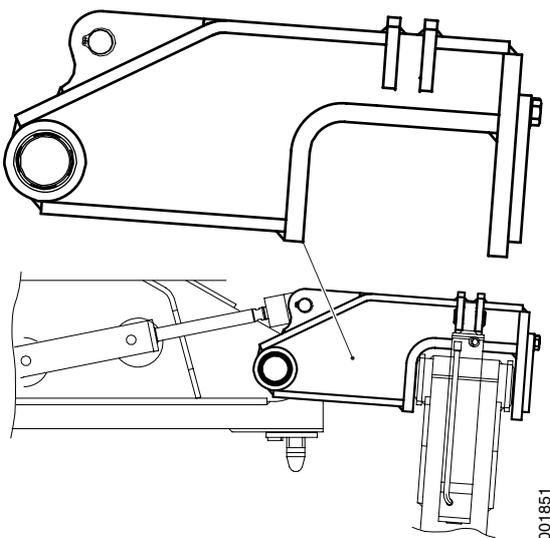
The brackets for knee and hydraulic cylinder knee and clamp are located on the attachment's main beam.

### 7.9.2.7 Knee

#### Knee, description

The knee is located between the attachment's main beam and lift leg. There are four knees, one at each lift leg. The knee enables folding in and clamping with the legs. The knee is controlled by hydraulic cylinder knee and clamp.

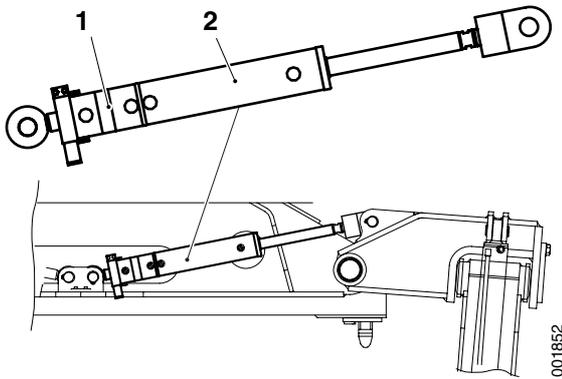
Located on the knee joint is an indicator ring which is turned with the lift leg. The indicator ring is used together with Sensor, knee, to determine whether the leg is raised, in intermediate position or lowered.



### 7.9.2.8 Hydraulic cylinder knee and bracket

#### Hydraulic cylinder knee/clamp, description

Hydraulic cylinder knee and clamp has two pistons in separate cylinders. There are four hydraulic cylinders, one at each lift leg. The hydraulic cylinder is located between attachment and knee. One of the hydraulic cylinder's pistons folds the knee joint out. The other piston clamps with the lift legs by angling the knee joint further.



1. Hydraulic cylinder, clamp
2. Hydraulic cylinder, knee

#### Hydraulic cylinders, repairing

See tab 10 *Common hydraulics*, group 10.7.1 *Hydraulic cylinders*.

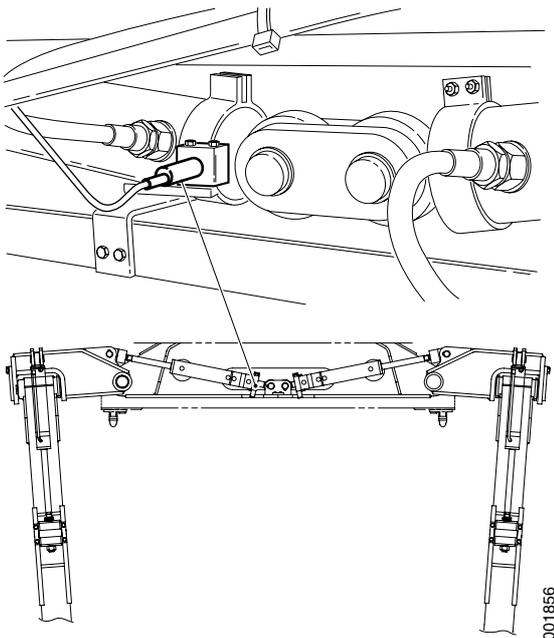
### 7.9.2.9 Sensor drive position

#### Sensor operating position, description

The sensor for operating position senses the position of the rear lift legs' hydraulic cylinder for knee and clamp. This is used to indicate operating position for the rear lift legs. There are two sensors, one on each side (right and left).

Sensor, operating position left (B7212L/R) provides a voltage signal when the rear hydraulic cylinder lowering knee/clamp is in its inner end position. The signal is used to stop activation of the solenoid valve for operating position when the rear lift leg is lowered.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.1 *COMBI*, menu 6.



#### Position sensor, checking and adjustment

See *Position sensor, checking and adjustment* page 5.

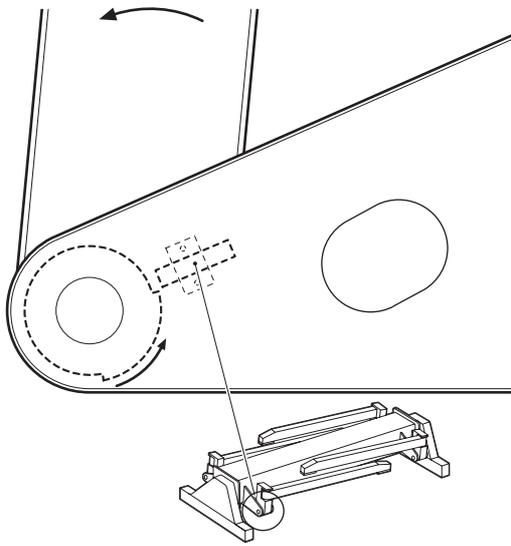
### 7.9.2.10 Sensor knee

#### Sensor knee, description

Sensor knee senses the position of the knee joint, this is used to control lowering of the legs. There are four sensors, one by each knee.

Sensor front knee (B7217) and Sensor rear knee (B7218) give voltage signals when the knee is between either end-position. The signal goes to 0 V when end-position is reached. This applies both when retracting and extending. The signal is used to activate the next step in the sequence. If the signal does not go to 0 V, the leg is not lowered.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.1 *COMBI*, menu 4–5.



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#### Position sensor, checking and adjustment

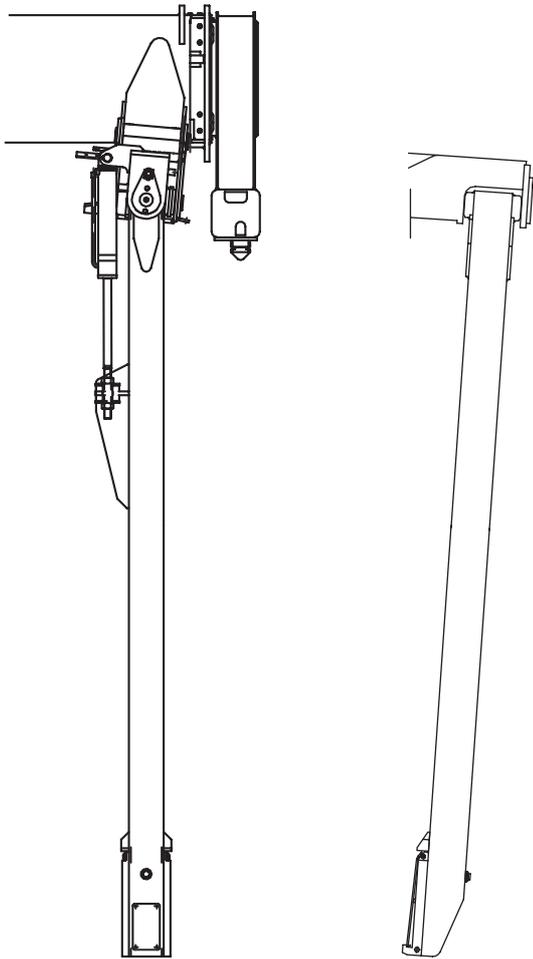
See *Position sensor, checking and adjustment* page 5.

### 7.9.2.11 Lift legs

#### Lift legs description

The lift legs grip underneath around the load. On the lower ends of the legs are lift shoes. The lift legs are raised and lowered with the hydraulic cylinder lift leg.

Located on the lift leg joint is an indicator ring which is turned with the lift leg. The indicator ring is used together with Sensor, leg, to determine whether the leg is raised, in intermediate position or lowered.

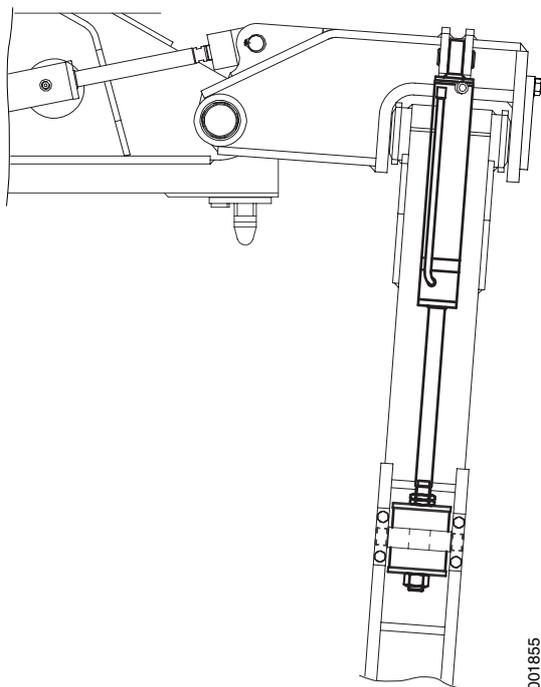


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### 7.9.2.12 Hydraulic cylinder legs

#### Hydraulic cylinder leg, description

Hydraulic cylinder lift leg is located between knee and lift leg. The hydraulic cylinder raises and lowers the lift legs.



#### Hydraulic cylinders, repairing

See tab 10 *Common hydraulics*, group 10.7.1 *Hydraulic cylinders*.

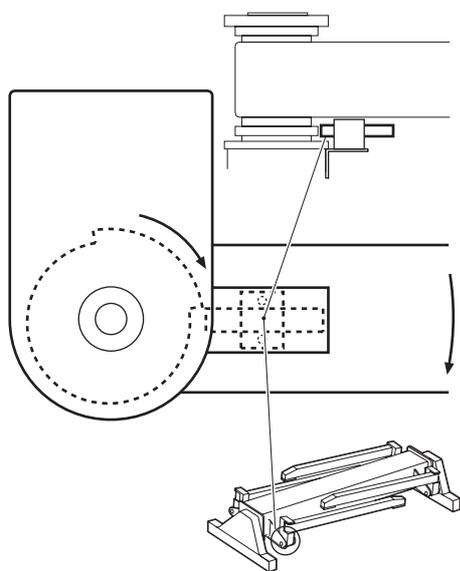
### 7.9.2.13 Sensor lift legs

#### Sensor lift leg, description

Sensor lift leg senses the position of the lift leg. This is used to control lowering of the legs. There are four sensors, one by each lift leg.

Sensor front leg (B7219) and Sensor rear lift leg (B7220) give voltage signals when the lift legs are between either end-position. The signal goes down to 0 V when end-position is reached. This applies both when raising and lowering. The signal is used to activate the next step in the sequence. If the signal doesn't go to 0 V, the knees are not actuated.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.1 *COMBI*, menu 4–5.



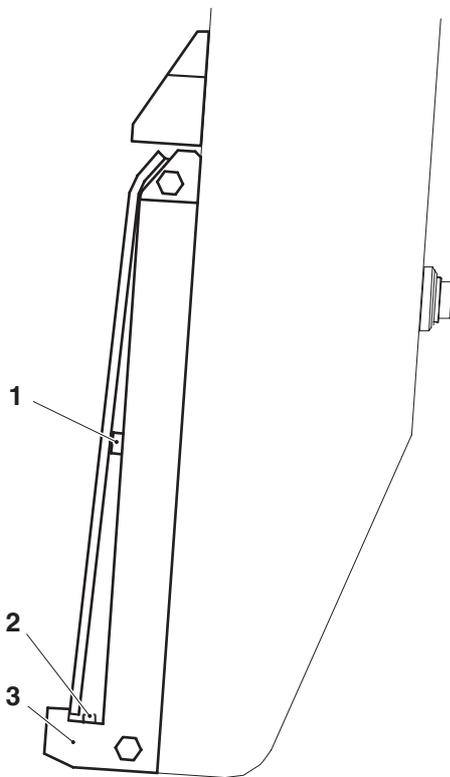
#### Position sensor, checking and adjustment

See *Position sensor, checking and adjustment* page 5.

### 7.9.2.14 Lifting shoe

#### Lift shoe, description

The lift shoe is located at the lower end of the lift legs. The lift shoe grips under the load. At each lift shoes there are two sensors. Sensor alignment senses when the lift shoe has contact with the load from above, see *Sensor alignment, description page 151*. Sensor clamping position senses when the lift shoe has horizontal contact with the load, see *Sensor clamping position, description page 152*.



1. Indicator pin, clamping position sensor
2. Indicator pin, alignment sensor
3. Lift shoe

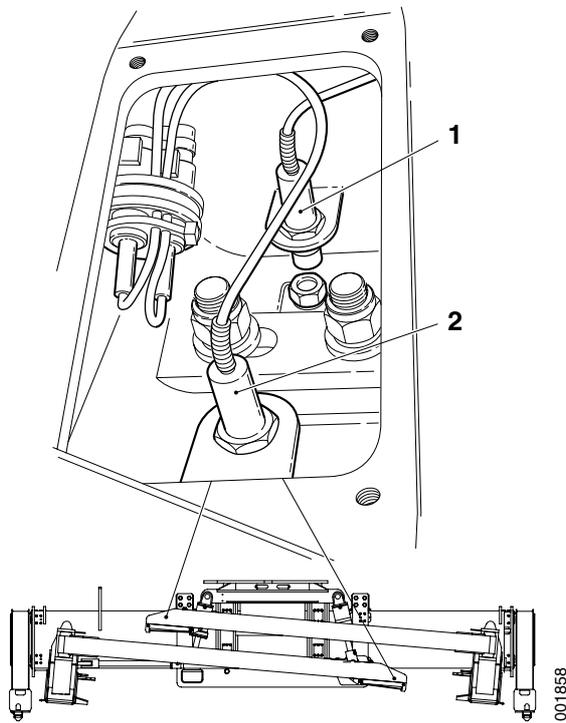
001857

### 7.9.2.15 Sensor alignment

#### Sensor alignment, description

The sensor for alignment (B7213L/R or B7214L/R) senses when the lift shoe has contact with the load from above. The sensor is located behind the lift shoe and senses the position on a linkage. The linkage is affected by a pin in the middle of the lift shoe which is pressed down when the load is positioned correctly in the lift shoe.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.1 *COMBI*, menu 3.



1. Sensor, clamping position (B7215L/R or B7216L/R)
2. Sensor, alignment (B7213L/R or B7214L/R)

#### Position sensor, checking and adjustment

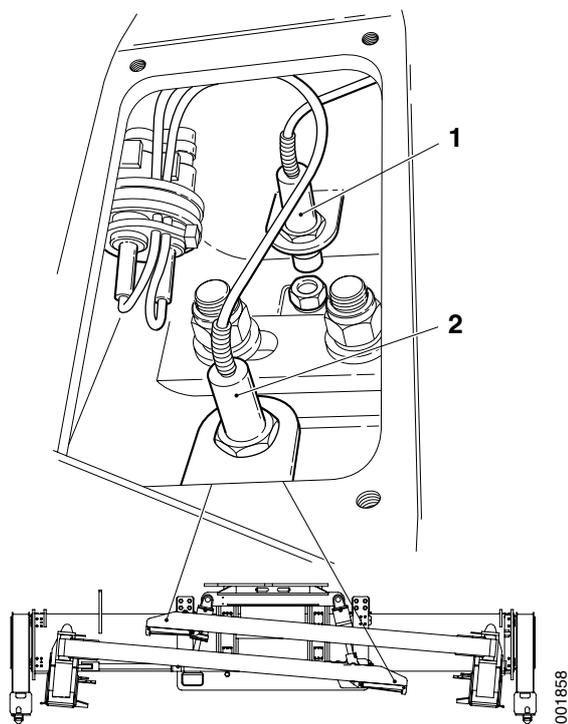
See *Position sensor, checking and adjustment* page 5.

### 7.9.2.16 Sensor clamping position

#### Sensor clamping position, description

The sensor for clamping position (B7215L/R or B7216L/R) senses when the lift shoe has horizontal contact with the load. The sensor is located behind the lift shoe and is activated by a bolt mounted on a spring-loaded plate on the lift shoe.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.1 *COMBI*, menu 2.



1. Sensor, clamping position (B7215L/R or B7216L/R)
2. Sensor, alignment (B7213L/R or B7214L/R)

#### Position sensor, checking and adjustment

See *Position sensor, checking and adjustment* page 5.

### 7.9.2.17 Unloading valve attachment

#### Relief valve attachment, description

See *Relief valve attachment, description* page 57.

### 7.9.2.18 Pipes and hoses

#### Pipes and hoses, description

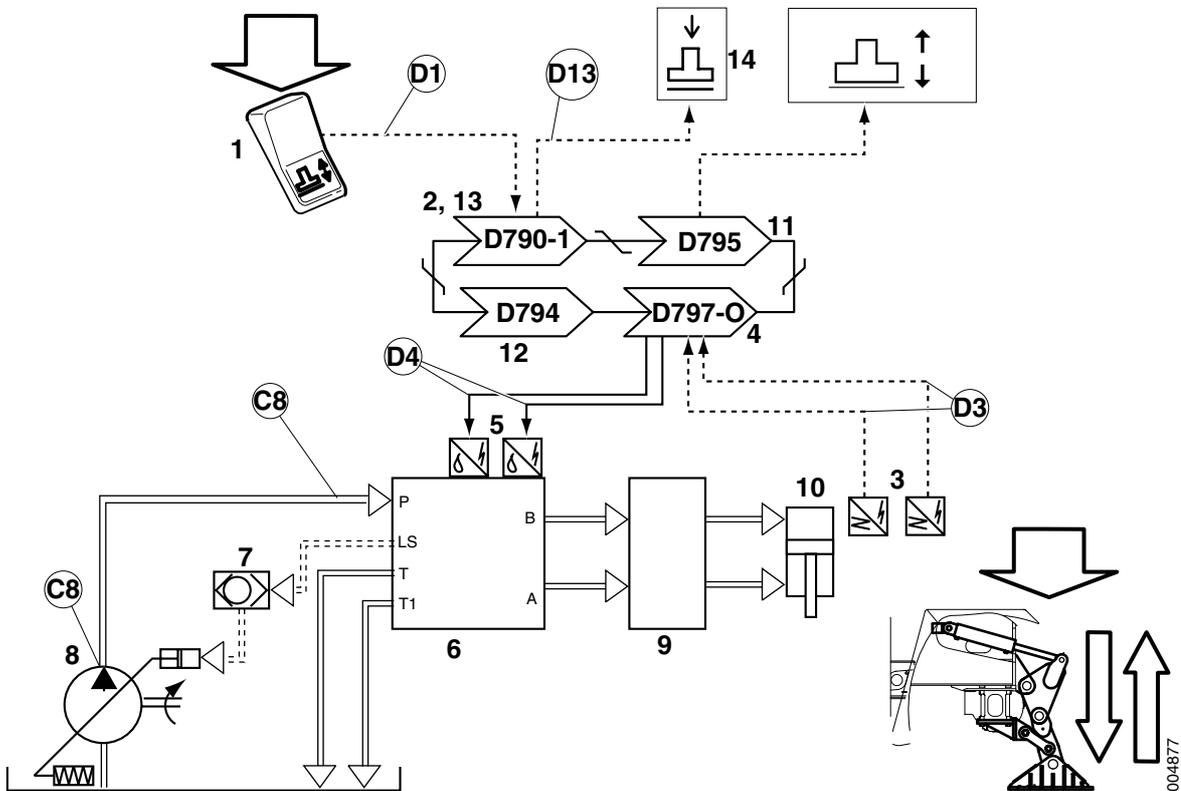
See section 10 *Common hydraulics*, group 10.5.1 *Pipes and hoses*.

## 7.10 Additional functions

### 7.10.1 Support jacks

#### Support jacks, function description

Condition	Reference value	Reference
Control switch	Disengaged	Tab 10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement
Parking brake	Released	Tab 4 Brakes, group 4.5 Parking brake system
Transmission	Neutral position	Tab 2 Transmission
Machine stationary	Speed = 0 km/h	-



Pos	Explanation	Signal description	Reference
1	Switch support jacks (S1013) sends voltage signal to Control unit cab (D790-1).	U = 24 V	Tab 9 Frame, body, cab and accessories, group 9.1 Controls and instrumentation D1: Diagnostic menu, see section 8 Control and monitoring system, group 8.4.11.3 SUPPORT-JACKS, menu 1

Pos	Explanation	Signal description	Reference
2	Control unit cab (D790-1) sends support jacks up or down on CAN bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
3	Sensor support jacks up (B7222) or Sensor support jacks down (B7021) sends voltage signal to Control unit frame option (D797-O).	Support jacks up or down: U = 24 V Support jacks in middle position: U = 0 V	<i>Sensor support jacks up, description page 159</i> <i>Sensor support jacks down, description page 160</i> D3: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.3 <i>SUPPORT-JACKS</i> , menu 2
4	Control unit frame option (D797-O) activates Solenoid valve support jacks down (Y6064) or Solenoid valve support jacks up (Y6063) and sends status for support jacks' position on the CAN-bus.	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.4 <i>Control unit frame option</i> D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.3 <i>SUPPORT-JACKS</i> , menu 3
5	Solenoid valve option frame down (Y6064) or Solenoid valve support jacks up (Y6063) pressurizes the support jack slide in Control valve option frame.	-	<i>Control valve option frame, description page 155</i> D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.3 <i>SUPPORT-JACKS</i> , menu 3
6	Control valve option frame sends load signal to shuttle valve option frame and pressurizes valve block support jack cylinder.	-	<i>Control valve option frame, description page 155</i>
7	The shuttle valve sends pressure signal on to hydraulic oil pump 1 & 2.	-	Tab 10 <i>Common hydraulics</i> , group 10.5.3 <i>Shuttle valve</i>
8	Hydraulic oil pump 1 & 2 pump oil from the hydraulic oil tank.	See pressure plate on left frame beam.	Tab 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
9	Valve block support jacks pressurizes hydraulic cylinder support jack.	-	<i>Valve block support jacks, description page 160</i>
10	Hydraulic cylinder lowers or raises the support jack.	-	<i>Hydraulic cylinder support jacks, description page 158</i>
11	Control unit KID (D795) activates event menu support jacks and blocks shifting from neutral position.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>
12	Control unit engine (D794) sends engine rpm on the CAN-bus. If the engine rpm is higher than 1000 rpm, then Control unit cab (D790-1) activates automatic lowering of support jacks.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.10 <i>Control unit engine</i>

Pos	Explanation	Signal description	Reference
13	Control unit cab (D790-1) activates the indicator light for support jacks down.  When support jacks are down, Control unit cab (D790-1) changes the load curve (limit for overload system).  When support jacks are up, Control unit cab (D790-1) allows shifting from neutral position.	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>  D13: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.3 <i>SUPPORT-JACKS</i> , menu 4

### 7.10.1.1 Hydraulic oil pump

#### Hydraulic oil pump, general

See section 10 *Common hydraulics*, group 10.4.2 *Axial piston pump with variable displacement*.

### 7.10.1.2 Control valve option frame

#### Control valve option frame, description



On machines with support jacks, movement of the support jacks is controlled by a separate section in Control valve frame option. The control valve is located on a bracket at the front of the engine compartment.

The control valve is controlled by Control unit frame option (D797-O). Control valve option frame is made up of several sections, each section controls a function. The following functions are controlled by control valve option frame.

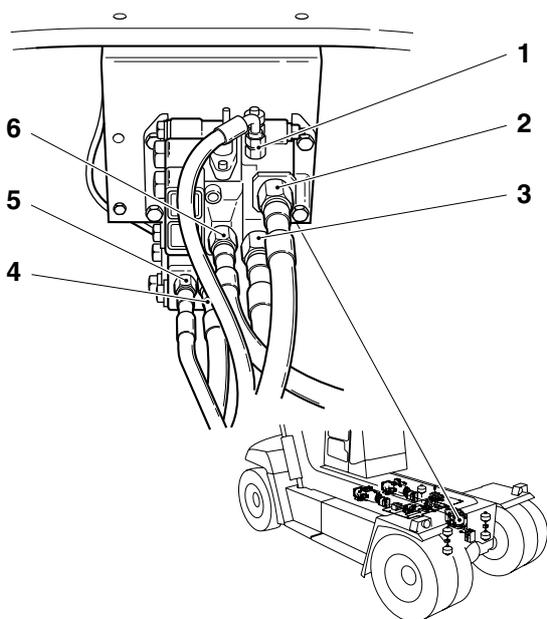
- Support jacks
- Sliding cab/Cab lift
- Cab tilt

The control valve is an electro-hydraulically controlled, proportional, and pressure-compensating directional valve. Electrically controlled pressure reducing valves convert electric current to servo pressure. The servo pressure controls spring-centred valve slides that control pressure and flow for the function in question. The valve slide has a limitation of flow in order to enable activation of several functions at the same time.

#### Valve slide support jacks

The valve slide controls the direction and speed of support jack lowering by controlling the hydraulic pressure to hydraulic cylinder support jacks.

The valve slide is controlled by servo valve support jacks up and servo valve support jacks down.



000624

1. Load signal (LS)
2. Pressure supply (P)
3. Tank return (T1)
4. Connection, steering cylinder (B)
5. Tank return (TP)
6. Connection, steering cylinder (A)

### Servo valve support jacks down

Servo valve support jacks up controls servo pressure to valve slide support jacks so that it controls oil pressure for support jacks up.

Servo valve support jacks down is controlled electrically with Solenoid valve support jacks down (Y6064) which is activated by Control unit frame option (D797-O).

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.3 *SUPPORT-JACKS*, menu 3.

### Servo valve support jacks up

Servo valve support jacks down controls servo pressure to valve slide support jacks so that it controls oil pressure for support jacks down.

Servo valve support jacks up is controlled electrically with Solenoid valve support jacks up (Y6063) which is activated by Control unit frame option (D797-O).

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.3 *SUPPORT-JACKS*, menu 3.

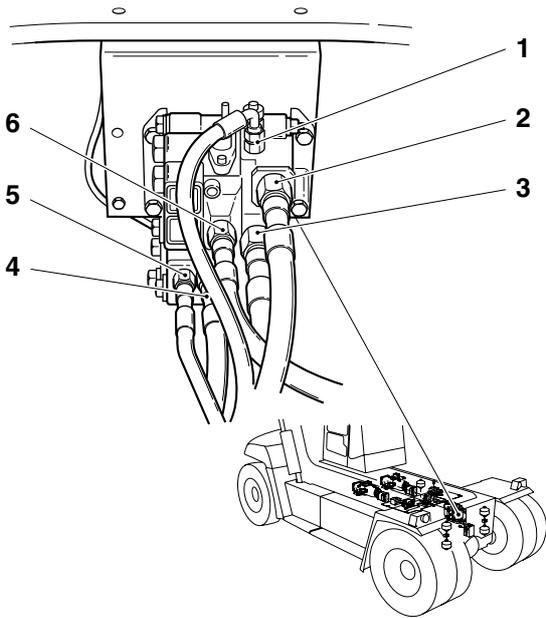
### Control valve option frame, changing



## NOTE

*Read the safety instructions for oil before working, see tab B Safety.*

- 1 Machine in service position, see tab *B Safety*.
- 2 Depressurize the brake and hydraulic systems, see tab *B Safety*.



000624

1. Load signal (LS)
2. Pressure supply (P)
3. Tank return (T1)
4. Connection, steering cylinder (B)
5. Tank return (TP)
6. Connection, steering cylinder (A)

- 3 Mark up and detach the hydraulic hoses from the control valve.

### NOTE

*Plug all connections immediately to protect the hydraulic system from impurities.*

- 4 Mark up and detach the wiring from the control valve.
- 5 Remove the control valve.

Remove the attaching bolts and lift away the valve. Place the valve on a clean, protected surface.

- 6 Transfer parts to the new control valve.

### NOTE

*Check that the O-rings on the hydraulic connections are intact and in place.*

### NOTE

*Transfer one part at a time so that the marking is not mixed up.*

- 7 Mark up the servo valves on the new control valve.
- 8 Fit the valve.
- 9 Connect the wiring to the control valve in accordance with the marking.
- 10 Connect the hydraulic hoses to the control valve in accordance with the marking.

### NOTE

*Check that the O-rings are intact and correctly fitted.*

- 11 Start the engine and check for leaks.
- 12 Check the function.



## CAUTION

**Air in the hydraulic system may cavitate and can result in product damage.**

**Activate the steering carefully and operate at the lowest possible speed a couple of times to avoid cavitation.**



- 13 Check the oil level in the hydraulic oil tank with the lift cylinders completely down and the extension cylinder completely in. The oil level should be at the top of the level glass. Top up as needed.

## CAUTION

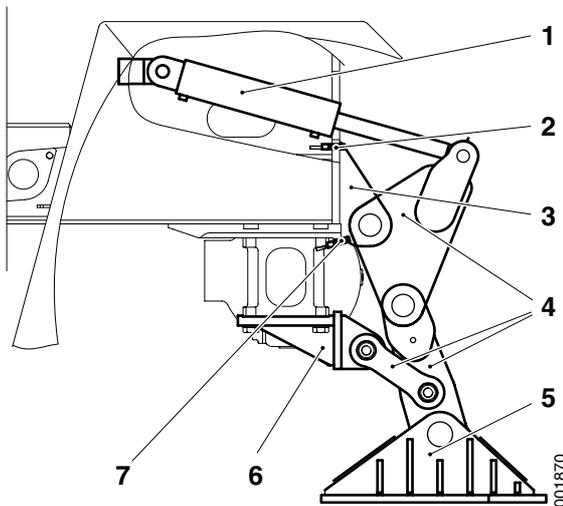
**Overfilling of oil, leakage, and environmental damage.**

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

### 7.10.1.3 Hydraulic cylinder support jacks

#### Hydraulic cylinder support jacks, description

Hydraulic cylinder support jacks lowers the support jack up and down. The hydraulic cylinder is located between support jacks and frame.



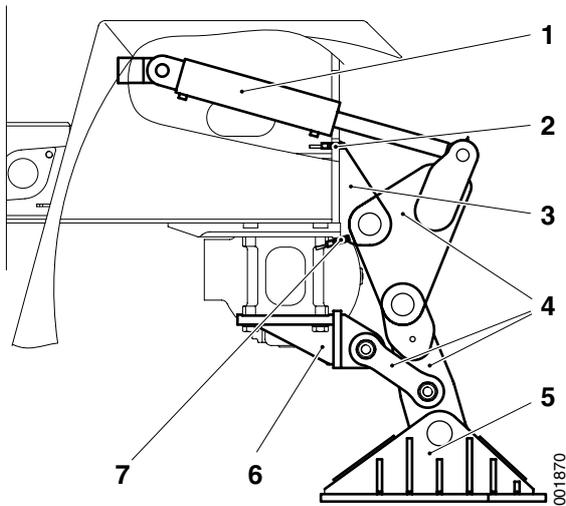
1. Hydraulic cylinder, support jacks
2. Sensor, support jacks up (B7222)
3. Upper bracket
4. Support jacks
5. Support foot
6. Upper bracket
7. Sensor, support jacks down (B7221)

### 7.10.1.4 Support jacks

#### Support jacks, description

The support jack consists of linkage and support. The linkage is designed so that it locks automatically when it is loaded from below in its lowered position.

The support jack is secured in the frame and in the drive axle's attaching bolts.



1. Hydraulic cylinder, support jacks
2. Sensor, support jacks up (B7222)
3. Upper bracket
4. Support jacks
5. Support foot
6. Upper bracket
7. Sensor, support jacks down (B7221)

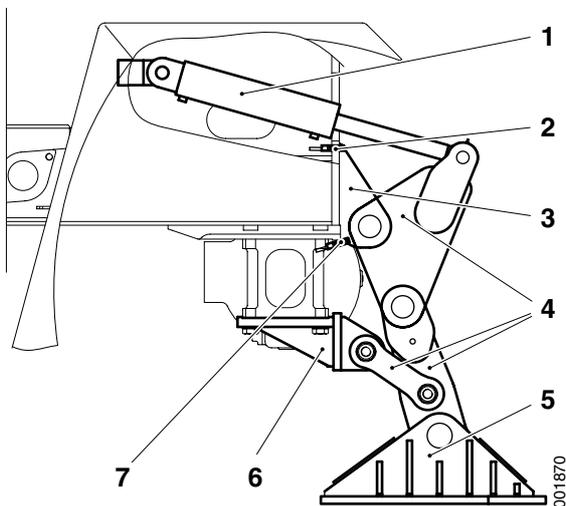
### 7.10.1.5 Sensor raised support jacks

#### Sensor support jacks up, description

Sensor support jacks up (B7222) is located under hydraulic cylinder support jacks and senses when the support jack is raised. There is a sensor by each support jack. The sensor indicates when the support jack is completely raised. This is used to control event menu support jacks.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.3 *SUPPORT-JACKS, menu 2*.

Sensor support jacks up (B7222) sends a voltage signal to Control unit frame option (D797-O) when the support jack is completely raised.



1. Hydraulic cylinder, support jacks
2. Sensor, support jacks up (B7222)
3. Upper bracket
4. Support jacks
5. Support foot
6. Lower bracket
7. Sensor, support jacks down (B7221)

### Position sensor, checking and adjustment

See *Position sensor, checking and adjustment* page 5.

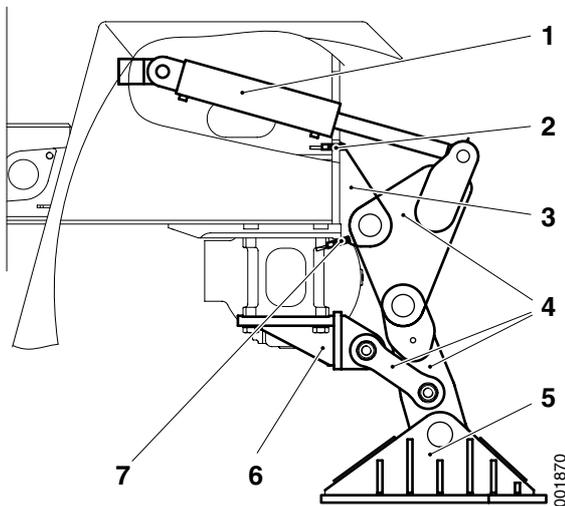
#### 7.10.1.6 Sensor lowered support jacks

##### Sensor support jacks down, description

Sensor support jacks down (B7221) is located under the support jack's upper attachment and senses when the support jack is lowered. There is a sensor by each support jack. This is used to control the support jacks and activation of the indicator light support jacks down.

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.11.3 *SUPPORT-JACKS*, menu 2.

Sensor support jacks down (B7221) sends a voltage signal to Control unit frame option (D797-O) when the support jack is completely lowered.



1. Hydraulic cylinder, support jacks
2. Sensor, support jacks up (B7222)
3. Upper bracket
4. Support jacks
5. Support foot
6. Lower bracket
7. Sensor, support jacks down (B7221)

### Position sensor, checking and adjustment

See *Position sensor, checking and adjustment* page 5.

#### 7.10.1.7 Pipes and hoses

##### Pipes and hoses, description

See section 10 *Common hydraulics*, group 10.5.1 *Pipes and hoses*.

#### 7.10.1.8 Shuttle valve option

##### Shuttle valve option, description

See section 10 *Common hydraulics*, group 10.5.3 *Shuttle valve*.

#### 7.10.1.9 Valve block support jacks

##### Valve block support jacks, description

Valve block support jacks is located by the hydraulic cylinders and contains a blocking valve which protects against accidental raising and lowering of the support jacks.

## 7.10.2 Weight indicator

### Weight indicator, description



The weight indicator is available in two versions, fixed scale and dynamic scale. The fixed scale makes it possible to weigh the load with boom and extension in a certain position. The dynamic scale shows the load regardless of position of the boom and extension.

The weight indicator uses Sensor hydraulic pressure lift cylinder (B768) and sensor boom angle to calculate the load. For more information about sensors, see section *8 Control and monitoring system*, group *8.2.1 Overload protection*.

The pressure sensor can be checked with diagnostic menu, see section *8 Control and monitoring system*, group *8.4.5.3 HYD, menu 3*.

#### Fixed scale

The fixed scale weighs the load in a pre-set position on the boom by measuring the pressure on the piston side in the lift cylinders. The boom angle for the measuring position is indicated by a rod and marking on the left lift cylinder. The boom length for the measuring position is indicated with an extra Sensor boom length (Position sensor boom length 60 cm).

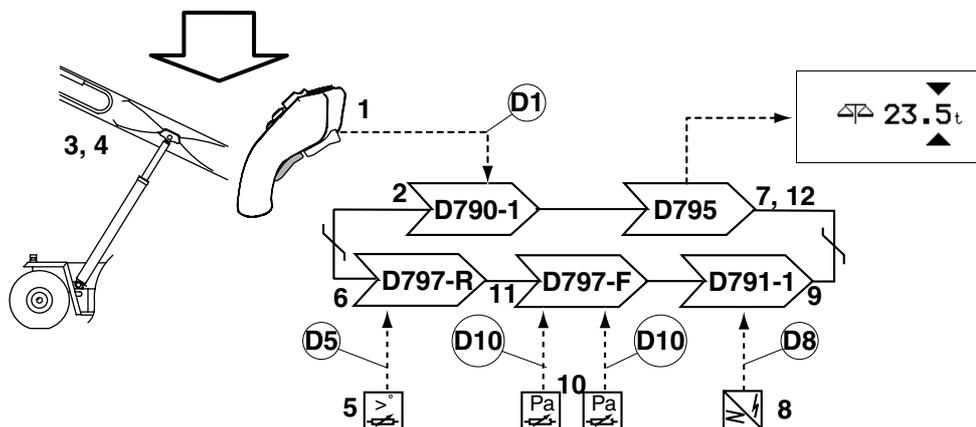
#### Dynamic scale

The dynamic scale weighs the load regardless of position. The weight is calculated as a function of boom angle, boom length and the pressure in the lift cylinders. The dynamic scale uses Sensor hydraulic pressure lift cylinder, Sensor boom angle (analogue sensor) and Sensor boom length (analogue sensor).

### Weight indicator, function description (product alternative fixed scale)



Condition	Reference value	Reference
Control switch	Disengaged	Tab 11 <i>Common electric</i> , group 11.5.1.4 <i>Manoeuvre switch voltage</i>



006890

Pos	Explanation	Signal description	Reference
1	The pistol trigger on the control lever sends voltage signal to Control unit cab (D790-1).	$U_{S815/T4} = 24 \text{ V}$	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i> D1: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.9.2 <i>ATTACH</i> , menu 2
2	Control unit cab (D790-1) sends weighing activated on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
3	Boom is lowered to measuring position (when the boom is in measuring position, boom lowering is stopped automatically).	-	<i>Lift and lower</i> , function description page 11
4	The boom is operated to 60 cm extension (when the boom is in measuring position, boom extension is stopped automatically).	-	<i>Extension</i> , function description page 32
5	Sensor boom angle (B771) sends voltage signal proportional to boom angle to Control unit frame rear (D797-R).	$U = 0,5-4,5 \text{ V}$	Tab 8 <i>Control system</i> , group 8.2.1.5 <i>Sensor boom angle</i> D5: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.10.4 <i>OP</i> , menu
6	Control unit frame rear (D797-R) sends boom angle on the CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i> D5: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.10.4 <i>OP</i> , menu

Pos	Explanation	Signal description	Reference
7	Control unit KID (D795) activates event menu fixed scale (flashing).	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>
8	Sensor boom length 60 cm (B7224) sends signal to Control unit attachment (D791-1).	U =24 V	Tab 8 <i>Control system</i> , group 8.2.1.6 <i>Sensor boom length</i>  D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.9.5 <i>ATTACH</i> , menu 5
9	Control unit attachment (D791-1) sends Boom length 60 cm on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i>  D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.9.5 <i>ATTACH</i> , menu 5
10	Sensor hydraulic pressure lift cylinder piston side left (B768-L1) and Sensor hydraulic pressure lift cylinder piston side right side (B768-R1) send voltage signal to Control unit frame front (D797-F).	U = 0.5 - 4.5 V	<i>Sensor hydraulic pressure lift cylinder, description page 28</i>  D10: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.10.3 <i>OP</i> , menu 3
11	Control unit frame front (D797-F) sends weight information on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i>
12	Control unit KID (D795) updates weight information in the display (fixed light).	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>



Pos	Explanation	Signal description	Reference
6	Sensor hydraulic pressure lift cylinder piston side left (B768-12), Sensor hydraulic pressure lift cylinder rod side left (B768-11), Sensor hydraulic pressure lift cylinder piston side right (B768-10) and Sensor hydraulic pressure lift cylinder rod side right (B768-13) send voltage signals proportional to the hydraulic pressure in the lift cylinders to Control unit frame front (D797-F).	U = 0.5-4.5 V	<i>Sensor hydraulic pressure lift cylinder, description page 28</i> D6: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.10.3 <i>OP, menu 3</i>
7	Control unit frame front (D797-F) calculates and sends the weight on the CAN-bus The weight is calculated with a machine-unique load curve based on sensor values for boom angle, boom length, and pressure in the lift cylinders.  <b>NOTE</b> <i>The load curve is unique to each machine.</i>	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i>
8	Control unit KID (D795) shows weight information in the display.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>

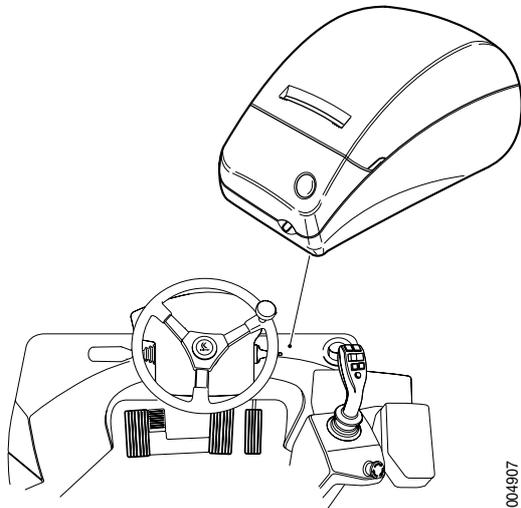
### Printer, description



Printer is an option to the function dynamic scale that makes it possible to save weights and print out lists of saved weights.

The printer is connected to Control unit KID (D795) and is located on the instrument panel on the right side of the steering wheel.

The printer is controlled via Operating menu printer in the display, where the operator selects which weights shall be saved and what is to be printed.



Position printer

004907

## 7.10.2.1 Sensor hydraulic pressure lifting cylinder

### Sensor hydraulic pressure lift cylinder, general

See *Sensor hydraulic pressure lift cylinder, description page 28*.

**7.10.2.2      Sensor boom angle****Sensor boom angle, general**

See section 8 *Control and monitoring system*, group 8.2.1.2 *Sensor boom angle*.

**7.10.2.3      Sensor boom length****Sensor boom length, general**

See section 8 *Control and monitoring system*, group 8.2.1.3 *Sensor boom length*.

### 7.10.3 Container counter

#### Container counter, description



The container counter counts the number of lifted containers. The counter has two counting units that can be reset separately. The container counter counts in different ways depending on if top lift (twistlocks) or bottom lift (lift legs) is used.

#### Top lift

The container counter counts lift when alignment disappears with locked twistlocks and twistlocks do not open within 8 seconds.

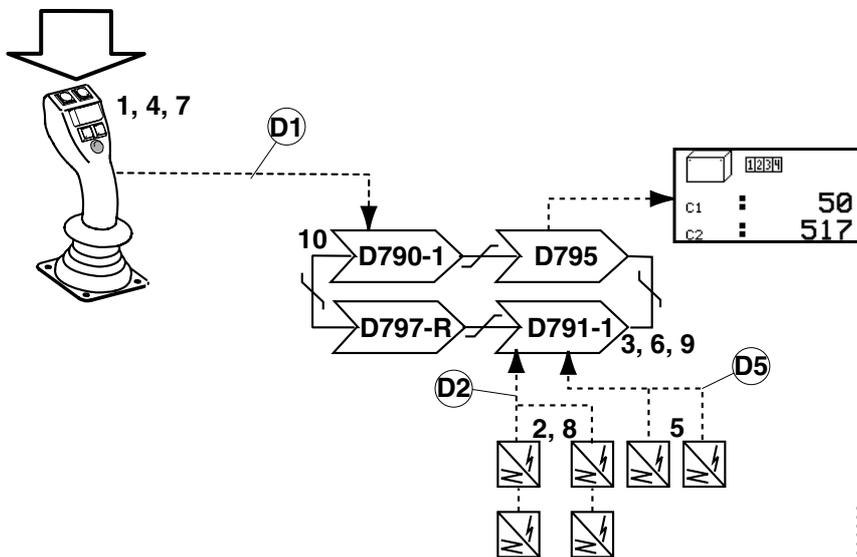
#### Bottom lift

The container counter counts lift when the clamping function is activated and lift is started, and release of clamping position is not activated within 10 seconds.

#### Container counter, function description (product alternative top lift)



Condition	Reference value	Reference
Control switch	Disengaged	Tab 11 Common electric, group 11.5.1.4 Manoeuvre switch voltage

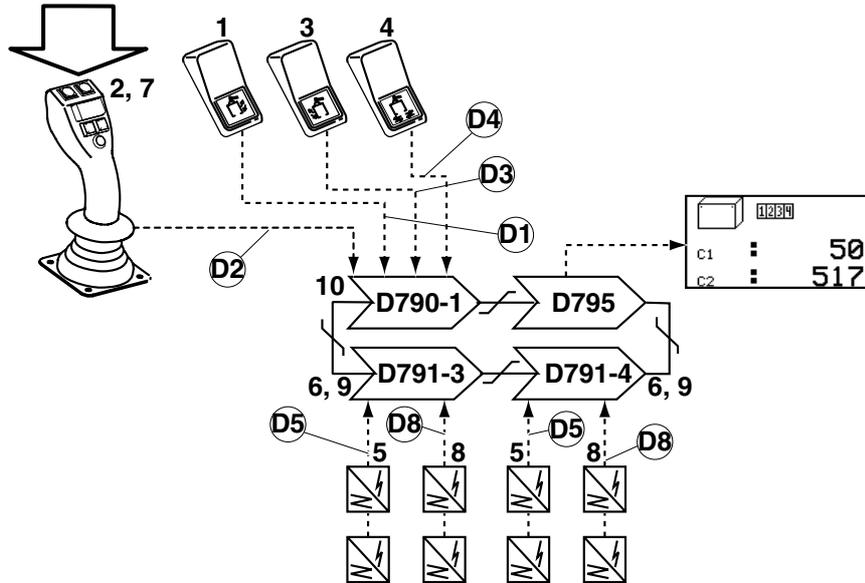


Pos	Explanation	Signal description	Reference
1	The attachment is positioned over a container with the functions 7.2 <i>Lift and lower</i> as well as 7.3 <i>Extension</i> .	-	<i>Lift and lower, function description page 11</i> <i>Extension, function description page 32</i> D1: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.8.1 <i>BOOM</i> , menu 1
2	Sensor alignment left front (7202L), Sensor alignment right front (7202R), Sensor alignment left rear (Y7203L) Sensor alignment right rear (Y7203R) send voltage signal to Control unit attachment (D791-1).	Sensor directly opposite indicator plate: U = 24 V	<i>Sensor alignment, description page 120</i> D2: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.9.6 <i>ATTACH</i> , menu 6
3	Control unit attachment (D791-1) sends alignment on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i>
4	Twistlocks are turned to locked position and close with the function 7.9.1 <i>Twistlocks</i> .	-	<i>Twistlocks, function description page 112</i>
5	Sensor locked twistlocks left (B7205L) and Sensor locked twistlocks right (B7205R) send voltage signal to Control unit attachment (D791-1).	Sensor directly opposite indicator plate: U = 24 V	<i>Sensor twistlocks, description page 121</i> D5: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.9.7 <i>ATTACH</i> , menu 7
6	Control unit attachment (D791-1) sends locked twistlocks on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i>
7	The container is lifted with the function 7.2 <i>Lift and lower</i> .	-	<i>Lift and lower, function description page 11</i>
8	Sensor alignment left front (7202L), Sensor alignment right front (7202R), Sensor alignment left rear (Y7203L) Sensor alignment right rear (Y7203R) <b>stop</b> sending voltage signal to Control unit attachment (D791-1).	U = 0 V	<i>Sensor alignment, description page 120</i> D2: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.9.6 <i>ATTACH</i> , menu 6
9	Control unit attachment (D791-1) sends no alignment on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i>
10	If twistlocks remain locked for 8 seconds then Control unit cab (D790-1) counts up a lift for the container counter.	-	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>

**Container counter, function description (product alternative bottom lift)**



Condition	Reference value	Reference
Control switch	Disengaged	Section 11 <i>Common electrical</i> , group 11.5.1.4 <i>Control breaker voltage (15E)</i>



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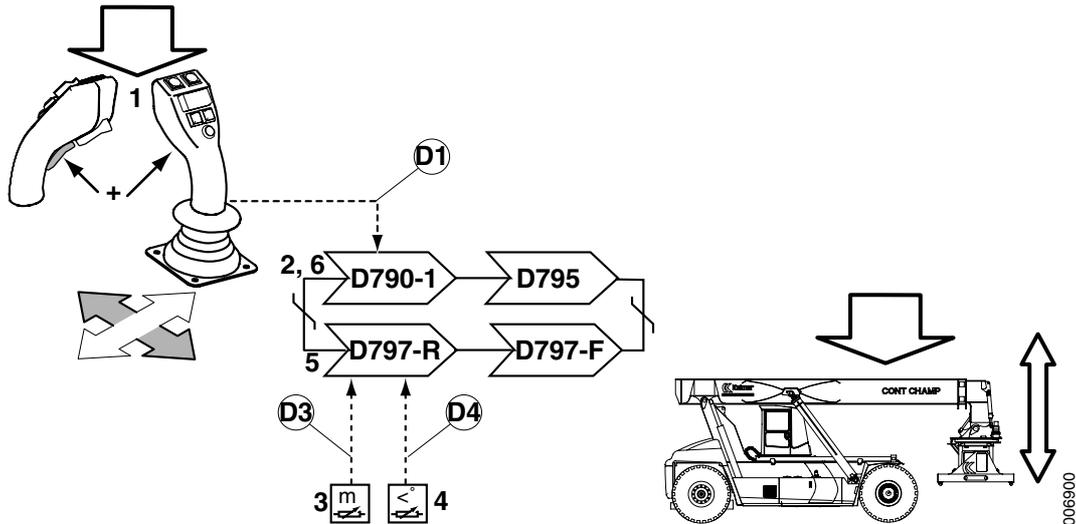
Pos	Explanation	Signal description	Reference
1	The attachment's rear lift legs are lowered to operating position with the function 7.9.2 <i>Lift legs</i> .	-	<i>Raising/lowering of rear lift legs, function description page 128</i>  D1: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 1
2	The attachment is positioned over a container with the functions 7.2 <i>Lift and lower</i> as well as 7.3 <i>Extension</i> .	-	<i>Lift and lower, function description page 11</i> <i>Extension, function description page 32</i>  D2: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.8.1 <i>BOOM</i> , menu 1
3	The front lift legs are lowered with the function 7.9.2 <i>Lift legs</i> .	-	<i>Raising/lowering of front lift legs, function description page 124</i>  D3: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 1
4	The lift legs clamp around the container with the function 7.9.2 <i>Lift legs</i> .	-	<i>Clamp with left legs, function description page 133</i>  D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.1 <i>COMBI</i> , menu 1

<b>Pos</b>	<b>Explanation</b>	<b>Signal description</b>	<b>Reference</b>
5	<p>Sensor clamping position front leg left (B7215L) and Sensor clamping position rear leg left (B7216L) send voltage signal to Control unit attachment left legs (D791-3).</p> <p>Sensor clamping position front leg right (B7215R) and Sensor clamping position rear leg right (B7216R) send voltage signal to Control unit attachment right leg pair (D791-4).</p>	Sensor directly opposite indicator plate: U = 24 V	<p><i>Sensor clamping position, description page 152</i></p> <p>D5: Diagnostic menu, see section 8 <i>Control and monitoring system</i>, group 8.4.11.1 <i>COMBI</i>, menu 2</p>
6	Control unit attachment left legs (D791-3) and Control unit attachment right leg pair (D791-4) send clamping position lift legs on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	<p>Tab 11 <i>Common electric</i>, group 11.5.3.7 <i>Control unit attachment left legs</i></p> <p>Tab 11 <i>Common electric</i>, group 11.5.3.8 <i>Control unit attachment right legs</i></p>
7	The container is lifted with the function 7.2 <i>Lift and lower</i> .	-	<i>Lift and lower, function description page 11</i>
8	<p>Sensor alignment front leg left (B7213L) and Sensor alignment rear leg left (B7214L) send voltage signal to Control unit attachment left leg pair (D791-3).</p> <p>Sensor alignment front leg right (B7213R) and Sensor alignment rear leg right (B7214R) send voltage signal to Control unit attachment right leg pair (D791-4).</p>	Sensor directly opposite indicator plate: U = 24 V	<p><i>Sensor alignment, description page 151</i></p> <p>D8: Diagnostic menu, see section 8 <i>Control and monitoring system</i>, group 8.4.11.1 <i>COMBI</i>, menu 3</p>
9	Control unit attachment (D791-1) sends alignment on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i>
10	If clamping position remains to be active for 10 seconds then Control unit cab (D790-1) counts up one bottom lift for the container counter.	-	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i>

## 7.10.4 Synchronous lift

### Synchronous lift, function description

Condition	Reference value	Reference
Control switch	Disengaged	Tab 11 <i>Common electric</i> , group 11.5.1.4 <i>Manoeuvre switch voltage</i>
 Height limitation	By-passed or boom height lower than height limitation	Tab 8 <i>Control system</i> , group 8.2.4 <i>Height limitation</i>



Pos	Explanation	Signal description	Reference
1	The control lever for lift or lower and pistol trigger send voltage to Control unit cab (D790-1).	Lower: $U_{S815/P1} = 0.5-2.0 \text{ V}$ Lift: $U_{S815/P1} = 3.0-4.5 \text{ V}$ Pistol trigger: $U_{S815/T4} = 24 \text{ V}$	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i> D1: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.8.1 <i>BOOM</i> , menu 1 and 8.4.9.2 <i>ATTACH</i> , menu 2
2	Control unit cab (D790-1) sends synchronized lift on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
3	Sensor boom angle (B771) sends voltage signal to Control unit frame rear (D797-R).	$U = 0.5-4.5 \text{ V}$	Tab 8 <i>Control system</i> , group 8.2.1.5 <i>Sensor boom angle</i> D3: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.10.1 <i>OP</i> , menu 1
4	Sensor boom length (B777) sends voltage signal to Control unit frame rear (D797-R).	$U = 0.5-4.5 \text{ V}$	Tab 8 <i>Control system</i> , group 8.2.1.6 <i>Sensor boom length</i> D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.10.4 <i>OP</i> , menu 4

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<b>Pos</b>	<b>Explanation</b>	<b>Signal description</b>	<b>Reference</b>
5	Control unit frame rear (D797-R) sends length and angle information on CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i>
6	Control unit cab (D790-1) controls activates functions 7.2 <i>Lift and lower</i> as well as 7.3 <i>Extension</i> at the same time so that the lifting movement becomes vertical.	-	<i>Lift and lower</i> , function description page 11 <i>Extension</i> , function description page 32

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# 8 Control system

## Control and monitoring system, general

The machine's functions are electrically controlled in many cases. The signals which control the machine are monitored to warn the operator or limit the machine's functions in certain dangerous situations or if faults arise in the machine.

The function control and monitoring system is divided into the following functions:

- Monitoring functions
- Error codes
- Diagnostic test
- Settings
- Software

Monitoring functions describes the machine's monitoring functions that warn the operator or limit the machine's functions in the event of any dangerous situations.

Error codes notify operators and mechanics when malfunctions have been detected.

The diagnostic test is a tool to perform service and troubleshooting using menus in the machine's display.

Settings is the tool for setting and adapting the machine's functions.

The software creates the functions in the control and monitoring system.

## 8.1 Controls and instrumentation

### 8.1.4 Switch by-passing of load centre limitation and height limitation

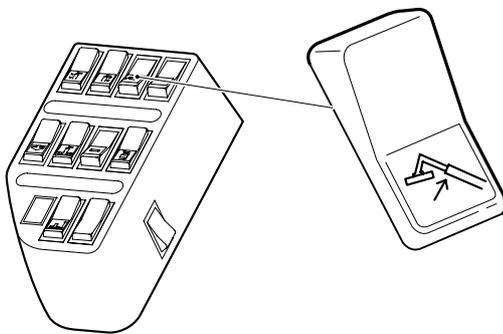
#### Switch by-passing height limitation, description



Switch by-passing height limitation (S1015) by-passes height limitation and makes it possible to raise the boom over the limit for height limitation. See *Height limitation, description page 16*.

The switch is supplied with voltage from and sends a voltage signal to Control unit, cab (D790-1) when the switch is activated.

The signals can be checked from the diagnostic menu, see *section 8 Control and monitoring system, group 8.4.9.3 ATTACH, menu 3*.



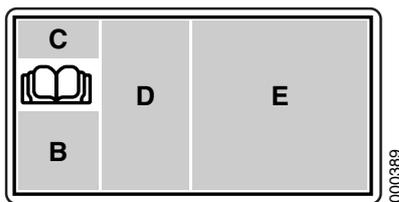
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#### 8.1.10 Error code menu

##### Error code menu, description

The control and monitoring system's display is divided into four fields where information is shown (see figure to the left).

- Field B: Error code level shown with a symbol.
- Field C: Indicates error code.
- Field D: Indicates type of error.
- Field E: Indicates which function is affected by error code.
- The book symbol means that there's information in the operator's manual.



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##### Field B: Error code level

The control and monitoring system gives error code information in three levels which are indicated with a symbol in the lower left corner (B) on the display unit.

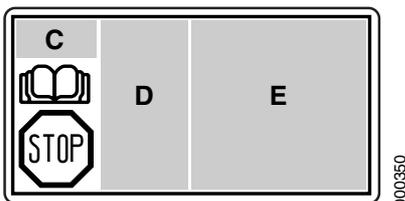
- Stop
 

Indicates a serious malfunction that may affect operator safety or cause machine breakdown. The error code must be taken care of immediately. Stop working with the machine and contact service immediately.

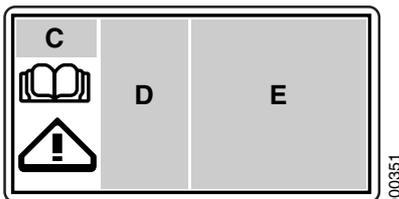
The error code is shown automatically on the display.
- Warning
 

Indicates machine malfunction that should be taken care of as soon as possible. At the end of the work shift with the machine, contact service as soon as possible.

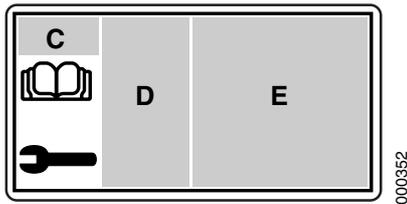
The error code is shown automatically on the display.



000350



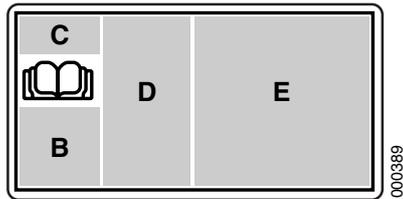
000351



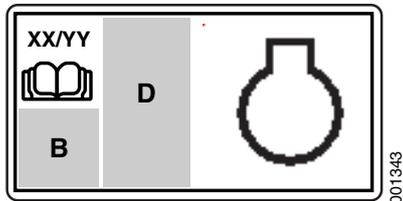
- Information  
Information to the operator that something should be taken care of as soon as possible, e.g., defective light bulb. Take action to fix the cause of the error code as soon as possible.  
The error code is stored in the error code list under operating menu for service.

**Field C: Error code number**

The control and monitoring system gives error codes from three sub-systems:



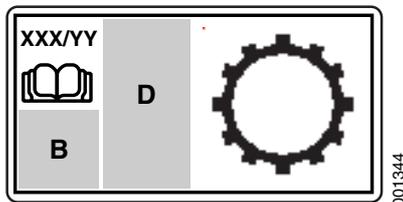
- Machine:  
Shown with error code number XXX on display.



- Engine:  
Shown with error code number XXX/YY on display.

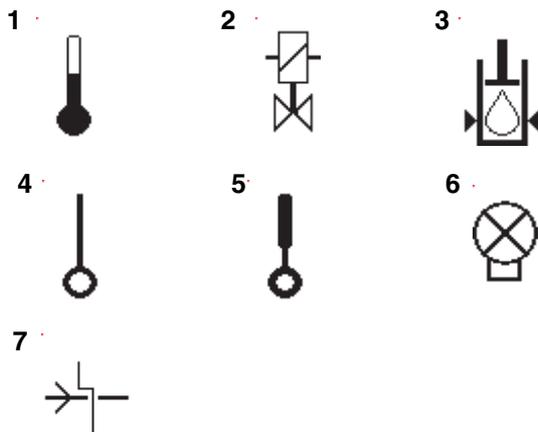
**NOTE**

*If several error codes come from the engine, the error code level is shown for the most serious error code.*

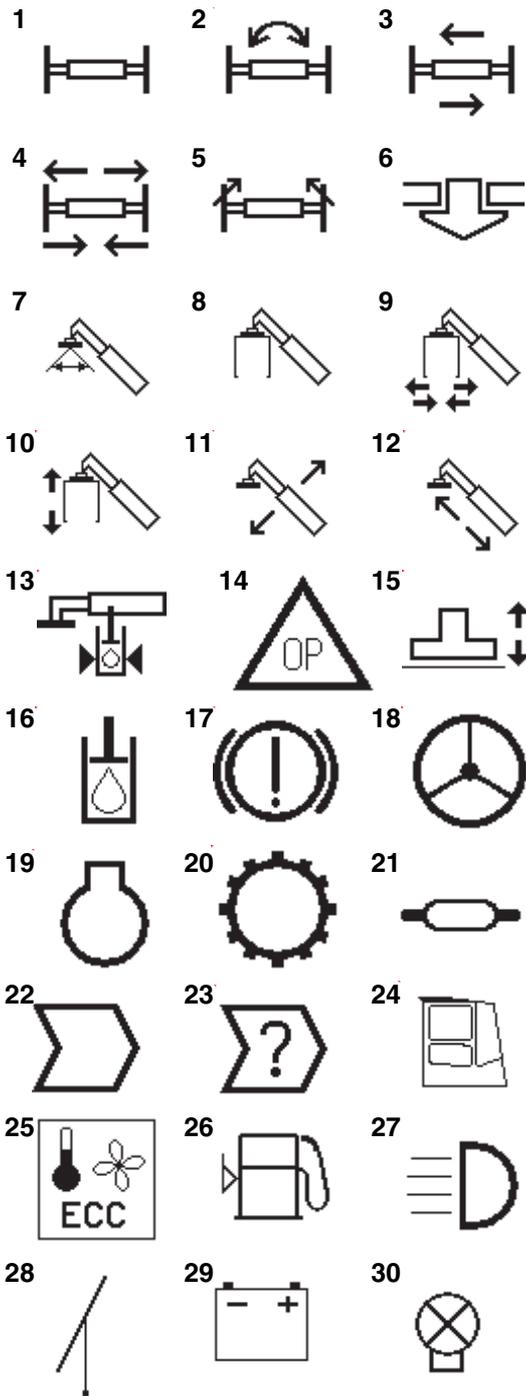


- Transmission:  
Shown with error code number XX/YY on display.

**Field D: Type of error**



1. Temperature too high/too low.
2. Incorrect signal to solenoid valve.
3. Incorrect hydraulic pressure.
4. Incorrect sensor signal.
5. Incorrect signal from control.
6. Incorrect signal to bulb.
7. Incorrect signal, for example, open circuit.

**Field E: Affected function**

1. Attachment
2. Rotation of attachment
3. Sideshift attachment
4. Length adjustment attachment
5. Leveling attachment
6. Twistlocks
7. Tilt attachment
8. Bottom lift attachment
9. Bottom lift attachment, clamping position
10. Bottom lift attachment, legs up/down
11. Boom up/down
12. Boom in/out
13. Pressure sensor lift cylinder (overload system, OP)
14. If overload system not installed
15. Support jacks up/down
16. Hydraulic functions
17. Brake system
18. Steering
19. Engine
20. Transmission
21. Central lubrication
22. Control unit
23. Hardware-related error
24. Cab
25. Climate control unit
26. Fuel system
27. Headlights
28. Windshield wipers
29. Battery voltage
30. Bulb for lighting

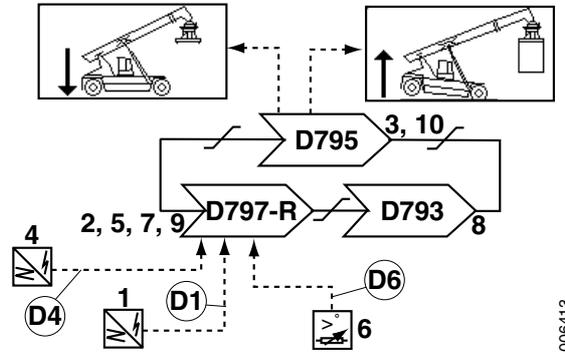
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## 8.2 Monitoring

### 8.2.1 Overloading system

#### 8.2.1.1 Mechanical overloading system

##### Mechanical overload system, function description



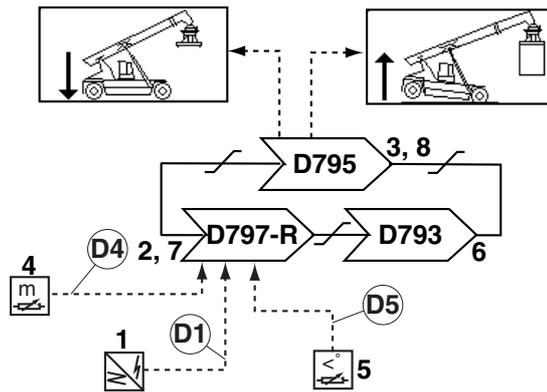
006413

Pos	Explanation	Signal description	Reference
1	Sensor steering axle load (B7221) sends a voltage signal to Control unit frame rear (D797-R) if the load on the steering axle is low.	Normal: U = 24 V Overload: U = 0 V	<i>Sensor steering axle load, description page 11</i> D1: Diagnostic menu, see section 8 Control and monitoring system group 8.4.10.1 OP, menu 1
2	Control unit frame rear (D797-R) sends "Overload forward" on the CAN-bus.	Checked by control and monitoring system, error indicated with error code.	Tab 11 Common electric, group 11.5.3.3 Control unit frame rear
3	Control unit KID (D795) shows event menu overload forward	-	Tab 11 Common electric, group 11.5.3.12 Control unit KID
4	Position sensor boom length 1.5 m (B777) sends voltage signal to Control unit frame rear (D797-R) if the boom's extension is shorter than 1.5 m.	Extension less than 1.5 m: U = 24 V Extension more than 1.5 m: U = 0 V	<i>Sensor boom length, description (position sensor) page 13</i> D4: Diagnostic menu, see section 8 Control and monitoring system group 8.4.10.1 OP, menu 1
5	Control unit frame rear (D797-R) sends "boom length less than 1.5 m" on the CAN-bus.	Checked by control and monitoring system, error indicated with error code.	Tab 11 Common electric, group 11.5.3.3 Control unit frame rear
6	Sensor boom angle (B771) sends voltage signal proportional to boom angle to Control unit frame rear (D797-R).	$U_{B771/1} = 5 \text{ V}$ $U_{B771/2} = 0 \text{ V}$ $U_{B771/3} = 0.5 - 4.5 \text{ V}$	<i>Sensor boom angle, description (angle sensor) page 12</i> D6: Diagnostic menu, see section 8 Control and monitoring system group 8.4.10.4 OP, menu 4
7	Control unit frame rear (D797-R) sends "boom angle" on the CAN-bus.	Checked by control and monitoring system, error indicated with error code.	Tab 11 Common electric, group 11.5.3.3 Control unit frame rear

Pos	Explanation	Signal description	Reference
8	Control unit transmission (D793) sends speed information on the CAN-bus.	Checked by control and monitoring system, error indicated with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.9 <i>Control unit transmission</i>
9	If both Position sensor boom length 1.5 m (B777) sends voltage signal and boom angle is greater than 35° at the same time as the machine is operated faster than 10 km/h, Control unit frame rear (D797-R) sends "Overload on steering axle" on the CAN-bus.	Checked by control and monitoring system, error indicated with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i>
10	Control unit KID (D795) activates event menu overload on steering axle.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>

### 8.2.1.2 Mechanical overloading system with analogue sensors

#### Mechanical overload system with analogue sensors, function description



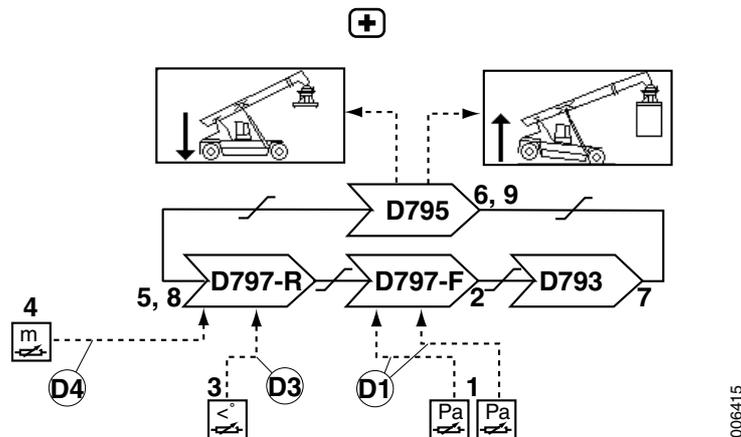
006414

Pos	Explanation	Signal description	Reference
1	Sensor steering axle load (B7221) sends a voltage signal to Control unit frame rear (D797-R) if the load on the steering axle is low.	Normal: U = 24 V Overload: U = 0 V	<i>Sensor steering axle load, description page 11</i> D1: Diagnostic menu, see section 8 <i>Control and monitoring system</i> group 8.4.10.1 <i>OP, menu 1</i>
2	Control unit frame rear (D797-R) sends "Overload forward" on the CAN-bus.	Checked by control and monitoring system, error indicated with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i>
3	Control unit KID (D795) activates event menu overload forward	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>
4	Sensor boom length (R777) sends voltage signal proportional to boom length to Control unit frame rear (D797-R).	$U_{B777/1} = 5\text{ V}$ $U_{B777/2} = 0\text{ V}$ $U_{B777/3} = 0.5 - 4.5\text{ V}$	<i>Sensor boom length, description (analogue sensor) page 14</i> D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> group 8.4.10.4 <i>OP, menu 4</i>

Pos	Explanation	Signal description	Reference
5	Sensor boom angle (R771) sends voltage signal proportional to boom angle to Control unit frame rear (D797-R).	$U_{B771/1} = 5\text{ V}$ $U_{B771/2} = 0\text{ V}$ $U_{B771/3} = 0.5 - 4.5\text{ V}$	<i>Sensor boom angle, description (angle sensor) page 12</i> D6: Diagnostic menu, see section 8 Control and monitoring system group 8.4.10.4 OP, menu 4
6	Control unit transmission (D793) sends speed information on the CAN-bus.	Checked by control and monitoring system, error indicated with error code.	Tab 11 Common electric, group 11.5.3.9 Control unit transmission
7	If the boom's length is less than 1.5 m and the boom's angle is greater than 35° at the same time as the machine is operated faster than 10 km/h, then Control unit frame rear (D797-R) sends "Overload forward on steering axle" on the CAN-bus.	Checked by control and monitoring system, error indicated with error code.	Tab 11 Common electric, group 11.5.3.3 Control unit frame rear
8	Control unit KID (D795) activates event menu overload on steering axle.	-	Tab 11 Common electric, group 11.5.3.12 Control unit KID

### 8.2.1.3 Electrical overloading system

#### Electrical overload system, function description



Pos	Explanation	Signal description	Reference
1	Sensor hydraulic pressure lift cylinder left (B768-L1 and B768-L2) sends voltage signal proportional to the pressure in left lift cylinder to Control unit frame front (D797-F).  Sensor hydraulic pressure lift cylinder right (B768-R1 and B768-R2) sends voltage signal proportional to the pressure in right lift cylinder to Control unit frame front (D797-F).	$U_{B768-??/1} = 5\text{ V}$ $U_{B768-??/2} = 0\text{ V}$ $U_{B768-??/3} = 0.5 - 4.5\text{ V}$	Tab 8 Control system, group 8.2.1.7 Sensor hydraulic pressure lifting cylinder D1: Diagnostic menu, see section 8 Control and monitoring system group 8.4.10.3 OP, menu 3

Pos	Explanation	Signal description	Reference
2	Control unit frame front (D797-F) sends pressure information on the CAN-bus.	Checked by control and monitoring system, error indicated with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i>
3	Sensor boom length (B777) sends voltage signal proportional to boom length to Control unit frame rear (D797-R).  Alternatively for Sensor boom length (B777) there may be a position sensor for no or max. boom extension.	$U_{B777/1} = 5\text{ V}$ $U_{B777/2} = 0\text{ V}$ $U_{B777/3} = 0.5 - 4.5\text{ V}$	Tab 8 <i>Control system</i> , group 8.2.1.6 <i>Sensor boom length</i>  D3: Diagnostic menu, see section 8 <i>Control and monitoring system</i> group 8.4.10.4 <i>OP</i> , menu 4
4	Sensor boom angle (BR771) sends voltage signal proportional to boom angle to Control unit frame rear (D797-R).	$U_{B771/1} = 5\text{ V}$ $U_{B771/2} = 0\text{ V}$ $U_{B771/3} = 0.5 - 4.5\text{ V}$	Tab 8 <i>Control system</i> , group 8.2.1.5 <i>Sensor boom angle</i>  D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> group 8.4.10.4 <i>OP</i> , menu 4
5	Control unit frame front (D797-F) and sends the weight is calculated and compared with a machine-unique load curve based on sensor values for boom angle, boom length, and pressure in the lift cylinders.  <b>NOTE</b> <i>The load curve is unique to each machine.</i>  If the load is high then Control unit frame front (D797-F) sends Overload forward on the CAN-bus.	Checked by control and monitoring system, error indicated with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i>
6	Control unit KID (D795) activates event menu for overload depending on load situation.	-	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>
7	Control unit transmission (D793) sends speed information on the CAN-bus.	Checked by control and monitoring system, error indicated with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.9 <i>Control unit transmission</i>
8	At overload on the steering axle, speed is gradually limited at increasing load.	Checked by control and monitoring system, error indicated with error code	

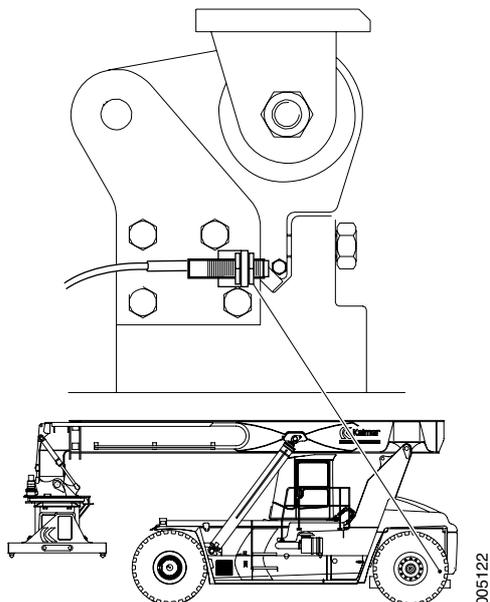
### 8.2.1.4 Sensor load steering axle

#### Sensor steering axle load, description

Sensor steering axle load (B7221L and B7221R) senses when the steering axle's rear suspension springs out. The sensors are located on each side of the steering axle's rear mounting.

Sensor steering axle load are inductive position sensors that are supplied with voltage by and sends voltage signal to Control unit frame rear (D797-R).

The sensors' signals can be checked with the diagnostic menu, see *section 8 Control and monitoring system, group 8.4.10.1 OP, menu 1.*



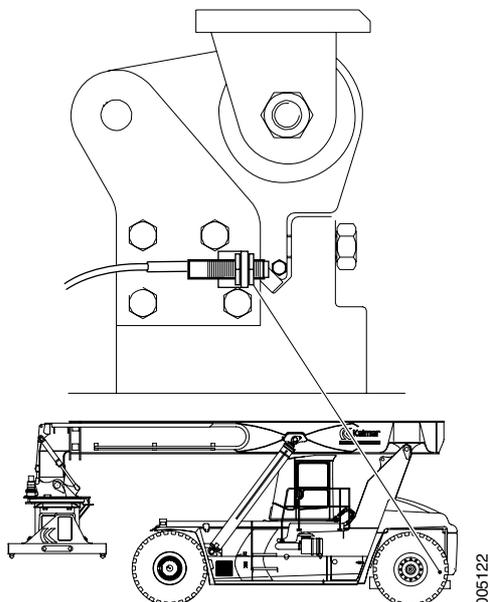
Position Sensor steering axle load (B7221L) and (B7221R)

#### Position sensor, checking and adjustment

See *tab 7 Load handling.*

#### Sensor, steering axle load, replacement

- 1 Machine in service position
- 2 Replace the sensor.
- 3 Adjust the position of the sensor, see *tab 7 Load handling.*
- 4 Turn on the main electric power and turn the start key to position I.
- 5 Check the overload protection, see *tab 8 Control system, group 8.2.1 Overloading system.*



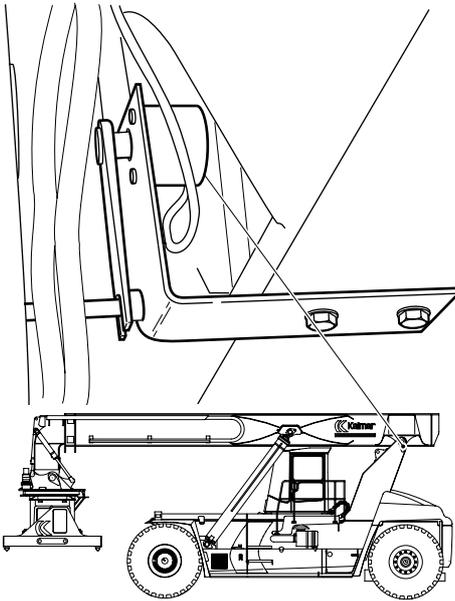
### 8.2.1.5 Sensor boom angle

#### Sensor boom angle, description (angle sensor)

The boom's angle is measured by a sensor that senses the boom's angle in relation to the frame. The sensor consists of a sensor housing, potentiometer, and arm. The sensor housing is installed on the boom. The arm is connected to the frame and turns the potentiometer when the boom is angled.

The sensor is supplied with voltage and sends a signal proportional to the angle to the Control unit frame rear (D797-R).

The signal can be checked from the diagnostic menu, see section *8 Control and monitoring system*, group *8.4.10.4 OP, menu 4*.

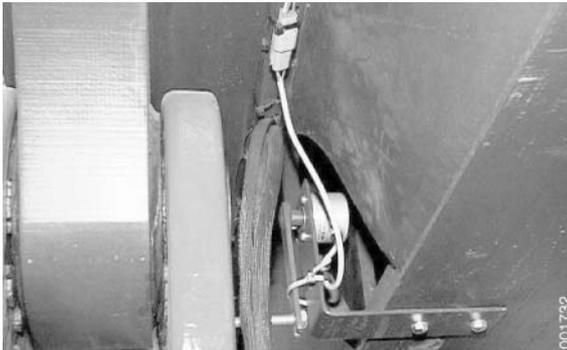


Sensor, boom angle (B771)

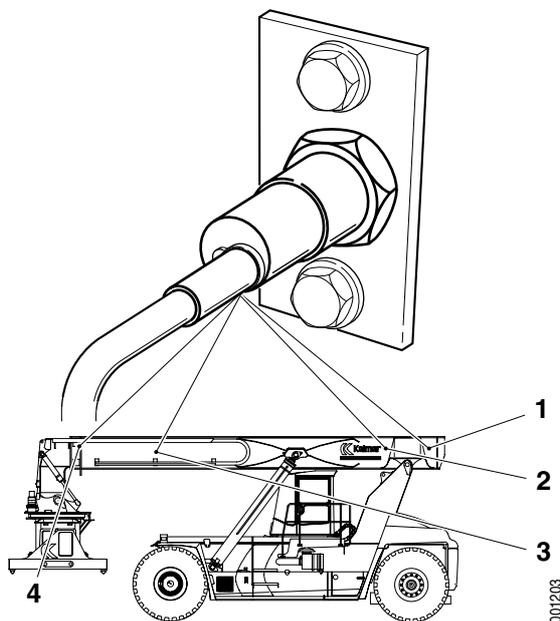
001093

#### Sensor boom angle, replacement (angle sensor)

- 1 Machine in service position, see tab *B Safety*.
- 2 Replace the sensor.
- 3 Turn on the main electric power and turn the start key to position I.
- 4 Calibrate sensor, boom angle, see *Weight indicator, calibrating (product alternative dynamic scale) page 180*.
- 5 Check that the end position damping is working in both outer and inner end positions.



001732



1. Position sensor, damping boom in (B769-3)
2. Position sensor 1.5 m (B777)
3. Position sensor, damping boom out (B769-4)
4. Position sensor, boom length 60 cm (B7224) 

### 8.2.1.6 Sensor boom length

#### Sensor boom length, description (position sensor)

Sensor boom length specifies the boom's extension and is available in two versions, position sensors or analogue sensors. Standard is three inductive position sensors. As an option there is an extra position sensor for fixed scale (60 cm extension).

Two inductive sensors, sensor damping boom in (B769-3) and sensor damping boom out (769-4), are used to control the damping of boom in and boom out. The sensors are located on the right side of the boom's outer part.

The sensors are supplied with voltage and a negative signal (grounds) to Control unit frame rear (D797-R) when the boom's indicator plate passes the sensor. Each sensor has a light-emitting diode that is activated when sensors sense the indicator plate. The light-emitting diodes can be used to check the sensor's function.

Position sensor damping extension sends a signal when the boom is close to outer and inner end positions, this is used to activate damping, see section 7 *Load handling*, group 7.3 *Extension*. The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.8.8 *BOOM*, menu 8.

Position sensor boom length 1.5 m (B777) sends a signal when the boom's extension is 1.5 m. This signal is used for overload protection of the steering axle. The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.10.1 *OP*, menu 1.

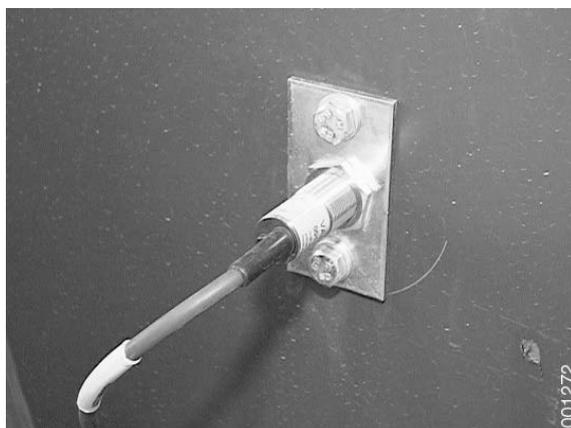
Position sensor boom length 60 cm (B7224) sends a signal when the boom's extension is in position for weighing on machines with fixed scale, see section 7 *Load handling*, group 7.10.2 *Weight indicator*. The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.9.5 *ATTACH*, menu 5.

#### Position sensor, checking and adjustment

See tab 7 *Load handling*.

#### Sensor boom length (position sensor), replacement

- 1 Machine in service position, see tab *B Safety*.
- 2 Replace the sensor.
- 3 Adjust the position of the sensor, see tab 7 *Load handling*.
- 4 Check that the end position damping is working in both outer and inner end positions.



### Sensor boom length, description (analogue sensor)

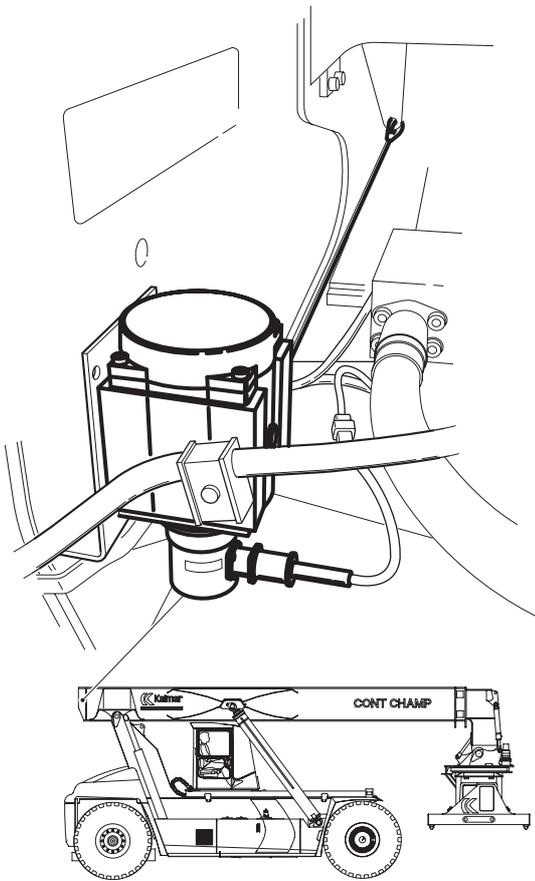


Sensor boom length (R777) senses the lift boom's extension and is located in the rear edge of the boom on the left-hand side.

The sensor is connected to a spring-loaded wire that is connected to a rotary potentiometer via a gearbox. The wire is connected to the inner boom. When the boom is extended, the wire affects the potentiometer and the signal changes.

The sensor is supplied with voltage by and sends voltage signal proportional to Control unit, frame rear (D797-R).

The signal can be checked from the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.10.4 *OP*, menu 4.

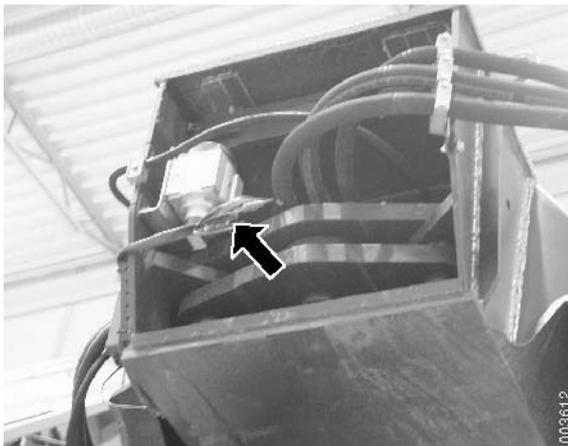


Sensor boom length (R777)

### Sensor boom length (analogue sensor), replacement



- 1 Machine in service position, see tab *B Safety*.
- 2 Replace the sensor.
- 3 Turn on the main electric power and turn the start key to position I.
- 4 Calibrate sensor, see *Weight indicator, calibrating (product alternative dynamic scale) page 180*
- 5 Check that the end position damping is working in both the outer and the inner end positions.



## 8.2.1.7 Sensor hydraulic pressure lifting cylinder

### Sensor hydraulic pressure lift cylinder, general

See section 7 *Load handling*, group 7.2.9 *Sensor hydraulic pressure lift cylinder*.

## 8.2.2 By-passing

### By-passing, description

When the overload system engages and turns off the hydraulic controls, it might occur in a situation where it is necessary to by-pass the safety system.

By-pass is activated with a switch, there is one to three switches depending on the machine's equipment:

- Switch by-pass
- Switch by-passing height limitation 
- Switch rotation stop 

By-passing the safety system makes it possible to:

- lowering of load at overload
- locking and opening twistlocks without full alignment
- Spreading 20'-40' with locked twistlocks
- bottom lift without full alignment
- manual control of recirculation damper for ECC or EHC
- release of parking brake in case of malfunction of switch parking brake
- lift above height limitation
- rotation past rotation stop
- load handling past limitation for load centre limitation.
- lifting, lowering and extension with active error on the overload system



## DANGER

**By-passing the safety systems results in risk of tipping forward, use at your own risk.**

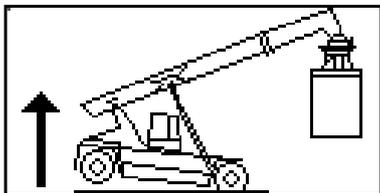
## 8.2.3 Load centre limitation

### Load centre limitation, description



Load-centre limitation prevents the load from being moved to close to the machine. Load-centre limitation is controlled by the control and monitoring system with signals from Sensor boom angle, see *Sensor boom angle, description (angle sensor) page 12* and Sensor boom length, see *Sensor boom length, description (analogue sensor) page 14*. This is used, e.g., in connection with cab lift to prevent the container from damaging the cab.

For details on lift and lower or extension, see tab 7 *Load handling*, group 7.2 *Lifting/lowering* and tab 7 *Load handling*, group 7.3 *Protruding*.



000358

Event menu load-centre limitation.

Load-centre limitation reaches its limit, synchronized lift is activated (see tab 7 *Load handling*, group 7.10.4 *Synchronous lift*) this function can be by-passed temporarily with switch by-passing (see *By-passing*, description page 15).

The load-centre limitation's values can be checked with the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.10.5 *OP*, menu 5.

## 8.2.4 Height limitation

### Height limitation, description



Height limitation is a part of the control and monitoring system and prevents the machine from lifting higher than a pre-set height without the operator being informed.

Height limitation is controlled by the control and monitoring system with signals from Sensor boom angle and Sensor boom length. When boom angle and extension indicate that permitted height is reached, lift and extension are blocked, and display information height limitation is also activated.

For details on lift and lower or extension, see tab 7 *Load handling*, group 7.2 *Lifting/lowering* and tab 7 *Load handling*, group 7.3 *Protruding*.

Height limitation can be by-passed temporarily with Switch by-passing of load-centre and height limitation (S1015), see *Switch by-passing height limitation*, description page 4.

The height limitation's signals can be checked with the diagnostic menu, see section 8 *Control and monitoring system*, group 8.4.10.6 *OP*, menu 6.

## 8.2.5 Speed limitation

### Speed limitation, description



Speed limitation prevents the machine's speed from exceeding pre-set value by limiting gear position and engine rpm.

Setting of speed limitation is done with initiation menu, see section 8 *Control and monitoring system* group 8.5.1.5 *INIT DRIVETRAIN*, menu 9.

## 8.2.6 Service indicator

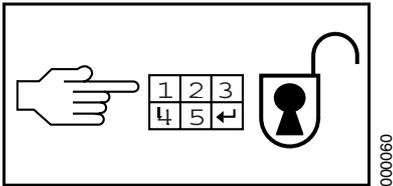
### Service indicator, resetting



- 1 Machine in service position, see tab *B Safety*.
- 2 Navigate first to the service menu and press Enter.



000056



000000

SERVICE INTERVALL	
NEXT SERVICE	XXXXh
SERVICE INTERVALL	
STORED	XXXXh
PRESENT	XXXXh

004908

- 3 Enter code for resetting service indicator.  
The code is obtained via Kalmar Industries Support.

### NOTE

*The code determines which service menu shall be activated (Service, Diagnostic test, Initiation or Calibration).*

- 4 Reset the service indication by pressing Enter. NEXT SERVICE is changed to given interval.

To change length of the service interval, set the desired interval with the plus and minus key.

DIAGNOSIS
<b>CAN/POWER</b> LIGHTS CAB
CLIMATE HYD ENGINE
TRANSM BOOM ATTACH
OP EXTRA HIST

000084

## 8.4 Diagnostics

### Diagnostic test, general

The machine has built-in functions for troubleshooting called diagnostic test. The diagnostic test consists of several menus shown on the display. The menus are grouped for faster access. The following pages describe the menu figures content and which functions that can be controlled.

The diagnostic test is divided into the following groups:

- Voltage feed and communication for the Control and monitoring system, *CAN/POWER*, description page 20.
- Lighting, *LIGHTS*, description page 39.
- Cab functions, *CAB*, description page 50.
- Climate control unit, *CLIMATE*, description page 58.
- Hydraulic functions, *HYD*, description page 65.
- Engine, *ENGINE*, description page 69.
- Transmission, *TRANSM*, description page 76.
- Boom functions, *BOOM*, description page 88.
- Attachment functions, *ATTACH*, description page 94.
- Overload system, *OP*, description page 115.
- Optional functions, *EXTRA*, description page 120.
  - Bottom lift, *COMBI*, menu 1 page 120.
  - Hydraulic sliding/cab lift and lower, *SLIDING CAB*, menu 1 page 136.
  - Support jacks, *SUPPORT JACKS*, menu 1 page 140
  - Mini-wheel or joystick, *EL-STEERING*, menu 1 page 143
- RMI (Remote Machine Interface), *RMI*, description page 147

### Diagnostic menu, description

Diagnostic tests show how the control units interpret input signals as well as which signals that the control units send.

	1	2	3	4	
7	DIAG	CAB	2	(10)	
6	FRONT WIPER SWITCH (1-3)		2		5
	OUTPUT		11		
	FEEDBACK		0		

004856

1. DIAG = Diagnostic menus
2. Menu group
3. Menu number
4. Total number of menus in loop
5. Signal value
6. Variable
7. Menu heading

DIAG	Indicates that diagnostic tests are selected.
Menu group	Indicates which menu group is selected, these groups are: <i>CAN/POWER, description page 20.</i> <i>LIGHTS, description page 39.</i> <i>CAB, description page 50.</i> <i>CLIMATE, description page 58.</i> <i>HYD, description page 65.</i> <i>ENGINE, description page 69.</i> <i>TRANSM, description page 76.</i> <i>BOOM, description page 88.</i> <i>ATTACH, description page 94.</i> <i>EXTRA, description page 120.</i>
Menu number	Number of current menu. Every menu group consists of several menus in a loop.
Number of menus	Total number of menus in group.
Variable	The signal that is measured. Different signals are designated in different ways: SWITCH: a digital input signal, e.g., a switch. OUTPUT: a digital output signal, e.g., feed to a motor. INPUT: an analogue input signal, e.g., from a sensor. REFERENCE: status for an analogue output signal. REQUIRED: triggered output signal for a control current FEEDBACK: either feedback signal from a motor or measured current on the minus side for an analogue output signal.
Signal value	Measurement value or status for signal for variable. On the same row there are different types that are interpreted in different ways. SWITCH: 1 or 0 where 1 means closed circuit. OUTPUT: two characters where the first number is 1 if the output signal is active. The second number is status for the circuit, 1=circuit OK, 0=open circuit or short-circuiting. INPUT: numerical value corresponding to the signal. REFERENCE: two characters where the first number is 1 if the input signal is active. The second number is status for the circuit, 1=circuit OK, 0=open circuit or short-circuiting. REQUIRED: numerical value corresponding to the signal. FEEDBACK: numerical value corresponding to the signal.
Menu heading	Description of the function for which the menu reads signals.

DIAGNOSIS
<b>CAN/POWER</b> LIGHTS CAB
CLIMATE HYD ENGINE
TRANSM BOOM ATTACH
OP EXTRA HIST

000084

DIAG CAN/POWER 1 (20)
PRESENT REDCAN STATUS
COMMUNICATION MODE X
NUMBERS OF UNITS X
SEGMENT ERROR X

003177

DIAG CAN/POWER 1 (20)
PRESENT REDCAN STATUS
COMMUNICATION MODE X
NUMBERS OF UNITS X
SEGMENT ERROR X

003177

## 8.4.1 CAN/POWER

### CAN/POWER, description

This group handles redundant voltage feed of control units as well as communication CAN bus.

Confirm selection with function key for Enter.

#### 8.4.1.1 CAN/POWER, menu 1

##### PRESENT REDCAN STATUS, COMMUNICATION MODE

Description: Indicates communications status for the redundant CAN-bus.

Circuit diagram: -

Connection: -

Function: 11.6.2 Redundant CAN-bus

Signal value:

3	Ok.
2	Segment check
0	Error.

##### PRESENT REDCAN STATUS, NUMBER OF UNITS

Description: Indicates number of nodes on the redundant CAN-bus that should be on the machine in question, excluding Control unit cab (D790-1) and Control unit KID (D795). (Control unit transmission (D793) and Control unit engine (D794) are connected to a separate CAN-bus and, therefore, are not counted).

Circuit diagram: Wiring CAN-BUS Opt. chassis KDU group 11.6, Wiring CAN-BUS ATT group 11.6

Connection: -

Function: 11.6.2 Redundant CAN-bus

Signal value:

X	Number of nodes that should be in the machine. Number of nodes dependent on installed options.
---	--

DIAG CAN/POWER	1 (20)
PRESENT REDCAN STATUS	
COMMUNICATION MODE	X
NUMBERS OF UNITS	X
SEGMENT ERROR	X

003177

**PRESENT REDCAN STATUS, SEGMENT ERROR**

Description: Indicates if there is open circuit on the redundant CAN-bus. And in that case, where the first open circuit is. If there is open circuit, it is indicated with a number that corresponds to the incorrect segment on the redundant CAN-bus.

Circuit diagram: Wiring CAN-BUS Opt. chassis KDU group 11.6, Wiring CAN-BUS ATT group 11.6

Connection: -

Function: 11.6.2 Redundant CAN-bus

Signal value:

0	No open circuit.
>0	If X is separated from 0, the first segment is indicated as missing contact. A 1 means that the first segment is incorrect, that is, that contact between first and second control unit is cut off.  To see which control units are on the machine and the order of these, the diagnostic menu is used <i>CAN/POWER, menu 2</i> , see <i>PRESENT REDCAN STATUS, RED.CON.CITIES page 21</i> .

**8.4.1.2 CAN/POWER, menu 2**

**PRESENT REDCAN STATUS, RED.CON.CITIES**

Description: Indicates which control units have contact with Control unit cab (D790-1) via the redundant CAN-bus. Note that certain control units are optional and may not be installed on the machine.

Circuit diagram: Wiring CAN-BUS Opt. chassis KDU group 11.6, Wiring CAN-BUS ATT group 11.6

Connection:

**D790-1:** K13:4, K13:5, K13:7 and K13:8

**D795:** K1:10, K1:11, K1:12 and K1:13

**D797-F, D797-R, D797-O, D791-1, D791-2, D791-2, D791-3, D797-4:** K2:2, K2:3, K2:4 and K2:5

Function: 11.5.3.1 Control unit cab, 11.5.3.2 Control unit frame front, 11.5.3.3 Control unit frame rear, 11.5.3.4 Control unit frame option, 11.5.3.5 Control unit attachment, 11.5.3.6 Control unit attachment option, 11.5.3.7 Control unit attachment left leg pair, 11.5.3.8 Control unit attachment right leg pair, 11.5.3.12 Control unit KID, 11.6.2 Redundant CAN-bus

Signal value:

1	Communication with the node is OK.
0	No communication and/or there is some node error.

Position 1: Control unit attachment (D791-1)

Position 2: Control unit attachment option (D791-2) 

DIAG CAN/POWER	2 (20)
PRESENT REDCAN STATUS	
RED.CON.CITIES	
XYXYXYXY	
1234ROFD	

000087

Position 3: Control unit attachment left legs (D791-3) 

Position 4: Control unit attachment right leg pair (D791-4) 

Position R: Control unit frame rear (D797-R)

Position O: Control unit frame option (D797-O) 

Position F: Control unit frame front (D797-F)

Position D: Control unit KID (D795)

### 8.4.1.3 CAN/POWER, menu 3

#### PRESENT DRIVE-TRAIN CAN BUS STATUS, ENGINE

Description: Indicates status for engine in drivetrain's CAN bus.

Circuit diagram: Wiring CAN-BUS Opt. chassis KDU group 11.6, Wiring Motor Volvo 1240&1250, group 1.0, Circuit engine Cummins group 1.0

Connection:

Volvo TWD1240VE: CAN J1939 from D790-1/K13:1 and K13:2 till D794/1 and 2

Volvo TAD1250VE: CAN J1939 from D790-1/K13:1 and K13:2 till D794/1 and 2

Cummins QSM11: CAN J1939 from D790-1/K13:1 and K13:2 till D794/46 and 37

Function: 11.6.3 Communication

Signal value:

DIAG CAN/POWER	3 (20)
PRESENT DRIVE-TRAIN CAN BUS STATUS	
ENGINE	X
TRANSMISSION	X

000088

1	Communication with the node is OK.
0	No communication and/or there is some node error.

#### NOTE

*The cable harness for CAN-bus drivetrain is common to nodes and transmission from electrical distribution box frame, in electrical distribution box frame the cable harness is branched. If communication is cut off with both engine and transmission, troubleshoot the cable harness between electrical distribution box cab and electrical distribution box frame first. If communication either engine or transmission, then defect in the cable harness between electrical distribution box cab and electrical distribution box frame excluded.*

<b>DIAG CAN/POWER 3 (20)</b>		000088
PRESENT DRIVE-TRAIN CAN BUS STATUS		
ENGINE	X	
TRANSMISSION	X	

### PRESENT DRIVE-TRAIN CAN BUS STATUS, TRANSMISSION

Description: Indicates status for transmission in drivetrain's CAN bus

Circuit diagram: Wiring CAN-BUS Opt. chassis KDU group 11.6, Circuit Dana TE32000 group 2.0

Connection: CAN J1939 from D790-1/K13:1 and K13:2 to D793/L2 and M2

Function: 11.6.3 Communication

Signal value:

1	Communication with the node is OK.
0	No communication and/or there is some node error.

### NOTE

*The cable harness for CAN-bus drivetrain is common to nodes and transmission from electrical distribution box frame, in electrical distribution box frame the cable harness is branched. If communication is cut off with both engine and transmission, troubleshoot the cable harness between electrical distribution box cab and electrical distribution box frame first. If communication either engine or transmission, then defect in the cable harness between electrical distribution box cab and electrical distribution box frame excluded.*

#### 8.4.1.4 CAN/POWER, menu 4

##### IGNITION, KEY IN

Description: Indicates if ignition is on (key in ignition).

Circuit diagram: Circuit Electric power group 11.5

Connection: signal from S150/15 to D790-1/K11:1

Function: 11.5.1.3 Ignition voltage

Signal value:

<b>DIAG CAN/POWER 4 (X)</b>		006859
INGNITION		
KEY IN	X	
RELAY K315-1	XY	
RELAY K315-2	XY	

1	Input signal active.
0	No signal.

<b>DIAG CAN/POWER</b>	<b>4 (X)</b>
IGNITION	
KEY IN	X
RELAY K315-1	XY
RELAY K315-2	XY

006859

**IGNITION, RELAY K315-1**

Description: Control current to Relay ignition voltage (K315-1), 15-voltage.

Circuit diagram: Circuit Electric power group 11.5

Connection: signal from D790-1/K10:10 to K315-1/86

Function: 11.5.1.3 Ignition voltage (15)

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

**IGNITION, RELAY K315-2**

Description: Control current to Relay ignition voltage (K315-2), 15-voltage.

Circuit diagram: Circuit Electric power group 11.5

Connection: signal from D790-1/K10:16 to K315-2

Function: 11.5.1.3 Ignition voltage (15)

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

<b>DIAG CAN/POWER</b>	<b>4 (X)</b>
IGNITION	
KEY IN	X
RELAY K315-1	XY
RELAY K315-2	XY

006859

<b>DIAG CAN/POWER</b>	<b>5 (X)</b>
EMERGENCY STOP, SW	X
RELAY K3009-1	XY
FEEDBACK	X
RELAY K3009-2	XY

0068960

<b>DIAG CAN/POWER</b>	<b>5 (X)</b>
EMERGENCY STOP, SW	X
RELAY K3009-1	XY
FEEDBACK	X
RELAY K3009-2	XY

0068960

<b>DIAG CAN/POWER</b>	<b>5 (X)</b>
EMERGENCY STOP, SW	X
RELAY K3009-1	XY
FEEDBACK	X
RELAY K3009-2	XY

0068960

### 8.4.1.5 CAN/POWER, menu 5

#### EMERGENCY STOP, SW

Description: Indicates if switch, control switch, is activated.

Circuit diagram: Circuit Electric power group 11.5

Connection: signal from S250/12 to D790-1/K8:4

Function: 11.5.1.4 Control switch voltage (15E)

Signal value:

1	Input signal active.
0	No signal.

#### EMERGENCY STOP, RELAY K3009-1

Description: Status of control current to Relay K2, for control breaker voltage (K3009-1), 15E-voltage.

Circuit diagram: Circuit Electric power group 11.5

Connection: signal from D790-1/K10:11 to K3009-1/86

Function: 11.5.1.4 Control switch voltage (15E)

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### EMERGENCY STOP, FEEDBACK

Description: Feedback signal from Relay control breaker voltage (K3009-1), indicates that relay is working normally.

Circuit diagram: Circuit Electric power group 11.5

Connection: signal from K3009-1/87 via F58-3/8 to digital in D790-1/K11:13

Function: 11.5.1.4 Control switch voltage (15E)

Signal value:

1	Input signal active.
0	No signal.

DIAG	CAN/POWER	5 (X)
EMERGENCY STOP, SW		X
RELAY K3009-1		XY
FEEDBACK		X
RELAY K3009-2		XY

006860

### EMERGENCY STOP, RELAY K3009-2

Description: Status of control current to Relay control breaker voltage (K3009-2), 15E-voltage.

Circuit diagram: Circuit Electric power group 11.5

Connection: signal from D790-1/K10:12 to K3009-2/86

Function: 11.5.1.4 Control switch voltage (15E)

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

## 8.4.1.6 CAN/POWER, menu 6

### 790-1 CAB, POWER

Description: Ignition voltage (15) to Control unit cab (D790-1).

Circuit diagram: Circuit Electric power group 11.5

Connection: 15-voltage from K315-1/87 via F54/4 and F58-5/1 to D790-1/K1:2, D790-1/K1:3 and D790-1/K1:4

Function: 11.5.1 Voltage feed

Signal value: XX.XXV = voltage on the connection. The signal value should be 22-30 V (battery voltage).

### 790-1 CAB, 5V REF

Description: Reference voltage 5 V to controls in cab.

Circuit diagram: Circuit Climate system group 9.4 (contact 1, 2), Wiring Drivetrain group 1.1 (contact 3), Circuit Joystick group 7.1 (contact 4)

Connection:

1. signal from digital out D790-1/K4:5 to Y672/10 and Y673/10
2. signal from digital out D 790-1/K5:11 to S118/1, S 139/1 and S117/1
3. signal from digital out D790-1/K5:13 till B690/1 and B697/1
4. signal from digital out D790-1/K7:2 to S815/9

Function: 9.4 Heating, ventilation and air conditioning (contact 1 and 2); 1 Engine and 2 Transmission (contact 3); 7 Load handling (contact 4)

Signal value: X.XXV = 5.00 V, Important that the signal value is stable (not varying).

DIAG	CAN/POWER	6 (20)
790-1 CAB		
POWER		XX.XXV
5V REF		X.XXV

000091

DIAG	CAN/POWER	6 (20)
790-1 CAB		
POWER		XX.XXV
5V REF		X.XXV

000091

DIAG CAN/POWER	7 (20)
790-1 CAB	
24V SENSOR SUPPLY	XY
24V SUPPLY, RPM>500	XY

003178

### 8.4.1.7 CAN/POWER, menu 7

#### 790-1 CAB, 24V SENSOR SUPPLY

Description: 24 V voltage feed to components in cab.

Circuit diagram:

1. Circuit Wipers group 9.5
2. Circuit Optional equipment group 9.1, Circuit Drivetrain group 2.1, Circuit Cab operator's seat group 9.3, Circuit Lighting group 9.6, Circuit Work lights group 9.6 and Wiring OPT Sensors Instr. group 9.1
3. Circuit Joystick group 7.1
4. Circuit Electric power group 11.5, Circuit Brake system group 4.0, Circuit By-pass group 8.2, Wiring Sliding/Vertically adjustable Cab group 9.10, Wiring Hyd Support jacks group 7.10, Wiring Twist-lock group 7.9, Wiring Spreading Sensors group 7.5, Circuit Optional equipment group 9.1
5. Wiring Combi Att group 7.9
6. -
7. Wiring Sliding/Vertically adjustable Cab group 9.10
8. Circuit Alarm, audible signals group 9.7
9. Circuit Wipers group 9.5
10. Circuit Wipers group 9.5

Connection:

1. signal from digital out D790-1/K4:14 to M650-1/53a
2. signal from digital out D790-1/K5:1 till S199-1/5, S199-3/5, S199-4/5, S220-2/1, S143/5, S100/5, S110/5, S105-3/5, S105-2/5, S105-1/5
3. signal from digital out D790-1/K7:12 to S815/15
4. signal from digital out D790-1/K8:16 till S250/11, S107/5, S1005/5, S1015/5, S1014/5, S177/3, S1013/3, S1003/3, S1003/4, S1004/5, S199-2/5
5. Connection: signal from digital out D790-1/K9:1 till S1006/3, S1007/3, S1008/3
6. signal from digital out D790-1/K9:7 not connected
7. signal from digital out D790-1/K10:1 to B769-2/1
8. signal from digital out D790-1/K11:12 to S230/2
9. signal from digital out D790-1/K12:1 to M650-2/53a
10. signal from digital out D790-1/K12:3 to M650-3/53a

Function:

1. 9.5.5 Wiper motor front
2. 2.0 Transmission, 9.3 Seats, 9.6 Lighting
3. 7.1.1 Control lever

4. 11.5.1.4 Control breaker voltage, 4.5 Parking brake system, 8.2.2 By-passing, 9.10.4 Sliding cab, 9.10.5 Cab lift and lower, 7.10.1 Support jacks, 7.9.1 Twistlocks
5. 7.9.2 Lift legs
6. -
7. 9.10.4 Sliding cab, 9.10.5 Cab lift and lower
8. 9.3.10 Sensor operator in seat
9. 9.5.7 Wiper motor rear
10. 9.5.6 Wiper motor roof

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK or open circuit.

<b>DIAG CAN/POWER</b>	<b>7 (20)</b>
790-1 CAB	
24V SENSOR SUPPLY	XY
24V SUPPLY, RPM>500	XY

003178

#### 790-1 CAB, 24V SUPPLY, RPM>500

Description: Voltage feed at engine rpm is higher than 500 rpm.

Circuit diagram: Circuit Sensors instr. group 9.1

Connection: signal from digital out D790-1/K10:9 to P708/+ and K358/86

Function: 9.3.6 Compressor air-suspension seat, 11.1.1 Hour meter

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

### 8.4.1.8 CAN/POWER, menu 8

#### 797-F FRAME, POWER

Description: Ignition voltage (15) to Control unit frame front (D797-F).

Circuit diagram: Circuit Electric power group 11.5

Connection: 15-voltage from K315-1/87 via F54/4 and F58-2/1 to D797-F/K2:1, D797-F/K2:9 and D797-F/K2:10

Function: 11.5.1.3 Ignition voltage (15)

Signal value: XX.XXV = voltage on the connection. The signal value should be 22-30 V (battery voltage).

<b>DIAG CAN/POWER</b>	<b>8 (20)</b>
797-F FRAME	
POWER	XX.XXV
RED.POWER	Le X Ri X
EME STOP POWER	X

000093

DIAG CAN/POWER 8 (20)	
797-F FRAME	
POWER	XX.XXV
RED.POWER	Le X Ri X
EME STOP POWER	X

000093

**797-F FRAME, RED. POWER**

Description: Redundant voltage to Control unit frame front (D797-F).

Circuit diagram: Wiring CAN-BUS Opt. chassis KDU group 11.6

Connection:

Le: redundant voltage to D797-F/K2:7

Ri: redundant feed to D797-F/K2:8

Function: 11.5.1.2 Redundant voltage feed of control units

Signal value:

1	Feed active.
0	No feed.

**797-F FRAME, EME STOP POWER**

Description: Control breaker voltage to Control unit frame front (D797-F).

Circuit diagram: Circuit Electric power group 11.5

Connection: 15E-voltage from K3009-1787 via K3009-2/87 and F58-3/2 to D797-F/K2:11

Function: 11.5.1.4 Control switch voltage (15E)

Signal value:

1	Feed active.
0	No feed.

DIAG CAN/POWER 8 (20)	
797-F FRAME	
POWER	XX.XXV
RED.POWER	Le X Ri X
EME STOP POWER	X

000093

**8.4.1.9 CAN/POWER, menu 9****797-F FRAME, 24V SENSOR SUPPLY**

Description: Voltage feed 24 V to sensors connected to Control unit frame front (D797-F) (pressure monitors).

Circuit diagram: Circuit Brake system group 4.0, Circuit Drivetrain group 2.1, Circuit Lighting group 9.6

Connection: signal from digital out D797-F/K1:39 to S, 200, S204, S216 and S220

Function: 9.6.4 Brake lights, 2.2.6 Make-contact disengagement, 4.3.7 Make-contact brake pressure, 4.3.8 Make-contact brake lights, 4.5.5 Make-contact parking brake

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG CAN/POWER 9 (20)	
797-F FRAME	
24V SENSOR SUPPLY	XY
5V REF	X.XXV

000094

DIAG CAN/POWER	9 (20)
797-F FRAME	
24V SENSOR SUPPLY	XY
5V REF	X.XXV

000094

**797-F FRAME, 5V REF**

Description: Reference voltage 5 V to sensors connected to Control unit frame front (D797-F) (voltage feed to pressure sensors).

Circuit diagram: Circuit OP + Scale group 8.2

Connection: digital out from 797-F/K1:8 to B768-R1, B768-R2, B768-L1 and B768-L2

Function: 7.2.9 Sensor hydraulic pressure lift cylinder

Signal value: X.XXV = 5.00 V, Important that signal value is stable (not varying).

**8.4.1.10 CAN/POWER, menu 10****797-R FRAME, POWER**

Description: Ignition voltage (15) to Control unit frame rear (D797-R).

Circuit: Circuit Electric power group 11.5

Connection: 15-voltage from K315-1/87 via F54/4 and F58-2/3 till D797-R /K2:1 and D797-R/K2:9

Function: 11.5.1.3 Ignition voltage (15)

Signal value: XX.XXV = voltage on the connection. The signal value should be 22-30 V (battery voltage).

DIAG CAN/POWER	10 (20)
797-R FRAME	
POWER	XX.XXV
RED.POWER	Le X Ri X

000095

**797-R FRAME, RED. POWER**

Description: Redundant voltage to Control unit frame rear (D797-R).

Circuit diagram: Wiring CAN-BUS Opt. chassis KDU group 11.6

Connection:

Le: redundant voltage to D797-R/K2:7

Ri: redundant feed to D797-R/K2:8

Function: 11.5.1.2 Redundant voltage feed of control units

Signal value:

1	Feed active.
0	No feed.

DIAG CAN/POWER	10 (20)
797-R FRAME	
POWER	XX.XXV
RED.POWER	Le X Ri X

000095

DIAG CAN/POWER 11 (20)	
797-R FRAME	
24V SENSOR SUPPLY	XY
5V REF	X.XXV

000096

DIAG CAN/POWER 11 (20)	
797-R FRAME	
24V SENSOR SUPPLY	XY
5V REF	X.XXV

000096

DIAG CAN/POWER 12 (20)	
797-O FRAME	
POWER	XX.XXV
RED.POWER	Le X Ri X
EME STOP POWER	X

000097

### 8.4.1.11 CAN/POWER, menu 11

#### 797-R FRAME, 24V SENSOR SUPPLY

Voltage feed 24 V to sensors connected to Control unit frame rear (D797-R).

Circuit diagram: Circuit OP + Scale group 8.2

Connection: digital out from D797-R/K1:2 to Y 7221

Function: 8.2.1.1 Sensor steering axle load

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### 797-R FRAME, 5V REF

Description: Reference voltage 5 V to sensors connected to Control unit frame rear (D797-R).

Circuit diagram: Circuit OP + Scale group 8.2

Connection: digital out from 797-R/K1:8 to B771/1 and B777/1

Function: 8.2.1.2 Sensor boom angle (angle sensor), 8.2.1.3 Sensor boom length (analogue sensor)

Signal value: X.XXV = 5.00 V, Important that signal value is stable (not varying).

### 8.4.1.12 CAN/POWER, menu 12

#### 797-O FRAME, POWER



Description: Ignition voltage (15) to Control unit frame option (D797-O).

Circuit diagram: Circuit Electric power group 11.5

Connection: 15-voltage from K315-1/30 via F54/4 and 58-2/4 to D797-O/K2:10

Function: 11.5.1.3 Ignition voltage (15)

Signal value: XX.XXV = voltage on the connection. The signal value should be 22-30 V (battery voltage).

DIAG CAN/POWER 12 (20)			
797-O FRAME			
POWER		XX.XXV	
RED.POWER	Le	X	Ri X
EME STOP POWER			X

000097

**797-O FRAME, RED. POWER**

Description: Redundant voltage to Control unit frame option (D797-O).

Circuit diagram: Wiring CAN-BUS Opt. chassis KDU group 11.6

Connection:

Le: redundant voltage to D797-O/K2:7

Ri: redundant feed to D797-O/K2:8

Function: 11.5.1.2 Redundant voltage feed of control units

Signal value:

1	Feed active.
0	No feed.

**797-O FRAME, EME STOP POWER**

Description: Control breaker voltage (15E) to Control unit frame option (D797-O).

Circuit diagram: Circuit Electric power group 11.5

Connection: 15E-voltage from K3009-1/87 via K3009-2/87 and F58-3/4 to D797-F O/K2:11

Function: 11.5.1.4 Control switch voltage (15E)

Signal value:

1	Feed active.
0	No feed.

DIAG CAN/POWER 12 (20)			
797-O FRAME			
POWER		XX.XXV	
RED.POWER	Le	X	Ri X
EME STOP POWER			X

000097

**8.4.1.13 CAN/POWER, menu 13****797-O FRAME, 24V SENSOR SUPPLY**

Description: Battery voltage to sensor.

Circuit diagram: Wiring Hyd Support jacks group 7.10, Circuit Cab tilt group 9.10

Connection: digital out D797-O/K1:9 to B7222L, B7222R, B7223L, B7223R

Function: 7.10.1.5 Sensor raised support jacks, 7.10.1.6 Sensor lowered support jacks

Signal value:

DIAG CAN/POWER 13 (20)			
797-O FRAME			
24V SENSOR SUPPLY		XY	
5V REF		X.XXV	

000098

DIAG CAN/POWER 13 (20)
797-O FRAME
24V SENSOR SUPPLY XY
5V REF X.XXV

000098

DIAG CAN/POWER 14 (20)
795 DISPLAY
RED.POWER Le X Ri X

000098

DIAG CAN/POWER 15 (20)
793 TRANSMISSION
POWER XX.XXV
IGNITION POWER XX.XXV
SENSOR SUPPLY XX.XXV

000100

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

**790-O FRAME, 5V REF**

Description: not connected

Circuit diagram: -

Connection: digital out from D797-O/K1:8, not connected

Function: -

Signal value: -

**8.4.1.14 CAN/POWER, menu 14****795 DISPLAY, RED. POWER**

Description: Redundant voltage to Control unit KID (D795).

Circuit diagram: Wiring CAN-BUS Opt. chassis KDU group 11.6

Connection:

Le: redundant feed to D790/K1:8

Ri: redundant feed to D790/K1:7

Function: 11.5.1.2 Redundant voltage feed of control units

Signal value:

1	Feed active.
0	No feed.

**8.4.1.15 CAN/POWER, menu 15****793 TRANSMISSION, POWER**

Description: Battery voltage (30) to Control unit transmission (D793).

Circuit diagram: Circuit Electric power group 11.5, Circuit Dana TE32000 group 2.0

Connection: 30-voltage from F54/2 via F58-1/5 to D793/A1

Function: 11.5.1.1 Battery voltage (30)

Signal value: XX.XXV = voltage on the connection. The signal value should be 22-30 V (battery voltage).

DIAG CAN/POWER 15 (20)	
793 TRANSMISSION	
POWER	XX.XXV
IGNITION POWER	XX.XXV
SENSOR SUPPLY	XX.XXV

000100

DIAG CAN/POWER 15 (20)	
793 TRANSMISSION	
POWER	XX.XXV
IGNITION POWER	XX.XXV
SENSOR SUPPLY	XX.XXV

000100

DIAG CAN/POWER 16 (20)	
791-1 ATTACHMENT	
POWER	XX.XXV
RED.POWER	Le X Ri X

00003179

DIAG CAN/POWER 16 (20)	
791-1 ATTACHMENT	
POWER	XX.XXV
RED.POWER	Le X Ri X

00003179

### 793 TRANSMISSION, IGNITION POWER

Description: Ignition voltage (15) to Control unit transmission (D793).

Circuit diagram: Circuit Electric power group 11.5, Circuit Dana TE32000 group 2.0

Connection: 15-voltage from K315/87 via F54/4 and F58-2/5 to D793/S2

Function: 11.5.1.3 Ignition voltage (15)

Signal value: XX.XXV = voltage on the connection. The signal value should be 22-30 V (battery voltage).

### 793 TRANSMISSION, SENSOR SUPPLY

Description: Voltage feed to sensors on transmission, reference voltage of 5 V.

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: 5V analogue Ref from D793/M1 to S221/1

Function: 2.9 Control and monitoring system transmission

Signal value: XX.XXV = voltage on connection. The signal value should be 8 V, stable (not vary).

## 8.4.1.16 CAN/POWER, menu 16

### 791-1 ATTACHMENT, POWER

Description: Voltage feed to Control unit attachment (D791-1).

Circuit diagram: Circuit Electric power group 11.5

Connection: 15E-voltage from K3009-1/87 via K3009-2/87, F58-3/1 and F52-1 to D791-1/K2:1, K2:9, K2:10, K2:11

Function: 11.5.1.4 Control switch voltage (15E)

Signal value: XX.XXV = voltage on the connection. The signal value should be 22-30 V (battery voltage).

### 791-1 ATTACHMENT, RED. POWER

Description: Redundant voltage feed to Control unit attachment (D791-1).

Circuit diagram: Wiring CAN-BUS Opt. chassis KDU group 11.6, Wiring CAN-BUS ATT group 11.6

Connection:

Le: redundant voltage feed to D791/K2:7

Ri: redundant voltage feed to D791/K2:8

Function: 11.5.1.2 Redundant voltage feed of control units

Signal value:

1	Feed active.
0	No feed.

DIAG CAN/POWER 17 (20)	
791-2 ATTACHMENT	
POWER	XX.XXV
RED.POWER	Le X Ri X

000102

DIAG CAN/POWER 17 (20)	
791-2 ATTACHMENT	
POWER	XX.XXV
RED.POWER	Le X Ri X

000102

DIAG CAN/POWER 18 (20)	
791-3 ATTACHMENT	
POWER	XX.XXV
RED.POWER	Le X Ri X

000103

### 8.4.1.17 CAN/POWER, menu 17

#### 791-2 ATTACHMENT, POWER



Description: Battery voltage to Control unit attachment option (D791-2).

Circuit diagram: Circuit Electric power group 11.5, Circuit Electric power attachment group 11.5

Connection: 15E-voltage from K3009-1/87 via K3009-2/87, F58-3/1 and F52-1 to D791-2/K2:1, K2:11

Function: 11.5.1.4 Control switch voltage (15E)

Signal value: XX.XXV = voltage on the connection. The signal value should be 22-30 V (battery voltage).

#### 791-2 ATTACHMENT, RED. POWER

Description: Redundant voltage to Control unit attachment option (D791-2).

Circuit diagram: Wiring CAN-BUS Opt. chassis KDU group 11.6, Wiring CAN-BUS ATT group 11.6

Connection:

Le: redundant feed to D791-2/K2:7

Ri: redundant feed to D791-2/K2:8

Function: 11.5.1.2 Redundant voltage feed of control units

Signal value:

1	Feed active.
0	No feed.

### 8.4.1.18 CAN/POWER, menu 18

#### 791-3 ATTACHMENT, POWER



Description: Battery voltage to Control unit attachment left legs (D791-3).

Circuit diagram: Circuit Electric power group 11.5, Wiring Combi Att group 7.9

Connection: 15E-voltage from K3009-1/87 via K3009-2/87, F58-3/1 and F52-2 to D791-3/K2:1, K2:11

Function: 11.5.1.4 Control switch voltage (15E)

Signal value: XX.XXV = voltage on connection. The signal value should be 22 - 30V (battery voltage).

DIAG CAN/POWER 18 (20)
791-3 ATTACHMENT
POWER XX.XXV
RED.POWER Le X Ri X

000103

### 791-3 ATTACHMENT, RED. POWER



Description: Redundant voltage to Control unit attachment left legs (D791-3).

Circuit diagram: Wiring CAN-BUS Opt. chassis KDU group 11.6, Wiring CAN-BUS ATT group 11.6

Connection:

Le: redundant feed to D791-3/K2:7

Ri: redundant feed to D791-3/K2:8

Function: 11.5.1.2 Redundant voltage feed of control units

Signal value:

1	Feed active.
0	No feed.

## 8.4.1.19 CAN/POWER, menu 19

### 791-4 ATTACHMENT, POWER



Description: Battery voltage to Control unit attachment right leg pair (D791-4).

Circuit diagram: Circuit Electric power group 11.5, Wiring Combi Att group 7.9

Connection: 15E-voltage from K3009-1/87 via K3009-2/87, F58-3/1 and F52-2 to D791-4/K2:1, K2:11

Function: 11.5.1.4 Control switch voltage (15E)

Signal value: XX.XXV = voltage on connection. The signal value should be 22 - 30V (battery voltage).

### 791-4 ATTACHMENT, RED. POWER



Description: Redundant voltage to Control unit attachment right leg pair (D791-4).

Circuit diagram: Wiring CAN-BUS Opt. chassis KDU group 11.6, Wiring CAN-BUS ATT group 11.6

Connection:

Le: redundant feed to D791-4/K2:7

Ri: redundant feed to D791-4/K2:8

Function: 11.5.1.2 Redundant voltage feed of control units

Signal value:

1	Feed active.
0	No feed.

DIAG CAN/POWER 19 (20)
791-4 ATTACHMENT
POWER XX.XXV
RED.POWER Le X Ri X

000104

DIAG CAN/POWER 19 (20)
791-4 ATTACHMENT
POWER XX.XXV
RED.POWER Le X Ri X

000104

DIAG	CAN/POWER	20 (20)
24V SENS.SUP	791-1	XY
24V SENS.SUP	791-2	XY
24V SENS.SUP	791-3	XY
24V SENS.SUP	791-4	XY

003180

### 8.4.1.20 CAN/POWER, menu 20

#### 24V SENS. SUP 791-1

Description: Voltage feed to position sensors connected to Control unit attachment (D791-1).

Circuit diagram: Wiring Spreading Valves group 7.5

Connection: digital out from D791/K1:10 to B769, B777-3, B7224, B7225, B7202L, B7202R, B7203L, B7203R, B7204L, B7204R, B7205L and B7205R

Function: 7.5.10 Position sensor spreading, 7.6.10 Sensor rotation stop, 7.9.1.8 Sensor alignment, 7.9.1.9 Sensor twistlocks, 8.2.1.6 Sensor boom length

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### 24V SENS. SUP 791-2



Description: Information forthcoming

Circuit diagram: Information forthcoming.

Connection: Information forthcoming.

Function: Information forthcoming.

Signal value: Information forthcoming.

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG	CAN/POWER	20 (20)
24V SENS.SUP	791-1	XY
24V SENS.SUP	791-2	XY
24V SENS.SUP	791-3	XY
24V SENS.SUP	791-4	XY

003180

DIAG	CAN/POWER	20 (20)
24V SENS.SUP	791-1	XY
24V SENS.SUP	791-2	XY
24V SENS.SUP	791-3	XY
24V SENS.SUP	791-4	XY

003180

**24V SENS. SUP 791-3**

Description: Battery voltage to position sensor for left leg pair on combi attachment.

Circuit diagram: Wiring Combi Att group 7.9

Connection: digital out from D791-3/K1:26 till B7212L, B7213L, B7214L, B7215L, B7216L, B7217L, B7218L, B7219L and B7220L

Function: 7.9.2.9 Sensor operating position, 7.9.2.10 Sensor knee, 7.9.2.13 Sensor lift legs, 7.9.2.15 Sensor alignment, 7.9.16 Sensor clamping position

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

**24V SENS. SUP 791-4**

Description: Battery voltage to position sensor for right leg pair on combi attachment.

Circuit diagram: Wiring Combi Att group 7.9

Connection: digital out from D791-4/K1:26 till B7212R, B7213R, B7214R, B7215R, B7216R, B7217R, B7218R, B7219R and B7220R

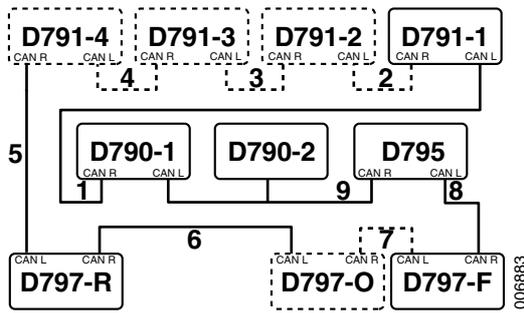
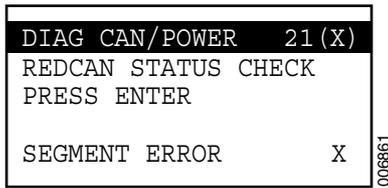
Function: 7.9.2.9 Sensor operating position, 7.9.2.10 Sensor knee, 7.9.2.13 Sensor lift legs, 7.9.2.15 Sensor alignment, 7.9.16 Sensor clamping position

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG	CAN/POWER	20 (20)
24V SENS.SUP	791-1	XY
24V SENS.SUP	791-2	XY
24V SENS.SUP	791-3	XY
24V SENS.SUP	791-4	XY

003180



Segment numbering maximum number of control units. Dashed control units are optional.

### 8.4.1.21 CAN/POWER, menu 21

#### REDCAN STATUS CHECK

Description: The check function from the redundant CAN-bus. Control unit attachment (D791-1) generates a virtual error in the redundant CAN-bus in order to check that all control units have contact and are connected in the correct order. The control and monitoring system points out the error by numbering the cable harnesses between the control units (segment) from 1 and up. Segment 1 is always between Control unit cab (D790-1) and Control unit attachment (D791-1). The last segment is always between Control unit KID (D795) and Control unit cab (D790-1). Segments in between those vary depending on the machine's equipment.

Circuit diagram: Wiring CAN-BUS Opt. chassis KDU group 11.6

Connection:

Function: 11.6.2 Redundant CAN-bus

Signal value:

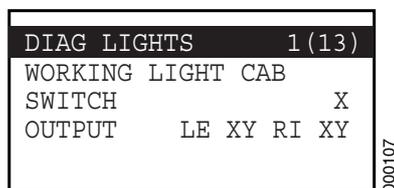
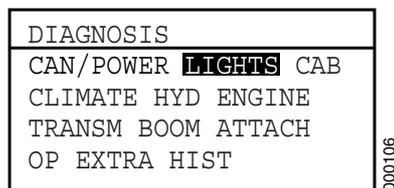
0	No errors.
> 0	X > 0, the number indicates incorrect segment. Use circuit diagram to find the incorrect segment.

### 8.4.2 LIGHTS

#### LIGHTS, description

This group handles lighting.

Confirm selection with function key for Enter.



#### 8.4.2.1 LIGHTS, menu 1

##### WORK LIGHT CAB, SWITCH

Description: Signal from switch work light cab roof.

Circuit diagram: Circuit Work lights group 9.6

Connection: from S105-1/1 to digital in D790-1/K6:10

Function: 9.6 Lighting system

Signal value:

1	Input signal active.
0	No signal.

DIAG LIGHTS	1 (13)	
WORKING LIGHT CAB		
SWITCH		X
OUTPUT	LE XY RI XY	

000107

**WORK LIGHT CAB, OUTPUT**

Description: Voltage feed to work light cab roof.

Circuit diagram: Circuit Work lights group 9.6

Connection:

- LE: digital out from D790-1/K2:7 to E404-1L
- RI: digital out from D790-1/K2:6 to E404-1R

Function: 9.6.9 Work light cab

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

**8.4.2.2 LIGHTS, menu 2****WORKING LIGHT ATTACH, SWITCH**

Description: Signal from switch work light attachment.

Circuit diagram: Circuit Work lights group 9.6

Connection: signal from S105-2/1 to digital in D790-1/K6:2

Function: 9.6 Lighting system

Signal value:

1	Input signal active.
0	No signal.

DIAG LIGHTS	2 (13)	
WORKING LIGHT ATTACH		
SWITCH		X
OUTPUT	LE XY RI XY	
OPTIONAL OUTPUT		XX

000108

**WORK LIGHT ATTACH, OUTPUT**

Description: Voltage feed to work light attachment, feed.

Circuit diagram: Circuit Work lights group 9.6

Connection:

LE: digital out from D791/K1:15 to E404-2L

RI: digital out from D791/K1:1 to E404-2R

Function: 9.6.11 Work light attachment

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG LIGHTS	2 (13)	
WORKING LIGHT ATTACH		
SWITCH		X
OUTPUT	LE XY RI XY	
OPTIONAL OUTPUT		XX

000109

<b>DIAG LIGHTS</b>	<b>2 (13)</b>
WORKING LIGHT ATTACH	
SWITCH	X
OUTPUT	LE XY RI XY
OPTIONAL OUTPUT	XX

000108

**WORK LIGHT ATTACH, OPTIONAL OUTPUT**

Description: Voltage feed to optional work light on attachment.

Circuit diagram: Wiring Opt. Work Light Att group 9.6

Connection: digital out from D791/K1:42 till E404-4 R and E404-4 L

Function: 9.6.11 Work light attachment

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

**8.4.2.3 LIGHTS, menu 3****WORK LIGHT BOOM, SWITCH**

Description: Signal from switch work light boom.

Circuit diagram: Circuit Work lights group 9.6

Connection: from S105-3/1 to digital in D790-1/K6:3

Function: 9.6 Lighting system

Signal value:

1	Input signal active.
0	No signal.

<b>DIAG LIGHTS</b>	<b>3 (13)</b>
WORKING LIGHT BOOM	
SWITCH	X
OUTPUT	LE XY RI XY
OPTIONAL OUTPUT	XX

601000

<b>DIAG LIGHTS</b>	<b>3 (13)</b>
WORKING LIGHT BOOM	
SWITCH	X
OUTPUT	LE XY RI XY
OPTIONAL OUTPUT	XX

601000

**WORK LIGHT BOOM, OUTPUT**

Description: Voltage feed to work light boom.

Circuit diagram: Circuit Work lights group 9.6

Connection:

LE: digital out from D797-R/K1:1 to E404-3L

RI: digital out from D797-R/K1:15 to E404-3R

Function: 9.6.10 Work light boom

Signal value:

<b>DIAG LIGHTS</b>	<b>3 (13)</b>
WORKING LIGHT BOOM SWITCH	X
OUTPUT LE XY RI XY	
OPTIONAL OUTPUT	XX

000009

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### WORK LIGHT BOOM, OPTIONAL OUTPUT



Description: Voltage feed to optional work light on boom.

Circuit diagram: Wiring OPT Work Light Boom group 9.6

Connection: digital out from D790-1/K10:8, via relay K304/87 to H404-5L and H404-5R

Function: 9.6.10 Work light boom

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### 8.4.2.4 LIGHTS, menu 4

##### MAIN LIGHT, SWITCH

Description: Signal from switch headlights.

Circuit diagram: Circuit Lighting group 9.6

Connection: from S100/1 to digital in D790-1/K6:5

Function: 9.6 Lighting system

Signal value:

<b>DIAG LIGHTS</b>	<b>4 (13)</b>
MAIN LIGHT SWITCH	X

000110

1	Input signal active.
0	No signal.

DIAG LIGHTS		5 (13)
PRESENT OUTPUT SIGNAL		
SIDE-F	LE XY RI XY	
SIDE-R	LE XY RI XY	
REAR	LE XY RI XY	

000111

DIAG LIGHTS		5 (13)
PRESENT OUTPUT SIGNAL		
SIDE-F	LE XY RI XY	
SIDE-R	LE XY RI XY	
REAR	LE XY RI XY	

000111

DIAG LIGHTS		5 (13)
PRESENT OUTPUT SIGNAL		
SIDE-F	LE XY RI XY	
SIDE-R	LE XY RI XY	
REAR	LE XY RI XY	

000111

### 8.4.2.5 LIGHTS, menu 5

#### PRESENT OUTPUT SIGNAL, SIDE-F

Description: Voltage feed to side running lights front.

Circuit diagram: Circuit Lighting group 9.6

Connection:

LE: digital out from D797-F/K1:25 to H 416-1

RI: digital out from D797-F/K1:29 to H 417-1

Function: 9.6.2 Running lights

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### PRESENT OUTPUT SIGNAL, SIDE-R

Description: Voltage feed to side running lights rear.

Circuit diagram: Circuit Lighting group 9.6

Connection:

LE: digital out from D797-R/K1:7 to H 416-2

RI: digital out from D797- R/K1:9 to H417-2

Function: 9.6.2 Running lights

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### PRESENT OUTPUT SIGNAL, REAR

Description: Voltage feed to rear lights.

Circuit diagram: Circuit Lighting group 9.6

Connection:

LE: digital out from D797-R/K1:10 to H412L

RI: digital out from D797-R/K1:25 to H412R

Function: 9.6.3 Rear lights

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

### 8.4.2.6 LIGHTS, menu 6

#### HEADLIGHTS, SWITCH

Description: Lighting headlights front, switch.

Circuit diagram: Circuit Lighting group 9.6

Connection: from S162/56A to digital in D790-2/K3:9

Function: 9.6 Lighting system

Signal value:

1	Input signal active.
0	No signal.

#### HEADLIGHTS, HEAD

Description: Voltage feed to headlights, high beams. If the machine is equipped with optional work lights, this is connected in parallel with the high beams.

Circuit diagram: Circuit Lighting group 9.6 and Wiring Opt. Work Light Chassis group 9.6

Connection:

LE: digital out from D797-F/K1:1 to E402L (⊕ E404-7L and E404-8L)

RI: digital out from D797-F/K1:15 to E402R (⊕ E404-7R and E404-8R)

Function: 9.6.1 Headlights

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

<b>DIAG LIGHTS</b>	<b>6 (13)</b>
HEAD LIGHTS	
SWITCH	X
HEAD	LE XY RI XY
DIMMED	XY

000112

<b>DIAG LIGHTS</b>	<b>6 (13)</b>
HEAD LIGHTS	
SWITCH	X
HEAD	LE XY RI XY
DIMMED	XY

000112

<b>DIAG LIGHTS</b>	<b>6 (13)</b>
HEAD LIGHTS	
SWITCH	X
HEAD	LE XY RI XY
DIMMED	XY

000112

**HEADLIGHTS, DIMMED**

Description: Voltage feed to headlights, low beams.

Circuit diagram: Circuit Lighting group 9.6

Connection: digital out from D797-F/K1:42 to E400 L and E400R

Function: 9.6.1 Headlights

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

**8.4.2.7 LIGHTS, menu 7****PRESENT INPUT SIGNAL, HAZARD SWITCH**

Description: Signal from switch flashing hazard lights (Hazard).

Circuit diagram: Wiring Flashing indicator, Hazard group 9.7

Connection: from S109/1 to digital in D790-1/K5:6

Function: 9.7 Signal system

Signal value:

1	Input signal active.
0	No signal.

**PRESENT INPUT SIGNAL, FLASH.SW.**

Description: Signal from switch direction indicators.

Circuit diagram: Wiring Flashing indicator, Hazard group 9.7

Connection:

LE: from S161/1 to digital in D790-2/K8:9

RI: from S161/6 to digital in D790-2/K8:8

Function: 9.6 Lighting system

Signal value:

1	Input signal active.
0	No signal.

<b>DIAG LIGHTS</b>	<b>7 (13)</b>
PRESENT INPUT SIGNAL	
HAZARD SWITCH	X
FLASH.SW.	LE X RI X

000113

<b>DIAG LIGHTS</b>	<b>7 (13)</b>
PRESENT INPUT SIGNAL	
HAZARD SWITCH	X
FLASH.SW.	LE X RI X

000113

DIAG LIGHTS	8 (13)
PRESENT OUTPUT SIGNAL HAZARD/FLASHER	
FRONT	LE XY RI XY
REAR	LE XY RI XY

000114

### 8.4.2.8 LIGHTS, menu 8

#### PRESENT OUTPUT SIGNAL HAZARD/FLASHER, FRONT

Description: Voltage feed to direction indicators, front.

Circuit diagram: Wiring Flashing indicator, Hazard group 9.7

Connection:

LE: digital out from D797-F/K1:9 to H422

RI: digital out from D797-F/K1:10 to H423

Function: 9.6.6 Direction indicators, 9.6.7 Flashing hazard lights (Hazard)

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### PRESENT OUTPUT SIGNAL HAZARD/FLASHER, REAR

Description: Voltage feed to direction indicators, rear.

Circuit diagram: Wiring Flashing indicator, Hazard group 9.7

Connection:

LE: digital out from D797-R/K1:29 to H426

RI: digital out from D797-R/K1:39 to H427

Function: 9.6.6 Direction indicators, 9.6.7 Flashing hazard lights (Hazard)

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG LIGHTS	8 (13)
PRESENT OUTPUT SIGNAL HAZARD/FLASHER	
FRONT	LE XY RI XY
REAR	LE XY RI XY

000114

<b>DIAG LIGHTS</b>	<b>9 (13)</b>
ROTATION BEACON	
SWITCH	X
OUTPUT	XY

000115

<b>DIAG LIGHTS</b>	<b>9 (13)</b>
ROTATION BEACON	
SWITCH	X
OUTPUT	XY

000115

<b>DIAG LIGHTS</b>	<b>10 (13)</b>
PRESENT INPUT SIGNAL	
BRAKE LIGHT SWITCH	X
REVERSE LIGT SIGNAL	X

000116

### 8.4.2.9 LIGHTS, menu 9

#### ROTATING BEACON, SWITCH

Description: Signal from switch rotating beacon.

Circuit diagram: Circuit Lighting group 9.6

Connection: from S110/1 to digital in D790-1/K6:4

Function: 9.6 Lighting system

Signal value:

1	Input signal active.
0	No signal.

#### ROTATING BEACON, OUTPUT

Description: Voltage feed to rotating beacon.

Circuit diagram: Circuit Lighting group 9.6

Connection: digital out D790-1/K2:5 to H428

Function: 9.6.8 Rotating beacon

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

### 8.4.2.10 LIGHTS, menu 10

#### PRESENT INPUT SIGNAL, BRAKE LIGHT SWITCH

Description: Signal from make-contact brake lights.

Circuit diagram: Circuit Lighting group 9.6

Connection: from S216/2 to digital in D797-F/K1:13

Function: 4.3.8 Make-contact brake lights

Signal value:

1	Input signal active.
0	No signal.

DIAG LIGHTS	10 (13)
PRESENT INPUT SIGNAL	
BRAKE LIGHT SWITCH	X
REVERSE LGT SIGNAL	X

000116

### PRESENT INPUT SIGNAL, BACK-UP (REVERSE) LIGHT SWITCH

Description: Signal from Control unit transmission (D793) when reverse gear is activated.

Circuit diagram: Circuit Lighting group 9.6

Connection: -

Function: 9.6.5 Back-up light

Signal value:

1	Input signal active. Output signal reverse gear active from Control unit transmission (D793).
0	No signal.

## 8.4.2.11 LIGHTS, menu 11

### PRESENT OUTPUT SIGNAL, BRAKE LIGHT

Description: Voltage feed to brake lights.

Circuit diagram: Circuit Lighting group 9.6

Connection:

LE: digital out from D797-R/K1:32 to H411L

RI: digital out from D797-R/K1:33 to H411R

Function: 9.6.4 Brake lights

Signal value:

DIAG LIGHTS	11 (13)
PRESENT OUTPUT SIGNAL	
BRAKE LIGHT LEXY RIXY	
REVERSE LGT LEXY RIXY	
REVERSE ALARM	XY

000117

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

<b>DIAG LIGHTS</b>	<b>11 (13)</b>
PRESENT OUTPUT SIGNAL	
BRAKE LIGHT LEXY RIXY	
REVERSE LGT LEXY RIXY	
REVERSE ALARM	XY

00017

**PRESENT OUTPUT SIGNAL, BACK-UP (REVERSE) LGT**

Description: Voltage feed to brake lights.

Circuit diagram: Circuit Lighting group 9.6

Connection:

LE: digital out from D797-R/K1:28 to H405L

RI: digital out from D797-R/K1:42 to H405R

Function: 9.6.5 Back-up light

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

**PRESENT OUTPUT SIGNAL, BACK-UP (REVERSE) ALARM**

Description: Voltage feed to back-up alarm.

Circuit diagram: Circuit Back-up alarm group 9.7

Connection: digital out from D797- R/K1:30 to H965

Function: 9.7.5 Back-up alarm

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

<b>DIAG LIGHTS</b>	<b>11 (13)</b>
PRESENT OUTPUT SIGNAL	
BRAKE LIGHT LEXY RIXY	
REVERSE LGT LEXY RIXY	
REVERSE ALARM	XY

00017

**8.4.2.12 LIGHTS, menu 12****CAB LIGHT, MANUAL SWITCH**

Description: Signal from switch lighting cab.

Circuit diagram: Circuit Lighting group 9.6

Connection: from KIT, D790-2/K8:11 to digital in D790-1/K11:2

Function: 9.6 Lighting system

Signal value:

1	Input signal active.
0	No signal.

<b>DIAG LIGHTS</b>	<b>12 (13)</b>
CAB LIGHT	
MANUAL SWITCH	X
DOOR SWITCH	X
OUTPUT	XXX

00018

DIAG LIGHTS	12 (13)
CAB LIGHT	
MANUAL SWITCH	X
DOOR SWITCH	X
OUTPUT	XXX

000118

**CAB LIGHT, DOOR SWITCH**

Description: Signal from contact breaking door.

Circuit diagram: Circuit Lighting group 9.6

Connection: from S266-LE or S266 RE (connected in parallel) to digital in D790-1/K11:3

Function: 9.10.2 Doors

Signal value:

1	Input signal active.
0	No signal.

DIAG LIGHTS	12 (13)
CAB LIGHT	
MANUAL SWITCH	X
DOOR SWITCH	X
OUTPUT	XXX

000118

**CAB LIGHT, OUTPUT**

Description: Voltage feed to interior light cab.

Circuit diagram: Circuit Sensors instr. group 9.1

Connection: from D790-1/K11:6 to E434

Function: 9.6.12 Interior cab light

Signal value: XXX = 0-255 = 0-24 V (255 means 24 V which corresponds to battery voltage).

**8.4.2.13 LIGHTS, menu 13****SWITCH LIGHTS, OUTPUT**

Description: Voltage feed to background lights in switches, panels and keys.

Circuit diagram: -

Connection: -

Function: 9.6.12 Interior cab light

Signal value:

50	Means 4-5 V.
170	Means 15-16 V.

DIAG LIGHTS	13 (13)
SWITCH LIGHTS	
OUTPUT	XXX

000119

**8.4.3 CAB****CAB, description**

This group handles functions in cab.

Confirm selection with function key for Enter.

DIAGNOSIS	
CAN/POWER LIGHTS	<b>CAB</b>
CLIMATE HYD ENGINE	
TRANSM BOOM ATTACH	
OP EXTRA HIST	

000120

<b>DIAG CAB</b>	<b>1 (X)</b>
WASHER	
SWITCH	X
OUTPUT FRONT	XY
OUTPUT REAR-ROOF	X

0068900

<b>DIAG CAB</b>	<b>1 (X)</b>
WASHER	
SWITCH	X
OUTPUT FRONT	XY
OUTPUT REAR-ROOF	X

2989000

<b>DIAG CAB</b>	<b>1 (X)</b>
WASHER	
SWITCH	X
OUTPUT FRONT	XY
OUTPUT REAR-ROOF	X

0068902

### 8.4.3.1 CAB, menu 1

#### WASHER, SWITCH

Description: Signal from gear and multi-function lever switch washer.

Circuit diagram: Circuit Wipers group 9.5

Connection: signal from S162/53C to digital in D790-2/K3:4

Function: 9.5 Wiping and cleaning of windows

Signal value:

1	Input signal active.
0	No signal.

#### WASHER, OUTPUT

Description: Voltage feed to motor windshield washer.

Circuit diagram: Circuit Wipers group 9.5

Connection: digital out D790-1/K10:13 to M651-1 and M651-2

Function: 9.5.4 Washer motor and reservoir

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### WASHER, OUTPUT REAR-ROOF

Description: Grounding of motor washer roof and rear window. The motor is supplied with voltage parallel with Motor windshield washing, activation is controlled by controlling grounding of the motor. The motor is grounded at windshield washing if the wiper motor roof or rear window is activated.

Circuit diagram: Circuit Wipers group 9.5

Connection: PWM out D790-1/K5:4 to M651-2

Function: 9.5.4 Washer motor and reservoir

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

DIAG CAB	2 (10)	
FRONT WIPER		
SWITCH (1-3)		X
OUTPUT		XY
FEEDBACK		X

000122

DIAG CAB	2 (10)	
FRONT WIPER		
SWITCH (1-3)		X
OUTPUT		XY
FEEDBACK		X

000122

DIAG CAB	2 (10)	
FRONT WIPER		
SWITCH (1-3)		X
OUTPUT		XY
FEEDBACK		X

000122

### 8.4.3.2 CAB, menu 2

#### FRONT WIPER, SWITCH (1-3)

Description: Signal from multi-function lever switch wiper function.

Circuit diagram: Circuit Wipers group 9.5

Connection:

X = 1 Interval slow: signal from S162/J1 to digital in D790-2/K3:6

X = 2 Interval less slow: signal from S162/J2 , digital in D790-2/K3:7

X = 3 Interval continuous: signal from S162/53, digital in D790-2/K3:8

Function: 9.5 Wiping and cleaning of windows

Signal value:

1	Long interval.
2	Normal interval.
3	Continuous operation.

#### FRONT WIPER, OUTPUT

Description: Voltage feed to wiper front.

Circuit diagram: Circuit Wipers group 9.5

Connection: digital out D790-1/K2:1 to M650-1/53

Function: 9.5.5 Wiper motor front

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

#### FRONT WIPER, FEEDBACK

Description: Signal from motor wiper front, indicates when wiper motion is completed.

Circuit diagram: Circuit Wipers group 9.5

Connection: from M650-1/31b to digital in D790-1/K4:13

Function: 9.5.5 Wiper motor front

Signal value:

1	Input signal active (wiper sweep).
0	No signal (resting position).

DIAG CAB	3 (10)
REAR WIPER	
SWITCH	X
OUTPUT	XY
FEEDBACK	X

000123

DIAG CAB	3 (10)
REAR WIPER	
SWITCH	X
OUTPUT	XY
FEEDBACK	X

000123

DIAG CAB	3 (10)
REAR WIPER	
SWITCH	X
OUTPUT	XY
FEEDBACK	X

000123

### 8.4.3.3 CAB, menu 3

#### REAR WIPER, SWITCH

Description: Status for switch windshield wiper rear on Control unit KIT (D790-2).

Circuit diagram: -

Connection: -

Function: 9.5 Wiping and cleaning of windows

Signal value:

1	Input signal active. Key for continuous/interval pressed down.
0	No signal.

#### REAR WIPER, OUTPUT

Description: Voltage feed to direction windshield wiper rear.

Circuit diagram: Circuit Wipers group 9.5

Connection: digital out from D790-1/K2:4 to M650-2/53

Function: 9.5.7 Wiper motor rear

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

#### REAR WIPER, FEEDBACK

Description: Signal from motor windshield wiper rear, indicates when wiper motion is completed.

Circuit diagram: Circuit Wipers group 9.5

Connection: signal from M650-2/31b to digital in D790-1/K12:2

Function: 9.5.7 Wiper motor rear

Signal value:

1	Input signal active (wiper sweep).
0	No signal (resting position).

DIAG CAB	4 (10)
ROOF WIPER	
SWITCH	X
OUTPUT	XY
FEEDBACK	X

000124

DIAG CAB	4 (10)
ROOF WIPER	
SWITCH	X
OUTPUT	XY
FEEDBACK	X

000124

DIAG CAB	4 (10)
ROOF WIPER	
SWITCH	X
OUTPUT	XY
FEEDBACK	X

000124

#### 8.4.3.4 CAB, menu 4

##### ROOF WIPER, SWITCH

Description: Signal from switch wiper roof.

Circuit diagram: -

Connection: -

Function: 9.5 Wiping and cleaning of windows

Signal value:

1	Input signal active. Key for continuous/interval pressed down.
0	No signal.

##### ROOF WIPER, OUTPUT

Description: Voltage feed to wiper roof.

Circuit diagram: Circuit Wipers group 9.5

Connection: digital out D790-1/K10:14 to M650-3/53

Function: 9.5.6 Wiper motor roof

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

##### ROOF WIPER, FEEDBACK

Description: Signal from motor wiper roof, indicates when wiper motion is completed.

Circuit diagram: Circuit Wipers group 9.5

Connection: signal from M650-3/31b to digital in D790-1/K12:4

Function: 9.5.6 Wiper motor roof

Signal value:

1	Input signal active (wiper sweep).
0	No signal (resting position).

DIAG CAB	5 (10)
HORN	
SWITCH	X
OUTPUT	XY

000125

DIAG CAB	5 (10)
HORN	
SWITCH	X
OUTPUT	XY

000125

DIAG CAB	6 (10)
BUZZER	XY
SWITCH SEAT	X
ALARM	X
OP	X

000126

### 8.4.3.5 CAB, menu 5

#### HORN, SWITCH

Description: Signal from switch horn.

Circuit diagram: Circuit Alarm, audible signals group 9.7

Connection: signal from S162/H to digital in D790-2/K3:2

Function: 9.7 Signal system

Signal value:

1	Input signal active.
0	No signal.

#### HORN, OUTPUT

Description: Voltage feed to horn.

Circuit diagram: Circuit Alarm, audible signals group 9.7

Connection: digital out D790-1/K11:11 to H850/8 (⊕) for compressor horn, signal to relay K3016/86)

Function: 9.7.1 Horn

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

### 8.4.3.6 CAB, menu 6

#### BUZZER

Description: Voltage feed to buzzer for alarm indication panel, feed.

Circuit diagram: Circuit Alarm, audible signals group 9.7

Connection: digital out D790-1/K11:5 to H853/1

Function: 9.3 Seats, 1 Engine, 8.2.1 Overload system

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG CAB	6 (10)
BUZZER	XY
SWITCH SEAT	X
ALARM	X
OP	X

000126

DIAG CAB	6 (10)
BUZZER	XY
SWITCH SEAT	X
ALARM	X
OP	X

000126

DIAG CAB	6 (10)
BUZZER	XY
SWITCH SEAT	X
ALARM	X
OP	X

000126

DIAG CAB	7 (10)
FUEL	
SENSOR VALUE	XXXOHM
PROC	XXX

000127

### SWITCH SEAT

Description: Signal from sensor operator in seat.

Circuit diagram: Circuit Alarm, audible signals group 9.7

Connection: signal from S230/1 to D790-1/K11:14

Function: 9.3.9 Sensor operator in seat

Signal value:

1	Input signal active. Operator in seat.
0	No signal. No operator in seat.

### ALARM

Description: Status for alarm indication panel, warning from Control and monitoring system.

Circuit diagram: -

Connection: -

Function: 8.1.2 Information display

Signal value:

1	Conditions for activation of buzzer from seat switch and parking brake are fulfilled.
0	Conditions for activation of buzzer are not fulfilled.

### OP

Description: Status for overload warning from control and monitoring system.

Circuit diagram: Circuit OP + Scale group 8.2

Connection: -

Function: 8.2.1 Overload system

Signal value: X = 1,

1	Conditions for activation of buzzer fulfilled, that is, overload system is indicating.
0	Conditions for activation of buzzer are not fulfilled.

## 8.4.3.7 CAB, menu 7

### FUEL, SENSOR VALUE

Description: Signal from sensor fuel level.

Circuit diagram: Circuit Sensors instr. group 9.1

Connection: analogue rheostat signal from B757/1 signal to D797-R/K2:15

Function: 1.2.2 Sensor fuel level

Signal value: XXXOHM = Current resistance value from sensor fuel level in ohm.

DIAG CAB	7 (10)
FUEL	
SENSOR VALUE	XXXOHM
PROC	XXX

000127

DIAG CAB	8 (10)
SEAT HEATER	
SWITCH	X
OUTPUT	XY

000128

DIAG CAB	8 (10)
SEAT HEATER	
SWITCH	X
OUTPUT	XY

000128

## FUEL, PROC

Description: Control and monitoring system's interpretation of signal from sensor fuel tank.

Circuit diagram: Circuit Sensors instr. group 9.1

Connection: -

Function: 1.2.2 Sensor fuel level

Signal value: XXX = 0-100 = 0-100 % = Fuel volume in tank.

### 8.4.3.8 CAB, menu 8

## SEAT HEATER, SWITCH



Description: Signal from switch seat heat.

Circuit diagram: Circuit Cab operator's seat group 9.3

Connection: signal from S143/1 to digital in D790-1/K6:6

Function: 9.3 Seats

Signal value:

1	Input signal active.
0	No signal.

## SEAT HEATER, OUTPUT



Description: Control voltage to relay seat heat.

Circuit diagram: Circuit Cab operator's seat group 9.3

Connection: digital out D790-1/K10:7 to K383/86

Function: 9.3.3 Heating coil

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG CAB	9 (X)
AUT LUBRICATION CHASSI	
OUTPUT	XY

006863

### 8.4.3.9 CAB, menu 9

#### AUT. LUBRICATION CHASSIS, OUTPUT



Description: Voltage feed to central lubrication chassis. Central lubrication is supplied with voltage only when the machine is in operation.

Circuit diagram: Circuit Central lubrication group 9.14

Connection: digital out D797-F/K1:28 to M693-1

Function: 9.14 Central lubrication

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

### 8.4.3.10 CAB, menu 10

#### AUT. LUBRICATION ATTACHMENT, OUTPUT



Description: Central lubrication attachment, feed. Central lubrication is supplied with voltage only when the machine is in operation

Circuit diagram: Circuit Central lubrication group 9.14

Connection: digital out D791/K1:14 to M693-2

Function: 9.14 Central lubrication

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

DIAG CAB	10 (X)
AUT LUBRICATION ATTACHMENT	
OUTPUT	XY

006864

## 8.4.4 CLIMATE

### CLIMATE, description

This group handles the cab's climate control unit.

Confirm selection with function key for Enter.

DIAGNOSIS
CAN/POWER LIGHTS CAB
<b>CLIMATE</b> HYD ENGINE
TRANSM BOOM ATTACH
OP EXTRA HIST

000131

DIAG CLIMATE	1 (8)
PRESENT INPUT SIGNAL	
REQUIRED TEMP	XXX
PRESENT TEMP	XXX
WATER VALVE FEEDB.	XXX

000132

DIAG CLIMATE	1 (8)
PRESENT INPUT SIGNAL	
REQUIRED TEMP	XXX
PRESENT TEMP	XXX
WATER VALVE FEEDB.	XXX

000132

DIAG CLIMATE	1 (8)
PRESENT INPUT SIGNAL	
REQUIRED TEMP	XXX
PRESENT TEMP	XXX
WATER VALVE FEEDB.	XXX

000132

DIAG CLIMATE	2 (8)
TEMP COIL	XXX
TEMP COOLANT	XXX
TEMP AMBIENT	XXX
TEMP DE-ICE	XXX

000133

DIAG CLIMATE	2 (8)
TEMP COIL	XXX
TEMP COOLANT	XXX
TEMP AMBIENT	XXX
TEMP DE-ICE	XXX

000133

### 8.4.4.1 CLIMATE, menu 1

#### PRESENT INPUT SIGNAL, REQUIRED TEMP

Description: Set value for desired temperature.

Circuit diagram: Circuit Climate system group 9.4

Connection: signal from S139/3 to analogue in D790-1/K5:8

Function: 9.4 Heating, ventilation and air conditioning

Signal value: XXX = 160-280 = 16-28 °C = Set temperature in tenths of degrees, in steps of half degrees (200 = 20 °C). Test by increasing or decreasing temperature with switch temperature on the panel.

#### PRESENT INPUT SIGNAL, PRESENT TEMP

Description: Signal from sensor cab temperature.

Circuit diagram: Circuit Climate system group 9.4

Connection: signal from B775-1/2 to input D790-1/K4:8

Function: 9.4.17 Sensor cab temperature

Signal value: XXX = Cab's interior temperature in tenths of degrees (200 = 20 °C).

#### PRESENT INPUT SIGNAL, WATER VALVE FEEDB.

Description: Water valve's position (opening in percent).

Circuit diagram: Circuit Climate system group 9.4

Connection: signal from Y673/9 to analogue in D790-1/K10:4

Function: 9.4.5 Water valve

Signal value: XXX = 0-100 = 0-100% = Water valve's opening in %. 0 = Closed. 100 = Fully open.

### 8.4.4.2 CLIMATE, menu 2

#### TEMP COIL

Description: Temperature of the air out from the fan. The sensor is located in the air distributor.

Circuit diagram: Circuit Climate system group 9.4

Connection: signal from B775-2/2 to input D790-1/K4:10

Function: 9.4.16 Sensor temperature outlet fan

Signal value: XXX = Temperature of the air blown into the cab in tenths of degrees (200 = 20 °C).

#### TEMP COOLANT

Description: Coolant temperature, temperature of the engine's coolant. Signal is retrieved from the engine via CAN-bus drivetrain.

Circuit diagram: Circuit Climate system group 9.4

Connection: from engine via CAN-bus, see *PRESENT INPUT SIGNAL, COOLANT TEMP* page 74.

Function: 1.7.9 Sensor coolant temperature

Signal value: XXX = Engine temperature in tenths of degrees (200 = 20 °C).

<b>DIAG CLIMATE</b>	<b>2 (8)</b>
TEMP COIL	XXX
TEMP COOLANT	XXX
TEMP AMBIENT	XXX
TEMP DE-ICE	XXX

000133

<b>DIAG CLIMATE</b>	<b>2 (8)</b>
TEMP COIL	XXX
TEMP COOLANT	XXX
TEMP AMBIENT	XXX
TEMP DE-ICE	XXX

000133

<b>DIAG CLIMATE</b>	<b>3 (X)</b>
PRESENT INPUT SIGNAL	
PRESSURE SWITCH	X
OPT DOOR SWITCH	X

006865

<b>DIAG CLIMATE</b>	<b>3 (X)</b>
PRESENT INPUT SIGNAL	
PRESSURE SWITCH	X
OPT DOOR SWITCH	X

006865

### TEMP AMBIENT

Description: Outdoor temperature. Heat radiation from engine and sun may affect the value since the sensor is located on the rear of the cab roof.

Circuit diagram: Circuit Climate system group 9.4

Connection: signal from B774/2 to input D790-1/K7:9

Function: 9.4.18 Sensor ambient temperature

Signal value: XXX = Outdoor temperature in tenths of degrees (200 = 20 °C).

### TEMP DE-ICE

Description: Temperature in refrigerant circuit.

Circuit diagram: Circuit Climate system group 9.4

Connection: signal from B775-3/2 to input D790-1/K4:11

Function: 9.4.12 Sensor temperature refrigerant

Signal value: XXX = Refrigerant temperature in tenths of degrees (200 = 20 °C).

## 8.4.4.3 CLIMATE, menu 3

### PRESENT INPUT SIGNAL, PRESSURE SWITCH

Description: Signal from pressure monitor refrigerant.

Circuit diagram: Circuit Climate system group 9.4

Connection: signal from S246/2 to digital in D797-R/K1:37

Function: 9.4.10 Pressure monitor

Signal value:

1	Input signal active. Press Ok.
0	No signal, too high or too low pressure.

### PRESENT INPUT SIGNAL, OPT DOOR SWITCH



Description: Signal from switch operator's door. On machines with the option automatic shut-off of AC, this signal is used to control shut-off.

Circuit diagram: Circuit Lighting group 9.6

Connection: signal from S266-LE or S266-RI to digital in D790-1/K11:3

Function: 9.10.2 Doors

Signal value:

1	Input signal active. Door open.
0	No signal. Doors closed.

<b>DIAG CLIMATE</b>	<b>4 (8)</b>
PRESENT INPUT SIGNAL	
WATER VALVE	XX.XXV
DRAUGHT VALVE	XX.XXV

000135

<b>DIAG CLIMATE</b>	<b>4 (8)</b>
PRESENT INPUT SIGNAL	
WATER VALVE	XX.XXV
DRAUGHT VALVE	XX.XXV

000135

<b>DIAG CLIMATE</b>	<b>5 (8)</b>
PRESENT INPUT SIGNAL	
REQUIRED TEMP	XX.XXV
REQ. DRAUGHT	XX.XXV
REQ. FAN SPEED	XX.XXV

000136

<b>DIAG CLIMATE</b>	<b>5 (8)</b>
PRESENT INPUT SIGNAL	
REQUIRED TEMP	XX.XXV
REQ. DRAUGHT	XX.XXV
REQ. FAN SPEED	XX.XXV

000136

<b>DIAG CLIMATE</b>	<b>5 (8)</b>
PRESENT INPUT SIGNAL	
REQUIRED TEMP	XX.XXV
REQ. DRAUGHT	XX.XXV
REQ. FAN SPEED	XX.XXV

000136

#### 8.4.4.4 CLIMATE, menu 4

##### PRESENT INPUT SIGNAL, WATER VALVE

Description: Signal from water valve, the voltage is a measure of the position.

Circuit diagram: Circuit Climate system group 9.4

Connection: signal from Y673/9 to analogue in D790-1/K10:4

Function: 9.4.5 Water valve

Signal value: XX.XXV = 0.50 - 4.50 V

##### PRESENT INPUT SIGNAL, DRAUGHT VALVE

Description: Signal from the engine to the air distributor. Voltage is a measure of the valve's position.

Circuit diagram: Circuit Climate system group 9.4

Connection: signal from Y672/9 to analogue in D790-1/K4:7

Function: 9.4.14 Air distributor

Signal value: XX.XXV = 0.50 - 4.50 V

#### 8.4.4.5 CLIMATE, menu 5

##### PRESENT INPUT SIGNAL, REQUIRED TEMP

Description: Signal from switch temperature. Voltage when switch is pressed in voltage level indicates increase or decrease of the temperature.

Circuit diagram: Circuit Climate system group 9.4

Connection: signal from S139/3 to analogue in D790-1/K5:8

Function: 9.4 Heating, ventilation and air conditioning

Signal value: XX.XXV ~ 2.4 / 0 / 5.0 V = Increase / - / decrease.

##### PRESENT INPUT SIGNAL, REQ. DRAUGHT

Description: Signal from switch air distribution, voltage when switch is pressed in. The voltage level indicates change of air control against windshield (up) or floor (down). The valve's position changes in steps between windshield - floor.

Circuit diagram: Circuit Climate system group 9.4

Connection: signal from S117/3 to analogue in D790-1/K5:9

Function: 9.4 Heating, ventilation and air conditioning

Signal value: XX.XXV ~ 2.4 / 0 / 5.0 V = Up / - / down.

##### PRESENT INPUT SIGNAL, FAN SPEED

Description: Signal from switch fan speed, switch controls increase or decrease of fan speed. Speed is endless adjustable. The voltage level indicates if the speed should be increased or decreased.

Circuit diagram: Circuit Climate system group 9.4

Connection: signal from S118/2 to analogue in D790-1/K5:7

Function: 9.4 Heating, ventilation and climate control unit

Signal value: XX.XXV ~ 2.4 / 0 / 5.0 V = Increase / - / decrease.

DIAG CLIMATE	6 (8)
PRESENT OUTPUT SIGNAL	
FAN SPEED	XXX
RECIRKULATION	XY
COMPRESSOR	XY

000137

DIAG CLIMATE	6 (8)
PRESENT OUTPUT SIGNAL	
FAN SPEED	XXX
RECIRKULATION	XY
COMPRESSOR	XY

000137

DIAG CLIMATE	6 (8)
PRESENT OUTPUT SIGNAL	
FAN SPEED	XXX
RECIRKULATION	XY
COMPRESSOR	XY

000137

### 8.4.4.6 CLIMATE, menu 6

#### PRESENT OUTPUT SIGNAL, FAN SPEED

Description: Current control of fan motor, speed is controlled with PWM-control of grounding (of fan motor).

Circuit diagram: Circuit Climate system group 9.4

Connection: analogue out from D790-1/K2:2 to M657/31

Function: 9.4.3 cab fan

Signal value: XXX = 0-255 = Fan speed (255 = max. fan speed).

#### PRESENT OUTPUT SIGNAL, RECIRCULATION

Description: Control voltage to motor for fresh air and recirculation damper.

Circuit diagram: Circuit Climate system group 9.4

Connection: digital out from D790-1/K2:3 to M612

Function: 9.4.2 Fresh air and recirculation damper

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

#### PRESENT OUTPUT SIGNAL, COMPRESSOR

Description: Voltage feed of magnet clutch on the AC compressor. Controls cut-in and cut-out of the compressor. Two outputs are connected in parallel to handle the current.

Circuit diagram: Circuit Climate system group 9.4

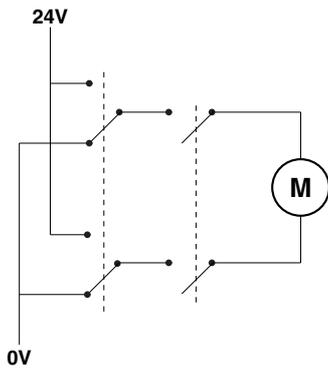
Connection: digital out from D797-R/K1:34 and K1:35 to M645/1

Function: 9.4.7 Compressor

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

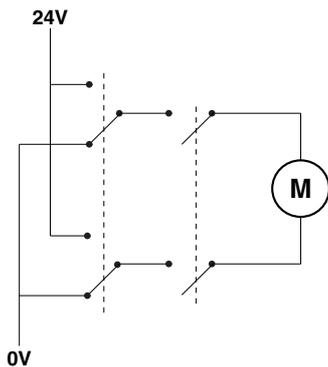
<b>DIAG CLIMATE</b>	<b>7 (8)</b>
OUTPUT WATER VALVE	
CLOCKWISE	XY XY
ANTI-CLOCKWISE	XY XY



H-bridge

000138

<b>DIAG CLIMATE</b>	<b>7 (8)</b>
OUTPUT WATER VALVE	
CLOCKWISE	XY XY
ANTI-CLOCKWISE	XY XY



H-bridge

000138

### 8.4.4.7 CLIMATE, menu 7

#### OUTPUT WATER VALVE, CLOCKWISE

Description: Voltage feed to water valve, for opening. The valve is connected to an H-bridge. The signal can only be diagnosed when the valve's position changes. The valve's opening and closing is controlled by the climate control unit's software depending on desired temperature, outside temp. cab temperature and coolant temperature, thereafter it may be difficult to determine if the valve is working as it should.

Circuit diagram: Circuit Climate system group 9.4

Connection: digital out from D790-1/K4:1 via R3 to Y673/5 and from D790-1/K4:2 via R4 to Y673/6

Function: 9.4.5 Water valve

Signal value: motor runs clockwise row 1: 11 11 row 2: 00 11

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### OUTPUT WATER VALVE, COUNTER-CLOCKWISE

Description: Voltage feed to water valve, for closing. The valve is connected to an H-bridge. The signal can only be diagnosed when the valve's position changes. The valve's opening and closing is controlled by the climate control unit's software depending on desired temperature, outside temp. cab temperature and coolant temperature, thereafter it may be difficult to determine if the valve is working as it should.

Circuit diagram: Circuit Climate system group 9.4

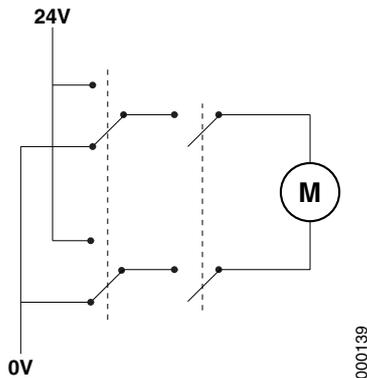
Connection: digital out from D790-1/K4:1 via R3 to Y673/5 and from D790-1/K4:2 via R4 to Y673/6

Function: 9.4.5 Water valve

Signal value: motor runs counter-clockwise row 1: 00 11, row 2: 11 11

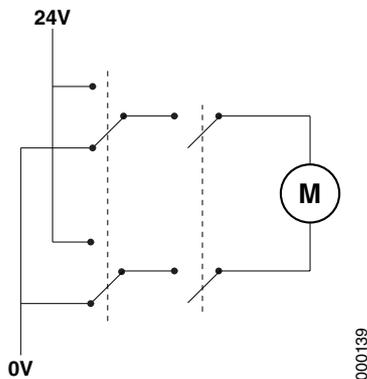
00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG CLIMATE	8 (8)
OUTPUT DRAUGHT VALVE	
CLOCKWISE	XY XY
ANTI-CLOCKWISE	XY XY



H-bridge

DIAG CLIMATE	8 (8)
OUTPUT DRAUGHT VALVE	
CLOCKWISE	XY XY
ANTI-CLOCKWISE	XY XY



H-bridge

### 8.4.4.8 CLIMATE, menu 8

#### OUTPUT DRAUGHT VALVE, CLOCKWISE

Description: Voltage feed to motor for the air distributor, rotation clockwise. Is connected to an H-bridge. Signal can only be diagnosed when the air distributor's position changes.

Circuit diagram: Circuit Climate system group 9.4

Connection: digital out from D790-1/K4:3 via R5 to Y672/5 and from D790-1/K4:4 via R6 to Y672/6

Function: 9.4.14 Air distributor

Signal value: motor runs clockwise row 1: 11 11, row 2: 00 11

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### OUTPUT DRAUGHT VALVE, COUNTER-CLOCKWISE

Description: Voltage feed to motor for the air distributor, rotation counter-clockwise. Motor is connected to an H-bridge. Signal can only be diagnosed when the air distributor's position changes.

Circuit diagram: Circuit Climate system group 9.4

Connection: digital out from D790-1/K4:3 via R5 to Y672/5 and from D790-1/K4:4 via R6 to Y672/6

Function: 9.4.14 Air distributor

Signal value: motor runs counter-clockwise row 1: 00 11, row 2: 11 11

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAGNOSIS	
CAN/POWER LIGHTS CAB	
CLIMATE	<b>HYD</b> ENGINE
TRANSM BOOM ATTACH	
OP EXTRA HIST	

000140

DIAG HYD	1 (6)
HYDRAULIC OIL	
TEMP	XXX
FAN	XY

000141

DIAG HYD	1 (6)
HYDRAULIC OIL	
TEMP	XXX
FAN	XY

000141

DIAG HYD	2 (6)
BRAKE COOLANT OIL	
TEMP	XXX
FAN	XY

000142

## 8.4.5 HYD

### HYD, description

This group handles the hydraulic functions.

Confirm selection with function key for Enter.

#### 8.4.5.1 HYD, menu 1

##### HYDRAULIC OIL, TEMP

Description: Signal from sensor hydraulic oil temperature.

Circuit diagram: Wiring Hydraulics group 10.0

Connection: signal from B776/1 to input D797-R/K2:13

Function: 10.6.3 Sensor hydraulic oil temperature

Signal value: XXX = Temperature in tenths of degrees (200 = 20 °C).

##### HYDRAULIC OIL, FAN

Description: Voltage feed cooling fan hydraulic oil.

Circuit diagram: Wiring Hydraulics group 10.0

Connection: digital out from D797-R/K and 1:14 till M668/1

Function: 10.6.4 Cooling fan

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

#### 8.4.5.2 HYD, menu 2

##### BRAKE COOLANT OIL, TEMP

Description: Signal from sensor brake oil temperature.

Circuit diagram: Circuit Brake system group 4.0

Connection: signal from B762/1 to input D797-F/K2:13

Function: 4.8.10 Sensor brake oil temperature

Signal value: XXX = Temperature in tenths of degrees (200 = 20 °C).

DIAG HYD	2 (6)
BRAKE COOLANT OIL	
TEMP	XXX
FAN	XY

000142

**BRAKE COOLANT OIL, FAN**

Description: Voltage feed to cooling fan brake oil.

Circuit diagram: Circuit Brake system group 4.0

Connection: digital out from D797- F/K1:14 to M674/1

Function: 4.8.8 Cooling fan

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

**8.4.5.3 HYD, menu 3****PRESSURE LIFTING CYL, C-**Description: Pressure on the lift cylinders' rod side (C-). For voltage value, see *OP, description page 115*.

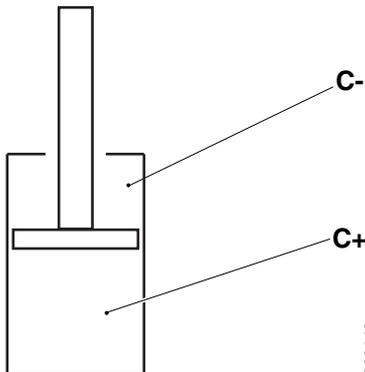
Circuit diagram: Circuit OP + Scale group 8.2

Connection: See *PRESENT INPUT SIGNAL LIFT CYL LE RI, C- page 117*

Function: 8.2.1 Overload system

Signal value: XXX = 0-250 = Hydraulic pressure 0 - 25 MPa. (255 = incorrect signal.)

DIAG HYD	3 (6)
PRESSURE LIFTING CYL	
	Le Ri
C-	XXX XXX
C+	XXX XXX

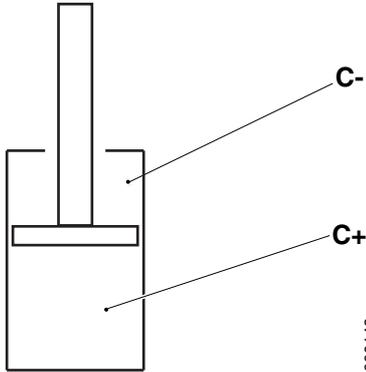


000143

**NOTE**

*It is possible to test the sensors quickly by lifting max. and overflowing the lift function all 4 sensors (C+ and C-) shall then show the same pressure  $\pm 0.1$  MPa.*

DIAG HYD	3 (6)	
PRESSURE LIFTING CYL	Le	Ri
C-	XXX	XXX
C+	XXX	XXX



000143

### PRESSURE LIFTING CYL, C+

Description: Pressure on lift cylinders' piston side (C+). For voltage value, see *OP, description page 115*. Sensor on right lift cylinder is optional .

Circuit diagram: Circuit OP + Scale group 8.2

Connection: See *PRESENT INPUT SIGNAL LIFT CYL LE RI, C+* page 117

Function: 8.2.1 Overload system

Signal value: XXX = 0-250 = Hydraulic pressure 0 - 25 MPa. (255 = incorrect signal.)

### NOTE

*It is possible to test the sensors quickly by lifting max. and overflowing the lift function all 4 sensors (C+ and C-) shall then show the same pressure  $\pm 0.1$  MPa.*

## 8.4.5.4 HYD, menu 4

### PRESSURE SWITCHES, BRAKE PRESSURE

Description: Signal from break-contact brake oil pressure.

Circuit diagram: Circuit Brake system group 4.0

Connection: signal from S204/2 to analogue in D797-F/K1:20

Function: 4.3.7 Break-contact brake oil pressure

Signal value:

1	Input signal active.
0	No signal.

### PRESSURE SWITCHES, BRAKE LIGHT PRESSURE

Description: Signal from make-contact brake lights.

Circuit diagram: Circuit Lighting group 9.6

Connection: from S216/2 to analog in D797-F/K1:13

Function: 4.3.8 Make-contact brake lights

Signal value:

1	Input signal active.
0	No signal.

DIAG HYD	4 (6)	
PRESSURE SWITCHES		
BRAKE PRESSURE		X
BRAKE LIGHT PRESS.		X
DECLUTCH PRESSURE		X

000144

DIAG HYD	4 (6)	
PRESSURE SWITCHES		
BRAKE PRESSURE		X
BRAKE LIGHT PRESS.		X
DECLUTCH PRESSURE		X

000144

DIAG HYD	4 (6)
PRESSURE SWITCHES	
BRAKE PRESSURE	X
BRAKE LIGHT PRESS.	X
DECLUTCH PRESSURE	X

000144

### PRESSURE SWITCHES, DECLUTCH PRESSURE

Description: Signal from make-contact declutch.

Circuit diagram: Circuit Drivetrain group 2.1

Connection: signal from S220-2/2 to analogue in D797-F/K1:41

Function: 2.8.2 Make-contact declutch

Signal value:

1	Input signal active.
0	No signal.

### 8.4.5.5 HYD, menu 5

#### P-BRAKE, SWITCH

Description: Signals from switch parking brake. Two signals, one for released parking brake and one for applied parking brake. Both signals must be valid to enable release of parking brake.

Circuit diagram: Circuit Brake system group 4.0

Connection: signal from S107/1 to digital in D790-1/K8:13 and from S107/7 to digital in D790-1/K8:5

Function: 4.1.2 Switch parking brake

Signal value:

1/0	Open, parking brake released.
0/1	On, parking brake applied.

#### P-BRAKE, FEEDBACK SWITCH

Description: Signal from break-contact parking brake.

Circuit diagram: Circuit Brake system group 4.0

Connection: signal from 200/2 to digital in D797-F/K1:27

Function: 4.5.5 Break-contact parking brake

Signal value:

1	Input signal active.
0	No signal.

DIAG HYD	5 (6)
P-BRAKE	
SWITCH	X/Y
FEEDBACK SWITCH	X
VALVE	XY

000145

DIAG HYD	5 (6)
P-BRAKE	
SWITCH	X/Y
FEEDBACK SWITCH	X
VALVE	XY

000145

DIAG HYD	5 (6)
P-BRAKE	
SWITCH	X/Y
FEEDBACK SWITCH	X
VALVE	XY

000145

**P-BRAKE, VALVE**

Description: Voltage feed to Solenoid valve parking brake.

Circuit diagram: Circuit Brake system group 4.0

Connection: digital out D797- F/K1:7 to Y642/1

Function: 4.5.3 Solenoid valve parking brake

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

**8.4.5.6 HYD, menu 6**

**PRESENT OUTPUT SIGNAL, PRESSURE TO ATTACHM. VALVE**

Description: Activate hydraulic pressure to attachment.

Circuit diagram: Wiring Rotation, group 7.6

Connection: digital out D797- R/K1:31 to Y6003/1

Function: 7.4 Sideshift, 7.5 Spreading, 7.6 Rotation, 7.7 Tilt, 7.8 Leveling 7.9.1 Twistlock, 7.9.2 Lift legs.

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

**8.4.6 ENGINE**

**ENGINE, description**

This group handles engine functions.

Confirm selection with function key for Enter.

DIAG HYD	6 (6)
PRESENT OUTPUT SIGNAL	
PRESSURE TO ATTACHM.	
VALVE	XY

000146

DIAGNOSIS
CAN/POWER LIGHTS CAB
CLIMATE HYD <b>ENGINE</b>
TRANSM BOOM ATTACH
OP EXTRA HIST

000147

<b>DIAG ENGINE</b>	<b>1 (X)</b>
PRESENT INPUT SIGNAL	
ACCELERATOR	X.XXV
REQUIRED SPD PROC	XXX
REQUIRED SPD RPM	XXXX

006866

<b>DIAG ENGINE</b>	<b>1 (X)</b>
PRESENT INPUT SIGNAL	
ACCELERATOR	X.XXV
REQUIRED SPD PROC	XXX
REQUIRED SPD RPM	XXXX

006866

<b>DIAG ENGINE</b>	<b>1 (X)</b>
PRESENT INPUT SIGNAL	
ACCELERATOR	X.XXV
REQUIRED SPD PROC	XXX
REQUIRED SPD RPM	XXXX

006866

<b>DIAG ENGINE</b>	<b>2 (10)</b>
PRESENT INPUT SIGNAL	
ENGINE SPEED EDC	XXXX
ENGINE SPEED TCU	XXXX

000149

<b>DIAG ENGINE</b>	<b>2 (10)</b>
PRESENT INPUT SIGNAL	
ENGINE SPEED EDC	XXXX
ENGINE SPEED TCU	XXXX

000149

### 8.4.6.1 ENGINE, menu 1

#### PRESENT INPUT SIGNAL, ACCELERATOR

Description: Signal from accelerator pedal.

Circuit diagram: Wiring Drivetrain group 1.1

Connection: signal from R690/2 to analogue in D790-1/K6:11

Function: 1 Engine

Signal value: X.XXV = 0.50 - 4.50 V

#### PRESENT INPUT SIGNAL, REQUIRED SPD PROC

Description: Required engine speed (in per cent) which is sent from Control unit cab (D790-1) to Control unit engine (D794) via the CAN-bus drivetrain.

Circuit diagram: -

Connection: -

Function: 1.9 Control and monitoring system, engine

Signal value: XXX = 0-100%

#### PRESENT INPUT SIGNAL, REQUIRED SPD RPM

Description: Required engine speed in rpm which is sent from Control unit cab (D790-1) to Control unit engine (D794) via the CAN-bus drivetrain.

Circuit diagram: -

Connection: -

Function: 1.9 Control and monitoring system, engine

Signal value: XXXX = 0-2010 rpm

### 8.4.6.2 ENGINE, menu 2

#### PRESENT INPUT SIGNAL, ENGINE SPEED EDC

Description: Engine speed from Control unit engine (D794) to Control unit cab (D790-1) via CAN-bus drivetrain. Actual value for engine speed.

Circuit diagram: -

Connection: -

Function: 1.9.2 Sensor engine rpm

Signal value: XXXX = Active speed in rpm.

#### PRESENT INPUT SIGNAL, ENGINE SPEED TCU

Description: Engine speed from Control unit transmission (D793) to Control unit cab (D790-1) via CAN-bus drivetrain. Actual value for engine speed engine.

Circuit diagram: -

Connection: -

Function: 2.2.5 Sensor engine rpm and oil temperature transmission

Signal value: XXXX = Active speed in rpm.

<b>DIAG ENGINE</b>	<b>3 (X)</b>
PRESENT INPUT SIGNAL	
PRESENT TORQUE	XXX
PRESENT TORQUE	XXX
PRES TORQUE @ RPM	XXX

006867

<b>DIAG ENGINE</b>	<b>3 (X)</b>
PRESENT INPUT SIGNAL	
PRESENT TORQUE	XXX
PRESENT TORQUE	XXX
PRES TORQUE @ RPM	XXX

006867

<b>DIAG ENGINE</b>	<b>3 (X)</b>
PRESENT INPUT SIGNAL	
PRESENT TORQUE	XXX
PRESENT TORQUE	XXX
PRES TORQUE @ RPM	XXX

006867

<b>DIAG ENGINE</b>	<b>4 (10)</b>
PRESENT INPUT SIGNAL	
PREHEAT SWITCH	X
CRANK ENGINE SWITCH	X
D+	X

000151

### 8.4.6.3 ENGINE, menu 3

#### PRESENT INPUT SIGNAL, PRESENT TORQUE

Description: Current torque from Control unit engine (D794). Percentage torque use of engine's capacity.

Circuit diagram: -

Connection: -

Function: 1.9 Control and monitoring system, engine

Signal value: XXX = 0-100%

#### PRESENT INPUT SIGNAL, REQUIRED TORQUE

Description: Requested torque from Control unit cab (D790-1) to Control unit engine (D794).

Circuit diagram: -

Connection: -

Function: 1.9 Control and monitoring system, engine

Signal value: XXX = 0-100%

#### PRESENT INPUT SIGNAL, PRES TORQUE @ RPM

Description: Available torque at current engine speed.

Circuit diagram: -

Connection: -

Function: 1.9 Control and monitoring system, engine

Signal value: XXX = 0-100%

### 8.4.6.4 ENGINE, menu 4

#### PRESENT INPUT SIGNAL, PREHEAT SWITCH



Description: Signal from ignition, preheating position. Only used on machines with Volvo engines.

Circuit diagram: Circuit Electric power group 11.5

Connection: signal from S150/19 to digital in D790-2/K2:2

Function: 1 Engine, 1.10.1 Preheating

Signal value:

1	Input signal active.
0	No signal.

<b>DIAG ENGINE</b>	<b>4 (10)</b>
PRESENT INPUT SIGNAL	
PREHEAT SWITCH	X
CRANK ENGINE SWITCH	X
D+	X

000151

### PRESENT INPUT SIGNAL, CRANK ENGINE SWITCH

Description: Signal from ignition, start position.

Circuit diagram: Circuit Electric power group 11.5

Connection: signal from S150/50 to digital in D790-2/K2:1

Function: 1 Engine, 1.11 Start and stop

Signal value:

1	Input signal active.
0	No signal.

<b>DIAG ENGINE</b>	<b>4 (10)</b>
PRESENT INPUT SIGNAL	
PREHEAT SWITCH	X
CRANK ENGINE SWITCH	X
D+	X

000151

### PRESENT INPUT SIGNAL, D+

Description: Signal from alternator, indicates if alternator supplies current.

Circuit diagram: Circuit Electric power group 11.5

Connection: from G660 (D+) to digital in D797-R/K2:16

Function: 11.4.1 Alternator

Signal value:

1	Input signal active.
0	No signal.

## 8.4.6.5 ENGINE, menu 5

### PRESENT OUTPUT SIGNAL, PREHEAT

Description: Status for preheating of induction air.

Circuit diagram: -

Connection:

Volvo: software signals on CAN-bus drivetrain

Cummins: controlled by engine's control and monitoring system.

Function: 1.10.1 Preheating

Signal value:

1	Output signal active.
0	No output signal.

<b>DIAG ENGINE</b>	<b>5 (10)</b>
PRESENT OUTPUT SIGNAL	
PREHEAT	X
CRANK ENGINE	X

000152

DIAG ENGINE	5 (10)
PRESENT OUTPUT SIGNAL	
PREHEAT	X
CRANK ENGINE	X

000152

### PRESENT OUTPUT SIGNAL, CRANK ENGINE

Description: Voltage feed starter motor.

Circuit diagram: Circuit Electric power group 11.5

Connection:

Volvo: software signals on CAN-bus drivetrain

Cummins: digital out D797-R/K1:36 to K360/86

Function: 1.11 Start and stop

Signal value:

1	Output signal active.
0	No output signal.

### 8.4.6.6 ENGINE, menu 6

#### PRESENT INPUT SIGNAL, OIL PRESSURE

Description: Engine oil pressure. CAN-bus message from Control unit engine (D794) to Control unit cab (D790-1).

Circuit diagram: see *supplier documentation engine*

Connection:

Volvo TWD1240VE: signal from "43 Sensor oil temperature / pressure" to Control unit engine (D794) "black connector" socket 14

Volvo TAD1250VE: signal from "28 Sensor oil temperature and oil pressure" to Control unit engine (D794) "Connector B" socket 11

Cummins QSM11: signal from "Oil pressure/temperature sensor" to Control unit engine (D794) "Sensor connector" socket 44

Function: 1.8.3 Sensor oil pressure engine

Signal value: XXX = 10 corresponds to 100 KPa.

#### PRESENT INPUT SIGNAL, BOOST PRESSURE

Description: Boost pressure. CAN-bus message from Control unit engine (D794) to Control unit cab (D790-1).

Circuit diagram: See *supplier documentation engine*

Connection:

Volvo TWD1240VE: signal from "36 Sensor boost pressure / charge-air temp" to Control unit engine (D794) "black connector" socket 2

Volvo TAD1250VE: signal from "23 Sensor boost pressure / charge-air temp" to Control unit engine (D794) "connector A" socket 22

Cummins QSM11: signal from "Intake manifold (Boost) pressure sensor" to Control unit engine (D794) "Sensor connector" socket 39

Function: 1.6.5 Sensor boost pressure

Signal value: XXX = 10 corresponds to 100 KPa.

DIAG ENGINE	6 (X)
PRESENT INPUT SIGNAL	
OIL PRESSURE	XXX
BOOST PRESSURE	XXX
OIL LEVEL	XXX

006868

DIAG ENGINE	6 (X)
PRESENT INPUT SIGNAL	
OIL PRESSURE	XXX
BOOST PRESSURE	XXX
OIL LEVEL	XXX

006868

DIAG ENGINE	6 (X)
PRESENT INPUT SIGNAL	
OIL PRESSURE	XXX
BOOST PRESSURE	XXX
OIL LEVEL	XXX

006868

DIAG ENGINE	7 (10)
PRESENT INPUT SIGNAL	
OIL TEMP	XXX
COOLANT TEMP	XXX
INTAKE MAIN.TEMP	XXX

000154

DIAG ENGINE	7 (10)
PRESENT INPUT SIGNAL	
OIL TEMP	XXX
COOLANT TEMP	XXX
INTAKE MAIN.TEMP	XXX

000154

## PRESENT INPUT SIGNAL, OIL LEVEL



Only on engine alternative Volvo TAD1250VE

Description: Oil level engine. CAN-bus message from Control unit engine (D794) to Control unit cab (D790-1).

Circuit diagram: See *supplier documentation engine*

Connection: Volvo TAD1250VE: signal from "15 Sensor oil level" to Control unit engine (D794) "connector A" socket 3

Function:

Signal value: XXX = 0-100 = 0-100% = Oil level in percent.

### 8.4.6.7 ENGINE, menu 7

## PRESENT INPUT SIGNAL, OIL TEMP

Description: Temperature engine oil. CAN-bus message from Control unit engine (D794) to Control unit cab (D790-1).

Circuit diagram: see *supplier documentation engine*

Connection:

Volvo TWD1240VE: signal from "43 Sensor oil temperature / pressure" to Control unit engine (D794) "black connector" socket 1

Volvo TAD1250VE: signal from "28 Sensor oil temperature and oil pressure" to Control unit engine (D794) "Connector A" socket 31

Cummins QSM11: signal from "Oil pressure/temperature sensor" socket 4 to Control unit engine (D794) "Sensor connector" socket 42

Function: 1.8.7 Sensor oil temperature

Signal value: XXX = 200 corresponds to 20 °C.

## PRESENT INPUT SIGNAL, COOLANT TEMP

Description: Temperature coolant. CAN-bus message from Control unit engine (D794) to Control unit cab (D790-1).

Circuit diagram: see *supplier documentation engine*

Connection:

Volvo TWD1240VE: signal from "35 Sensor coolant temperature" to Control unit engine (D794) "black connector" socket 25

Volvo TAD1250VE: signal from "16 Sensor coolant temperature" to Control unit engine (D794) "connector B" socket 27

Cummins QSM11: signal from "Coolant temperature sensor" to Control unit engine (D794) "Sensor connector" socket 02

Function: 1.7.9 Sensor coolant temperature

Signal value: XXX = 200 corresponds to 20 °C.

DIAG ENGINE	7 (10)
PRESENT INPUT SIGNAL	
OIL TEMP	XXX
COOLANT TEMP	XXX
INTAKE MAIN.TEMP	XXX

000154

**PRESENT INPUT SIGNAL, INTAKE MAIN.TEMP**

Description: Temperature charge-air. CAN-bus message from Control unit engine (D794) to Control unit cab (D790-1).

Circuit diagram: see *supplier documentation engine*

Connection:

Volvo TWD1240VE: signal from "36 Sensor boost pressure / charge-air temp" to Control unit engine (D794) "black connector" socket 2

Volvo TAD1250VE: signal from "23 Sensor boost pressure / charge-air temp" to Control unit engine (D794) "connector A" socket 47

Cummins QSM11: signal from "Intake manifold (Boost) temperature sensor" to Control unit engine (D794) "Sensor connector" socket 38

Function: 1.6.6 Sensor charge-air temperature

Signal value: XXX = 200 corresponds to 20 °C.

**8.4.6.8 ENGINE, menu 8****PRESENT EDC ERROR, NO. OF ACT ERROR**

Description: Number of active error codes from Control unit engine (D794).

Circuit diagram: -

Connection: -

Function: 1.9 Control and monitoring system

Signal value: XX = number of active error codes.

DIAG ENGINE	8 (8)
PRESENT EDC ERROR	
NR OF ACT ERROR	XX
SPN	XXXX
FMI	XX

002738

**PRESENT EDC ERROR, SPN**

Description: SPN-number for first error code from Control unit engine (D794). SPN indicates malfunction area, that is, what component or signal is defective. Error codes are shown with SPN/FMI in error code menus.

Circuit diagram: -

Connection: -

Function: 8.3 Error codes

Signal value: XXXX = error code number, use error code list, see tab *D Error codes*.

DIAG ENGINE	8 (8)
PRESENT EDC ERROR	
NR OF ACT ERROR	XX
SPN	XXXX
FMI	XX

002738

**PRESENT EDC ERROR, FMI**

Description: FMI-number for first error code from Control unit engine (D794). FMI indicates error type, e.g., short-circuiting or low value. Error codes are shown with SPN/FMI in error code menus.

Circuit diagram: -

Connection: -

Function: 8.3 Error codes

Signal value: XX = error type number, use error code list, see tab *D Error codes*.

DIAG ENGINE	8 (8)
PRESENT EDC ERROR	
NR OF ACT ERROR	XX
SPN	XXXX
FMI	XX

002738

DIAG ENGINE	9 (10)
AVERAGE FUEL CONS	XXX
???????????	

000156

DIAGNOSIS	
CAN/POWER LIGHTS CAB	
CLIMATE HYD ENGINE	
<b>TRANSM</b> BOOM ATTACH	
OP EXTRA HIST	

000158

DIAG TRANSM.	1 (15)
PRESENT INPUT SIGNAL	
BRAKE PEDAL	X.XXV
DECLUTCH SWITCH	X
DECLUTCH PRESS SW.	X

000159

DIAG TRANSM.	1 (15)
PRESENT INPUT SIGNAL	
BRAKE PEDAL	X.XXV
DECLUTCH SWITCH	X
DECLUTCH PRESS SW.	X

000159

### 8.4.6.9 ENGINE, menu 9

#### FUEL CONSUMPTION, MOMENTARILY l/h

Description: Current fuel consumption in litres/hour.

Circuit diagram: -

Connection: -

Function: 1.2 Fuel system

Signal value: XXX = fuel consumption in l/h

### 8.4.7 TRANSM

#### TRANSM, description

This group handles transmission functions.

Confirm selection with function key for Enter.

#### 8.4.7.1 TRANSM, menu 1

##### PRESENT INPUT SIGNAL, BRAKE PEDAL



Description: Not used.

Circuit diagram: Circuit Drivetrain group 2.1

Connection: signal from B697/3 to analogue in on D 790-1/K6:12

Function: -

Signal value: X.XXV = 0.00- 5.00 V

##### PRESENT INPUT SIGNAL, DECLUTCH SWITCH

Description: Signal from declutch pedal.

Circuit diagram: Circuit Drivetrain group 2.1

Connection: signal from S220-1/2 to digital in D790-1/K6:14

Function: 2.1.2 Declutch pedal

Signal value:

1	Input signal active. Declutch pedal pressed down.
0	No signal.

DIAG TRANSM.	1 (15)
PRESENT INPUT SIGNAL	
BRAKE PEDAL	X.XXV
DECLUTCH SWITCH	X
DECLUTCH PRESS SW.	X

000159

**PRESENT INPUT SIGNAL, DECLUTCH PRESS SW.**

Description: Signal from make-contact declutch (pressure monitor).

Circuit diagram: Circuit Drivetrain group 2.1

Connection: signal from S220-2/2 to digital in D797-F/K1:41

Function: 2.8.2 Make-contact declutch

Signal value:

1	Input signal active.
0	No signal.

**8.4.7.2 TRANSM, menu 2****SWITCHES, FORWARD**

Description: Signal from gear and multi-function lever (forward).

Circuit diagram: Circuit Drivetrain group 2.1

Connection: from S162-F to digital in 790-2/K3:11

Function: 2 Transmission

Signal value:

1	Input signal active. Travel direction forward selected.
0	No signal.

**SWITCHES, REVERSE**

Description: Signal from gear and multi-function lever (reverse).

Circuit diagram: Circuit Drivetrain group 2.1

Connection: signal from S162-R to digital in 790-2/K3:12

Function: 2 Transmission

Signal value:

1	Input signal active. Travel direction reverse selected.
0	No signal.

**SWITCHES, SHIFT MODE**

Description: Signal from switch shifting program. Status on CAN-bus from Control unit KIT (D790-2). Switches are integrated in Control unit KIT (D790-2).

Circuit diagram: -

Connection: -

Function: 2 Transmission

Signal value:

1	Shifting program 1 selected.
2	Shifting program 2 selected.
4	Automatic shifting selected.

DIAG TRANSM.	2 (15)
SWITCHES	
FORWARD	X
REVERSE	X
SHIFT MODE	X

000160

DIAG TRANSM.	2 (15)
SWITCHES	
FORWARD	X
REVERSE	X
SHIFT MODE	X

000160

DIAG TRANSM.	2 (15)
SWITCHES	
FORWARD	X
REVERSE	X
SHIFT MODE	X

000160

DIAG TRANSM.	3 (15)	
PRESENT VALUE		
FORWARD		X
REVERSE		X
GEAR		X

000191000

DIAG TRANSM.	3 (15)	
PRESENT VALUE		
FORWARD		X
REVERSE		X
GEAR		X

000191000

DIAG TRANSM.	3 (15)	
PRESENT VALUE		
FORWARD		X
REVERSE		X
GEAR		X

000191000

DIAG TRANSM.	4 (15)	
OPERATING STATE		
AUT/MAN MODE		X
WARNING		X
OPERATING MODE		X

00019162

### 8.4.7.3 TRANSM, menu 3

#### PRESENT VALUE, FORWARD

Description: Status for travel direction forward from Control unit transmission (D793). Shows if drive forward is activated in transmission.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value:

1	Output signal for travel direction forward active.
0	No output signal.

#### PRESENT VALUE, REVERSE

Description: Status for travel direction reverse from Control unit transmission (D793). Shows if drive reverse is activated in transmission.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value:

1	Output signal for travel direction reverse active.
0	No output signal.

#### PRESENT VALUE, GEAR

Description: Current gear, status from Control unit transmission (D793). Shows which gear is activated in transmission.

Circuit diagram: -

Function: 2.8 Control and monitoring system transmission

Connection: -

Signal value: X = current gear.

### 8.4.7.4 TRANSM, menu 4

#### OPERATING STATE, AUT/MAN MODE

Description: Shows which shifting program is selected automatic or manual.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value:

1	Automatic.
0	Manual.

DIAG TRANSM.	4 (15)	
OPERATING STATE		
AUT/MAN MODE		X
WARNING		X
OPERATING MODE		X

000162

DIAG TRANSM.	4 (15)	
OPERATING STATE		
AUT/MAN MODE		X
WARNING		X
OPERATING MODE		X

000162

DIAG TRANSM.	5 (15)	
OPERATING STATE		
SHIFT IN PROGRESS		X
FAULT		X
OLD FAULT		X

000163

**OPERATING STATE, WARNING**

Description: Warning for serious malfunction in transmission from Control unit transmission (D793).

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value:

1	Active error.
0	No errors.

**OPERATING STATE, OPERATING MODE**

Description: Status for operating mode for Control unit transmission (D793), also shown in display on the control unit.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value:

0	Not used.
1	Manual or automatic shifting, standard mode shown during operation.
2	Not used.
3	Not used.
4	Limp home, reduced capacity due to malfunction in transmission.
5	Shut down, serious transmission malfunction control unit shuts down, likely that malfunction cannot be shown as CAN-bus.
6	Calibration of transmission in progress.

**8.4.7.5 TRANSM, menu 5****OPERATING STATE, SHIFT IN PROGRESS**

Description: Status for transmission function during operation, shifting in progress. Active during shifting.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value:

1	Shifting in progress.
0	No activity.

DIAG TRANSM.	5 (15)
OPERATING STATE	
SHIFT IN PROGRESS	X
FAULT	X
OLD FAULT	X

000163

DIAG TRANSM.	5 (15)
OPERATING STATE	
SHIFT IN PROGRESS	X
FAULT	X
OLD FAULT	X

000163

**OPERATING STATE, FAULT**

Description: Status for transmission's function during operation, active error codes present.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value:

1	Active error code.
0	No error codes.

**OPERATING STATE, OLD FAULT**

Description: Status for transmission's function during operation, there are inactive error codes that have not been acknowledged.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value:

1	There are inactive error codes that have not been acknowledged.
0	No unacknowledged error codes.

**8.4.7.6 TRANSM, menu 6****DRUM SPEED**

Description: Signal from sensor rpm drum (position 1).

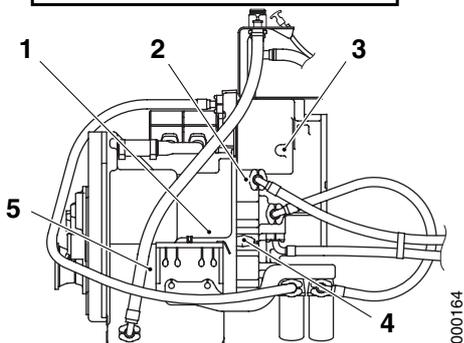
Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from B752 till D793/B3 and D793/C3

Function: 2.3.7 Sensor rpm drum

Signal value: XXXXHz = frequency, indicates pulses from the sensor in Hz (pulses /second). To convert to rpm, divide frequency by number of teeth on drum gear.

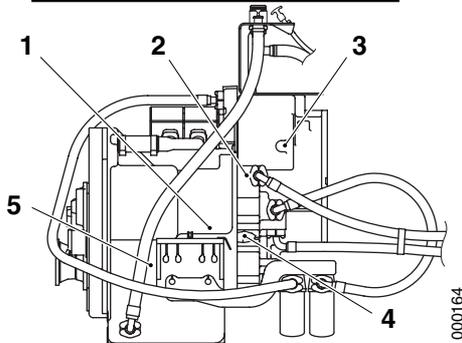
DIAG TRANSM.	6 (15)
DRUM SPEED	XXXXHz
OUTPUT SPEED	XXXXHz
ENGINE SPEED	XXXXHz
TURBINE SPEED	XXXXHz



000164

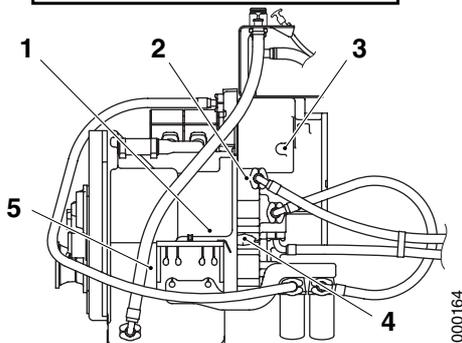
1. Sensor, drum rpm (B752)
2. Temperature monitor torque converter (S221)
3. Sensor engine rpm and temperature transmission (B758/766)
4. Sensor rpm turbine transmission (B751)
5. Sensor rpm output shaft (B758)

DIAG TRANSM.	6 (15)
DRUM SPEED	XXXXHz
OUTPUT SPEED	XXXXHz
ENGINE SPEED	XXXXHz
TURBINE SPEED	XXXXHz



1. Sensor, drum rpm (B752)
2. Temperature monitor torque converter (S221)
3. Sensor engine rpm and temperature transmission (B758/766)
4. Sensor rpm turbine transmission (B751)
5. Sensor rpm output shaft (B758)

DIAG TRANSM.	6 (15)
DRUM SPEED	XXXXHz
OUTPUT SPEED	XXXXHz
ENGINE SPEED	XXXXHz
TURBINE SPEED	XXXXHz



1. Sensor, drum rpm (B752)
2. Temperature monitor torque converter (S221)
3. Sensor engine rpm and temperature transmission (B758/766)
4. Sensor rpm turbine transmission (B751)
5. Sensor rpm output shaft (B758)

## OUTPUT SPEED

Description: Signal from sensor rpm output shaft (propeller shaft) (position 5).

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from B758 till D793/ D3 and D793/ E3

Function: 2.3.9 Sensor rpm output shaft

Signal value: XXXXHz = frequency, indicates pulses from the sensor in Hz (pulses /second). To convert to rpm, divide frequency by number of teeth on output shaft's gear.

## ENGINE SPEED

Description: Rpm signal from sensor rpm engine speed (position 3).

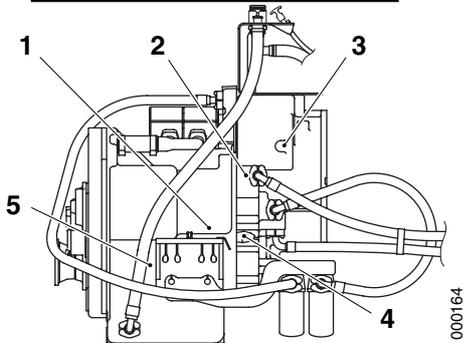
Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from B7558/766 to D793/ H3

Function: 2.2.5 Sensor engine rpm and oil temperature transmission

Signal value: XXXXHz = frequency, indicates pulses from the sensor in Hz (pulses /second). To convert to rpm, divide frequency by number of teeth on input shaft's gear.

DIAG TRANSM.	6 (15)
DRUM SPEED	XXXXHz
OUTPUT SPEED	XXXXHz
ENGINE SPEED	XXXXHz
TURBINE SPEED	XXXXHz



1. Sensor, drum rpm (B752)
2. Temperature monitor torque converter (S221)
3. Sensor engine rpm and temperature transmission (B758/766)
4. Sensor rpm turbine transmission (B751)
5. Sensor rpm output shaft (B758)

DIAG TRANSM.	7 (15)
OUTPUT STATUS	
RSP DRIVE	X X
2/4 VFS SELECTION	X
1/3 VFS SELECTION	X

000165

DIAG TRANSM.	7 (15)
OUTPUT STATUS	
RSP DRIVE	X X
2/4 VFS SELECTION	X
1/3 VFS SELECTION	X

000165

## TURBINE SPEED

Description: Signal from sensor rpm turbine transmission (position 4).

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from B751 to D793/ R2

Function: 2.3.6 Sensor rpm turbine

Signal value: XXXXHz = frequency, indicates pulses from the sensor in Hz (pulses /second). To convert to rpm, divide frequency by number of teeth on turbine's gear.

## 8.4.7.7 TRANSM, menu 7

### OUTPUT STATUS, RSP DRIVE

Description: Status high and low side for control of solenoid valve RSP Drive.

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from D793/K1 and D793/K2 to Y6066

Function: 2.8 Control and monitoring system transmission

1 1	Activated high and low side.
1 0	High side activated, low side no signal.
0 1	High side no signal, low side activated.
0 0	No signal.

### OUTPUT STATUS, 2/4 VFS SELECTION

Description: Status of feed to solenoid valve VFS 2ND/4TH.

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: digital out from D793/ D1 and D793/ E1 to Y6069

Function: 2.8 Control and monitoring system transmission

Signal value:

1	Activated.
0	No signal.

DIAG TRANSM.		7 (15)
OUTPUT STATUS		
RSP DRIVE	X	X
2/4 VFS SELECTION	X	
1/3 VFS SELECTION	X	

000166

**OUTPUT STATUS, 1/3 VFS SELECTION**

Description: Status of feed to solenoid valve VFS 1 ST/3 RD.

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from D793/ H1 and D793/ J1 to Y6067

Function: 2.8 Control and monitoring system transmission

Signal value:

1	Activated.
0	No signal.

**8.4.7.8 TRANSM, menu 8****FWD SUPPLY**

Description: Status for control current to clutch pack forward.

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from D793/B1 to Y630

Function: 2.3.5 Valve block transmission control, 2.8 Control and monitoring system transmission

Signal value:

1	Activated.
0	No signal.

DIAG TRANSM.		8 (15)
FWD SUPPLY	X	
REV SUPPLY	X	
2/4 SUPPLY	X	
1/3 SUPPLY	X	

000166

**REV SUPPLY**

Description: Status for control current to clutch pack reverse.

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from D793/F1 to Y631

Function: 2.3.5 Valve block transmission control, 2.8 Control and monitoring system transmission

Signal value:

1	Activated.
0	No signal.

DIAG TRANSM.		8 (15)
FWD SUPPLY	X	
REV SUPPLY	X	
2/4 SUPPLY	X	
1/3 SUPPLY	X	

000166

**2/4 SUPPLY**

Description: Status for control current to clutch pack 2/4.

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from D793/E2 to Y6074

Function: 2.3.5 Valve block transmission control, 2.8 Control and monitoring system transmission

Signal value:

1	Activated.
0	No signal.

DIAG TRANSM.		8 (15)
FWD SUPPLY	X	
REV SUPPLY	X	
2/4 SUPPLY	X	
1/3 SUPPLY	X	

000166

DIAG TRANSM.	8 (15)
FWD SUPPLY	X
REV SUPPLY	X
2/4 SUPPLY	X
1/3 SUPPLY	X

006869

### 1/3 SUPPLY

Description: Status for control current to clutch pack 1/3.

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from D793/F2 to Y6075

Function: 2.3.5 Valve block transmission control, 2.8 Control and monitoring system transmission

Signal value:

1	Activated.
0	No signal.

## 8.4.7.9 TRANSM, menu 9

### FWD FEEDBACK

Description: Present control current to solenoid valve clutch pack forward.

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from D793/B1 to Y630

Function: 2.3.5 Valve block transmission control, 2.8 Control and monitoring system transmission

Signal value: XXXX = Measured value in mA.

### REV FEEDBACK

Description: Present control current to solenoid valve clutch pack reverse

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from D793/F1 to Y631

Function: 2.3.5 Valve block transmission control, 2.8 Control and monitoring system transmission

Signal value: XXXX = Measured value in mA.

### 2/4 FEEDBACK

Description: Present control current to solenoid valve clutch pack 2/4.

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from D793/D1 to Y6069

Function: 2.3.5 Valve block transmission control, 2.8 Control and monitoring system transmission

Signal value: XXXX = Measured value in mA.

### 1/3 FEEDBACK

Description: Present control current to solenoid valve clutch pack 1/3.

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from D793/H1 to Y6067

Function: 2.3.5 Valve block transmission control, 2.8 Control and monitoring system transmission

Signal value: XXXX = Measured value in mA.

DIAG TRANSM.	9 (X)
FWD FEEDBACK	XXXXmA
REV FEEDBACK	XXXXmA
2/4 FEEDBACK	XXXXmA
1/3 FEEDBACK	XXXXmA

006869

DIAG TRANSM.	9 (X)
FWD FEEDBACK	XXXXmA
REV FEEDBACK	XXXXmA
2/4 FEEDBACK	XXXXmA
1/3 FEEDBACK	XXXXmA

006869

DIAG TRANSM.	9 (X)
FWD FEEDBACK	XXXXmA
REV FEEDBACK	XXXXmA
2/4 FEEDBACK	XXXXmA
1/3 FEEDBACK	XXXXmA

006869

DIAG TRANSM.	9 (X)
FWD FEEDBACK	XXXXmA
REV FEEDBACK	XXXXmA
2/4 FEEDBACK	XXXXmA
1/3 FEEDBACK	XXXXmA

006869

<b>DIAG TRANSM.</b>	<b>10 (X)</b>
PRESENT SENSOR INPUT	
PRESS FEEDBACK	XXXXmV
TRANSM. TEMP	XXXXmV
COOLER TEMP	XXXXmV

006870

<b>DIAG TRANSM.</b>	<b>10 (X)</b>
PRESENT SENSOR INPUT	
PRESS FEEDBACK	XXXXmV
TRANSM. TEMP	XXXXmV
COOLER TEMP	XXXXmV

006870

<b>DIAG TRANSM.</b>	<b>10 (X)</b>
PRESENT SENSOR INPUT	
PRESS FEEDBACK	XXXXmV
TRANSM. TEMP	XXXXmV
COOLER TEMP	XXXXmV

006870

<b>DIAG TRANSM.</b>	<b>11 (X)</b>
PRESENT VALUE	
AXLE RATIO	XXXXX
RADIUS	XXXX
SPEED LIMIT	XXXX

006871

### 8.4.7.10 TRANSM, menu 10

#### PRESENT SENSOR INPUT, PRESS FEEDBACK

Description: Signal from sensor oil pressure in transmission. The transmission uses a pressure-sensitive make-contact and two resistors in the cable harness to generate different voltage levels.

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from "pressure feedback sensor" to D793/A2

Function: 2.6.2 Sensor oil pressure

Signal value:

0-1000 mV	Short-circuiting to ground.
1500-2500 mV	Oil pressure is correct.
2500-4000 mV	Oil pressure is low.
4500-8000 mV	Open circuit.
Over 8000 mV	Short-circuiting to voltage

#### PRESENT SENSOR INPUT, TRANS.TEMP

Description: Signal from sensor transmission oil temperature.

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from B758/766 to D793/H3

Function: 2.7.2 Sensor engine rpm and oil temperature transmission

Signal value: XXXX mV = signal voltage in mV (0-5000mV).

#### PRESENT SENSOR INPUT, COOLER TEMP

Description: Signal from sensor oil temperature in cooler transmission. The transmission uses a pressure-sensitive make-contact and two resistors in the cable harness to generate different voltage levels.

Circuit diagram: Circuit Dana TE32000 group 2.0

Connection: signal from S221 to D793/J3

Function: 2.7.4 Sensor oil temperature oil cooler

Signal value:

0 mV	Transmission oil has operating temperature.
2500 mV	Transmission oil temperature is low

### 8.4.7.11 TRANSM, menu 11

#### AXLE RATIO

Description: Drive axle gear ratio.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value: XXXXX = Drive axle's total gear ratio x 1024.

DIAG TRANSM.	11 (X)
PRESENT VALUE	
AXLE RATIO	XXXXX
RADIUS	XXXX
SPEED LIMIT	XXXX

006871

DIAG TRANSM.	11 (X)
PRESENT VALUE	
AXLE RATIO	XXXXX
RADIUS	XXXX
SPEED LIMIT	XXXX

006871

DIAG TRANSM.	12 (X)
NOT USED	

006872

DIAG TRANSM.	13 (15)
ACT ERROR AREA	XXX
TYPE	XXX
NUMBER OF OCCU.	XXXXX
TIME AGO	XXXXX

000171

DIAG TRANSM.	13 (15)
ACT ERROR AREA	XXX
TYPE	XXX
NUMBER OF OCCU.	XXXXX
TIME AGO	XXXXX

000171

**RADIUS**

Description: Drive wheels' radius

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value: XXXX = Drive wheels' radius in mm.

**SPEED LIMIT**

Description: Speed limitation.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value: XXX = Speed limitation in km/h.

**8.4.7.12 TRANSM, menu 12****NOT USED**

This menu is not used.

**8.4.7.13 TRANSM, menu 13****ACT ERROR AREA**

Description: Indicates malfunction area active error, first part of the error code. In case of several error codes, the most serious error code is shown.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value: XXX = First part of error code, see tab *D Error codes*.**TYPE**

Description: Indicates type of active error.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value: XXX = Second part of error code.

DIAG TRANSM.	13 (15)
ACT ERROR AREA	XXX
TYPE	XXX
NUMBER OF OCCU.	XXXXX
TIME AGO	XXXXX

000171

DIAG TRANSM.	13 (15)
ACT ERROR AREA	XXX
TYPE	XXX
NUMBER OF OCCU.	XXXXX
TIME AGO	XXXXX

000171

DIAG TRANSM.	14 (X)
CONVERTER STATUS (Nm)	
TORQUE IMPELLER	XXXX
TORQUE TURBINE	XXXX

006873

DIAG TRANSM.	14 (X)
CONVERTER STATUS (Nm)	
TORQUE IMPELLER	XXXX
TORQUE TURBINE	XXXX

006873

**NUMBER OF OCCU.**

Description: Number of times active errors have occurred.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value: XXXXX = Number of times active errors have occurred.

**TIME AGO**

Description: When latest active error occurred.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value: XXXXX = Operating time in hours since latest error.

**8.4.7.14 TRANSM, menu 14****CONVERTER STATUS (Nm), TORQUE IMPELLER**

Description: Torque transmitted by from engine to impeller in torque converter. The torque absorbed by the transmission.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value: XXXX = Torque in Nm.

**CONVERTER STATUS (Nm), TORQUE TURBINE**

Description: Current torque transmitted by torque converter to transmission.

Circuit diagram: -

Connection: -

Function: 2.8 Control and monitoring system transmission

Signal value: XXXX = Torque in Nm.

DIAGNOSIS
CAN/POWER LIGHTS CAB
CLIMATE HYD ENGINE
TRANSM <b>BOOM</b> ATTACH
OP EXTRA HIST

000174

DIAG BOOM	1 (8)
PRESENT INPUT SIGNALS	
BOOM UP/DOWN	XX.XXV
BOOM IN/OUT	XX.XXV

000175

DIAG BOOM	1 (8)
PRESENT INPUT SIGNALS	
BOOM UP/DOWN	XX.XXV
BOOM IN/OUT	XX.XXV

000175

DIAG BOOM	2 (8)
BLOCK VALVES	
UP/DOWN	LE XY RI XY
IN/OUT	XY
RELIEVE PRESS. IN	XY

003181

## 8.4.8 BOOM

### BOOM, description

This group handles boom functions.

Confirm selection with function key for Enter.

#### 8.4.8.1 BOOM, menu 1

##### PRESENT INPUT SIGNALS, BOOM UP/DOWN

Description: Signal from control lever (boom up/down).

Circuit diagram: Circuit Joystick group 7.1

Connection: signal from S815/8 to analogue in D790-1/K7:3

Function: 7.1.1 Control lever

Signal value: XX.XXV = 0,50 - 4,50 V. 2,5 V in zero position.

##### PRESENT INPUT SIGNALS, BOOM IN/OUT

Description: Signal from control lever (boom in/out).

Circuit diagram: Circuit Joystick group 7.1

Connection: signal from S815/4 to analogue in D790-1/K7:4

Function: 7.1.1 Control lever

Signal value: XX.XXV = 0,50 - 4,50 V. 2,5 V in zero position.

#### 8.4.8.2 BOOM, menu 2

##### BLOCK VALVES, UP/DOWN

Description: Voltage feed to solenoid valve blocking lowering.

Circuit diagram: Circuit Boom up/down group 7.2

Connection:

LE: digital out from D797-F/K1:30 to Y6002/1

RI: digital out from D797-F/K1:31 to Y6001/1

Function: 7.2.7 Valve block lift cylinder

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG BOOM	2 (8)
BLOCK VALVES	
UP/DOWN	LE XY RI XY
IN/OUT	XY
RELIEVE PRESS. IN	XY

003181

DIAG BOOM	2 (8)
BLOCK VALVES	
UP/DOWN	LE XY RI XY
IN/OUT	XY
RELIEVE PRESS. IN	XY

003180

DIAG BOOM	3 (8)
BOOM HIGH SPEED	
UP	LE XY RI XY
OUT	XY

000177

### BLOCK VALVES, IN/OUT

Description: Voltage feed to solenoid valve blocking boom in.

Circuit diagram: Circuit Boom in/out group 7.3

Connection: digital out from D797-R/K1:5 to Y6050/1

Function: 7.3.7 Valve block extension cylinder

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

### BLOCK VALVES, RELIEVE PRESS. IN

Description: Voltage feed to solenoid valve pump unloading.

Circuit diagram: Circuit Boom in/out group 7.3

Connection: digital out from D797-R/K1:40 to Y6062/1

Function: 7.3.9 Valve block pump unloading.

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

## 8.4.8.3 BOOM, menu 3

### BOOM HIGH SPEED, UP

Description: Voltage feed to solenoid valve regeneration boom up.

Circuit diagram: Circuit Boom up/down group 7.2

Connection:

LE: digital out from D797-F/K1:33 to Y6052/1

RE: digital out from D797-F/K1:32 to Y6051/1

Function: 7.2.7 Valve block lift cylinder

<b>DIAG BOOM</b>	<b>3 (8)</b>
BOOM HIGH SPEED	
UP	LE XY RI XY
OUT	XY

000177

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

**BOOM HIGH SPEED, OUT**

Description: Voltage feed to solenoid valve regeneration extension.

Circuit diagram: Circuit Boom in/out group 7.3

Connection: digital out from D797-R/K1:4 to Y6046/1

Function: 7.3.7 Valve block extension cylinder

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

**8.4.8.4 BOOM, menu 4****OUTPUT BOOM UP, REFERENCE**

Description: Status for control current to control valve lift, lower and extension (solenoid valve lift).

Circuit diagram: Circuit Boom up/down group 7.2

Connection: digital out from D797-F/K1:2 to Y6005/1

Function: 7.2.5 Control valve lift, lower and extension

Signal value:

<b>DIAG BOOM</b>	<b>4 (8)</b>
OUTPUT BOOM UP	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000178

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

DIAG BOOM	4 (8)
OUTPUT BOOM UP	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000178

DIAG BOOM	4 (8)
OUTPUT BOOM UP	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000178

DIAG BOOM	5 (8)
OUTPUT BOOM DOWN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000179

DIAG BOOM	5 (8)
OUTPUT BOOM DOWN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000179

### OUTPUT BOOM UP, REQUIRED VALUE

Description: Reference value for control current to control valve lift, lower and extension (solenoid valve lift).

Circuit diagram: Circuit Boom up/down group 7.2

Connection: output signal reference value out from D797-F/K1:16 to Y6005/2

Function: 7.2.5 Control valve lift, lower and extension

Signal value: XXX = Current value: in mA for control of solenoid valve.

### OUTPUT BOOM UP, FEEDBACK

Description: Present control current to control valve lift, lower and extension (solenoid valve lift).

Circuit diagram: Circuit Boom up/down group 7.2

Connection: output signal actual value out from D797-F/K1:16 to Y6005/2

Function: 7.2.5 Control valve lift, lower and extension

Signal value: XXX = Measured current value in mA.

## 8.4.8.5 BOOM, menu 5

### OUTPUT BOOM DOWN, REFERENCE

Description: Status for control current to control valve lift, lower and extension (solenoid valve lower).

Circuit diagram: Circuit Boom up/down group 7.2

Connection: digital out from D797-F/K1:3 to Y6004/1

Function: 7.2.5 Control valve lift, lower and extension

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

### OUTPUT BOOM DOWN, REQUIRED VALUE

Description: Reference value for control current to control valve lift, lower and extension (solenoid valve lower).

Circuit diagram: Circuit Boom up/down group 7.2

Connection: output signal reference value out from D797-F/K1:17 to Y6004/2

Function: 7.2.5 Control valve lift, lower and extension

Signal value: XXX = Current value: in mA for control of solenoid valve.

DIAG BOOM	5 (8)
OUTPUT BOOM DOWN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000179

DIAG BOOM	6 (8)
OUTPUT BOOM IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000180

DIAG BOOM	6 (8)
OUTPUT BOOM IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000180

DIAG BOOM	6 (8)
OUTPUT BOOM IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000180

### OUTPUT BOOM DOWN, FEEDBACK

Description: Present control current to control valve lift, lower and extension (solenoid valve lower).

Circuit diagram: Circuit Boom up/down group 7.2

Connection: output signal reference value out from D797-F/K1:17 to Y6004/2

Function: 7.2.5 Control valve lift, lower and extension

Signal value: XXX = Measured current value in mA.

### 8.4.8.6 BOOM, menu 6

#### OUTPUT BOOM IN, REFERENCE

Description: Status for control current to control valve lift, lower and extension (solenoid valve extension in).

Circuit diagram: Circuit Boom in/out group 7.3

Connection: digital out from D797-F/K1:5 to Y6007/1

Function: 7.3.5 Control valve lift, lower and extension

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

#### OUTPUT BOOM IN, REQUIRED VALUE

Description: Reference value for control current to control valve lift, lower and extension (solenoid valve extension in).

Circuit diagram: Circuit Boom in/out group 7.3

Connection: output signal reference value out from D797-F/K1:19 to Y6007/2

Function: 7.3.5 Control valve lift, lower and extension

Signal value: XXX = Current value: in mA for control of solenoid valve.

#### OUTPUT BOOM IN, FEEDBACK

Description: Current for control current to control valve lift, lower and extension (solenoid valve extension in).

Circuit diagram: Circuit Boom in/out group 7.3

Connection: output signal, reference value out from D797-F/K1:19 to Y6007/2

Function: 7.3.5 Control valve lift, lower and extension

Signal value: XXX = Measured current value in mA.

DIAG BOOM	7 (8)
OUTPUT BOOM OUT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000181

DIAG BOOM	7 (8)
OUTPUT BOOM OUT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000181

DIAG BOOM	7 (8)
OUTPUT BOOM OUT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000181

DIAG BOOM	8 (8)
PRESENT INPUT SIGNAL	
BOOM LOW SPEED	
UP/DOWN	X
IN/OUT	X/X

000182

### 8.4.8.7 BOOM, menu 7

#### OUTPUT BOOM OUT, REFERENCE

Description: Status for control current to control valve lift, lower and extension (solenoid valve extension out).

Circuit diagram: Circuit Boom in/out group 7.3

Connection: digital out from D797-F/K1:4 to Y6006/1

Function: 7.3.5 Control valve lift, lower and extension

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

#### OUTPUT BOOM OUT, REQUIRED VALUE

Description: Reference value for control current to control valve lift, lower and extension (solenoid valve extension out).

Circuit diagram: Circuit Boom in/out group 7.3

Connection: output signal, reference value out from D797-F/K1:18 to Y6006/2

Function: 7.3.5 Control valve lift, lower and extension

Signal value: XXX = Current value: in mA for control of solenoid valve.

#### OUTPUT BOOM OUT, FEEDBACK

Description: Present control current to control valve lift, lower and extension (solenoid valve extension out).

Circuit diagram: Circuit Boom in/out group 7.3

Connection: output signal, reference value out from D797-F/K1:18 to Y6006/2

Function: 7.3.5 Control valve lift, lower and extension

Signal value: XXX = Measured current value in mA.

### 8.4.8.8 BOOM, menu 8

#### PRESENT INPUT SIGNAL BOOM LOW SPEED, UP/DOWN

Description: Signal from sensor boom angle, to activate damping for lift and lower.

Circuit diagram: Circuit OP + Scale group 8.2

Connection: signal in from B771 to analogue in D797-R/K1:21

Function: 7.2.11 Sensor boom angle (position sensor)

Signal value:

1	Input signal active.
0	No signal.

DIAG BOOM	8 (8)
PRESENT INPUT SIGNAL	
BOOM LOW SPEED	
UP/DOWN	X
IN/OUT	X/X

000182

**PRESENT INPUT SIGNAL BOOM LOW SPEED, IN/OUT**

Description: Signal from sensor boom length to activate damping for extension.

Circuit diagram: Circuit OP + Scale group 8.2 (Mechanical overload system with analogue position sensors or Electric overload system), Circuit Boom in/out group 7.3 (Mechanical overload system)

Connection:

Mechanical overload system with analogue position sensors or Electric overload system:

Analogue signal in from B777/3 to analogue in D797-R/K1:22

Mechanical overload system:

Boom in: digital in from B769-3/C to digital in D797-R/K1:26

Boom out: digital in from B769-4/C to analogue in D797-R/K1:23 (software-generated signal from overload system)

Function: 7.3.11 Sensor boom length

Signal value:

1	Input signal active.
0	No signal.

**8.4.9 ATTACH**

**ATTACH, description**

This group handles attachment functions.

Confirm selection with function key for Enter.

DIAGNOSIS
CAN/POWER LIGHTS CAB
CLIMATE HYD ENGINE
TRANSM BOOM <b>ATTACH</b>
OP EXTRA HIST

000183

**8.4.9.1 ATTACH, menu 1**

**PRESENT INPUT SIGNALS, ROT CW/CCW**

Description: Signals from control lever for rotation of attachment.

Circuit diagram: Circuit Joystick group 7.1

Connection: signal from S815/11 to analogue in D790-1/K7:5

Function: 7.6 Rotation

Signal value: XX.XXV = 0,50 - 4,50 V. 2,5 V in control lever zero position.

DIAG ATTACHMENT	1 (21)
PRESENT INPUT SIGNALS	
ROT CW/CCW	XX.XXV
TILT IN/OUT	XX.XXV

000184

DIAG ATTACHMENT 1 (21)	
PRESENT INPUT SIGNALS	
ROT CW/CCW	XX.XXV
TILT IN/OUT	XX.XXV

000184

DIAG ATTACHMENT 2 (21)	
PRESENT INPUT SIGNALS	
SIDE SHIFT LE X RI X	
PISTOL	X
30/35 STOP	X

000185

DIAG ATTACHMENT 2 (21)	
PRESENT INPUT SIGNALS	
SIDE SHIFT LE X RI X	
PISTOL	X
30/35 STOP	X

000185

## PRESENT INPUT SIGNALS, TILT IN/OUT



Description: Signals from control lever for tilt of attachment

Circuit diagram: Circuit Joystick group 7.1

Connection: signal from S815/1 to analogue in D790-1/K7:6

Function: 7.7 Tilt

Signal value: XX.XXV = 0,50 - 4,50 V. 2,5 V in control lever middle position.

### 8.4.9.2 ATTACH, menu 2

## PRESENT INPUT SIGNALS, SIDESHIFT

Description: Signals from control lever for sideshift of attachment. If pistol trigger is pressed in at the same time as sideshift, then spreading is activated. Text in brackets describes spreading.

Circuit diagram: Circuit Joystick group 7.1

Connection:

LE: from S815/14 , to digital in D790-1/K7:14 (spreading in)

RI: from S815/16 , to digital in D790-1/K7:13 (spreading out)

Function: 7.4 Sideshift

Signal value:

1	Input signal active.
0	No signal.

## PRESENT INPUT SIGNALS, PISTOL

Description: Signals from control lever for pistol trigger.

Circuit diagram: Circuit Joystick group 7.1

Connection: from S815/19 to digital in D790-1/K7:16

Function: 7.5 Spreading, 7.10.2 Weight indicator, 7.10.4 Synchronized lift

Signal value:

1	Input signal active.
0	No signal.

DIAG ATTACHMENT 2 (21)	
PRESENT INPUT SIGNALS	
SIDE SHIFT LE X RI	X
PISTOL	X
30/35 STOP	X

000186

### PRESENT INPUT SIGNALS, 30/35 STOP



Description: Signal from switch for stop at 30'/35'.

Circuit diagram: Wiring Spreading Sensors group 7.5

Connection: from S1004/1 to digital in D790-1/K8:10

Function: 7.5 Spreading

Signal value:

1	Input signal active.
0	No signal.

### 8.4.9.3 ATTACH, menu 3

#### PRESENT INPUT SIGNALS, LOCK TW

Description: Signal from switch lock twistlock.

Circuit diagram: Wiring Twistlock group 7.9

Connection: from S1003/7 and S 1007/2 to digital in D790-1/K8:12

Function: 7.9.1 Twistlocks

Signal value:

1	Input signal active.
0	No signal.

DIAG ATTACHMENT 3 (21)	
PRESENT INPUT SIGNALS	
LOCK TW	X
UNLOCK TW	X
BY-PASS HEIGHT	X

000186

#### PRESENT INPUT SIGNALS, UNLOCK TW

Description: Signal from control lever to unlock twistlock.

Circuit diagram: Circuit Joystick group 7.1

Connection: from 815/20 to digital in D790-1/K7:15

Function: 7.9.1 Twistlocks

Signal value:

1	Input signal active.
0	No signal.

DIAG ATTACHMENT 3 (21)	
PRESENT INPUT SIGNALS	
LOCK TW	X
UNLOCK TW	X
BY-PASS HEIGHT	X

000186

DIAG ATTACHMENT 3 (21)	
PRESENT INPUT SIGNALS	
LOCK TW	X
UNLOCK TW	X
BY-PASS HEIGHT	X

000186

### PRESENT INPUT SIGNALS, BY-PASS HEIGHT



Description: Signal from switch by-pass of load centre limitation and height limitation if the machine is equipped with these options.

Circuit diagram: Circuit By-pass group 8.2

Connection: from S1014/S1015/1 to digital in D790-1/K8:14

Function: 8.2.2 By-passing

Signal value:

1	Input signal active.
0	No signal.

### 8.4.9.4 ATTACH, menu 4

#### PRESENT INPUT SIGNALS, TILT LOCKING



Description: Signal from control lever for tilt lock.

Circuit diagram: Circuit Joystick group 7.1

Connection: from S815/18 to digital in D790-1/K8:2

Function: 7.7 Tilt

Signal value:

1	Input signal active.
0	No signal.

DIAG ATTACHMENT 4 (X)	
PRESENT INPUT SIGNALS	
TILT LOCKING	X
LEVELLING LOCKING	X
AUTO 20' -40'	X

006874

#### PRESENT INPUT SIGNALS, LEVELLING LOCKING



Description: Signal from control lever for leveling lock.

Circuit diagram: Circuit Joystick group 7.1

Connection: from S815/17 to digital in D790-1/K8:1

Function: 7.8 Levelling

Signal value:

1	Input signal active.
0	No signal.

DIAG ATTACHMENT 4 (X)	
PRESENT INPUT SIGNALS	
TILT LOCKING	X
LEVELLING LOCKING	X
AUTO 20' -40'	X

006874

DIAG ATTACHMENT	4 (X)
PRESENT INPUT SIGNALS	
TILT LOCKING	X
LEVELLING LOCKING	X
AUTO 20'-40'	X

006874

**PRESENT INPUT SIGNALS, AUTO 20'-40'**

Description: Signal from switch automatic spreading 20'-40'.

Circuit diagram: Circuit Optional equipment group 9.1

Connection: from S199-2 to digital in D790-1/K8:11

Function: 7.5 Spreading

Signal value:

1	Input signal active.
0	No signal.

DIAG ATTACHMENT	5 (21)
PRESENT INPUT SIGNALS	
LOW SPEED 20/40	X
30/35 STOP	X
EXTENSION 60CM	X

000188

**8.4.9.5 ATTACH, menu 5****PRESENT INPUT SIGNALS, LOW SPEED 20/40**

Description: Signal from position sensor spreading for end-position damping 20'/40'.

Circuit diagram: Wiring Spreading Sensors group 7.5

Connection: from inductive sensor B769/C to digital in D791-1/K1:12

Function: 7.5.10 Position sensor spreading

Signal value:

1	Input signal active.
0	No signal.

DIAG ATTACHMENT	5 (21)
PRESENT INPUT SIGNALS	
LOW SPEED 20/40	X
30/35 STOP	X
EXTENSION 60CM	X

000188

**PRESENT INPUT SIGNALS, 30/35 STOP**

Description: Signal from position sensor spreading for stop at 30'/35'.

Circuit diagram: Wiring Spreading Sensors group 7.5

Connection: from inductive sensor B777-3/C to digital in D791-1/K1:20

Function: 7.5.10 Position sensor spreading

Signal value:

1	Input signal active.
0	No signal.

DIAG ATTACHMENT 5 (21)		
PRESENT INPUT SIGNALS		
LOW SPEED 20/40		X
30/35 STOP		X
EXTENSION 60CM		X

000188

### PRESENT INPUT SIGNALS, EXTENSION 60CM



Description: Signal from position sensor extension 60 cm, for fixed scale.

Circuit diagram: Circuit OP + Scale group 8.2

Connection: from inductive sensor B7224/C to digital in D791-1/K1:21

Function: 7.10.2 Weight indicator

Signal value:

1	Input signal active.
0	No signal.

### 8.4.9.6 ATTACH, menu 6

#### PRESENT INPUT SIGNALS ALIGNMENT, FRONT

Description: Signals from sensors alignment right front and left front.

Circuit diagram: Wiring Twistlock group 7.9

Connection:

LE: signal from B7202L/C to analogue in (used as digital) D 791-1/K1:13

RI: signal from B7202R/C to digital in D791-1/K1:40

Function: 7.9.1.8 Sensor alignment

Signal value:

1	Input signal active.
0	No signal.

DIAG ATTACHMENT 6 (21)		
PRESENT INPUT SIGNALS		
ALIGNMENT	LE	RI
FRONT	X	X
REAR	X	X

000202

#### PRESENT INPUT SIGNALS ALIGNMENT, REAR

Description: Signals from sensors alignment right rear and left rear.

Circuit diagram: Wiring Twistlock group 7.9

Connection:

LE: signal from B7203L/C to analogue in (used as digital) D791-1/K1:27

RI: signal from B7203R/C to digital in D791-1/K1:26

Function: 7.9.1.8 Sensor alignment

Signal value:

1	Input signal active.
0	No signal.

DIAG ATTACHMENT 6 (21)		
PRESENT INPUT SIGNALS		
ALIGNMENT	LE	RI
FRONT	X	X
REAR	X	X

000202

DIAG ATTACHMENT 7 (21)		
PRESENT INPUT SIGNALS		
	LE	RI
LOCKED TW	X	X
UNLOCKED TW	X	X

001633

DIAG ATTACHMENT 7 (21)		
PRESENT INPUT SIGNALS		
	LE	RI
LOCKED TW	X	X
UNLOCKED TW	X	X

001633

### 8.4.9.7 ATTACH, menu 7

#### PRESENT INPUT SIGNAL, LOCKED TW

Description: Signals from sensors locked twistlock right and left.

Circuit diagram: Wiring Twistlock group 7.9

Connection:

LE: signal from B7205L/C to analogue in (used as digital) D791-1/K1:23

RI: signal from B7205R/C to analogue in (used as digital) D791-1/K1:24

Function: 7.9.1.9 Sensor twistlock

Signal value:

1	Input signal active.
0	No signal.

#### PRESENT OUTPUT SIGNAL, UNLOCKED TW

Description: Signals from sensors open twistlock right and left.

Circuit diagram: Wiring Twistlock group 7.9

Connection:

LE: signal from B7204L/C to analogue in (used as digital) D791-1/K1:22

RI: signal from B7204R/C to analogue in (used as digital) D791-1/K1:41

Function: 7.9.1.9 Sensor twistlock

Signal value:

1	Output signal active.
0	No signal.

<b>DIAG ATTACHMENT 8 (21)</b>
PRESENT OUTPUT SIGNAL
SIDE SHIFT LEFT XY
SIDE SHIFT RIGHT XY

000189

<b>DIAG ATTACHMENT 8 (21)</b>
PRESENT OUTPUT SIGNAL
SIDE SHIFT LEFT XY
SIDE SHIFT RIGHT XY

000189

### 8.4.9.8 ATTACH, menu 8

#### PRESENT OUTPUT SIGNAL, SIDESHIFT LEFT

Description: Voltage feed to control valve attachment, sideshift left.

Circuit diagram: Wiring Spreading Valves group 7.5

Connection: digital out from D791-1/K1:31 to Y6020/1

Function: 7.4.3 Control valve attachment

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### PRESENT OUTPUT SIGNAL, SIDESHIFT RIGHT

Description: Voltage feed to control valve attachment, sideshift right.

Circuit diagram: Wiring Spreading Valves group 7.5

Connection: digital out from D791-1/K1:30 to Y6021/1

Function: 7.4.3 Control valve attachment

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG ATTACHMENT 9 (21)	
PRESENT OUTPUT SIGNAL	
LOCK TW	XY
UNLOCK TW	XY

000190

DIAG ATTACHMENT 9 (21)	
PRESENT OUTPUT SIGNAL	
LOCK TW	XY
UNLOCK TW	XY

000190

### 8.4.9.9 ATTACH, menu 9

#### PRESENT OUTPUT SIGNAL, LOCK TW

Description: Voltage feed to control valve attachment, lock twistlock.

Circuit diagram: Wiring Twistlock group 7.9

Connection: digital out from D791-1/K1:32 to Y6040/1

Function: 7.9.1.3 Control valve attachment

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### PRESENT OUTPUT SIGNAL, UNLOCK TW

Description: Voltage feed to control valve attachment, open twistlock.

Circuit diagram: Wiring Twistlock group 7.9

Connection: digital out from D791-1/K1:33 to Y6039/1

Function: 7.9.1.3 Control valve attachment

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG ATTACHMENT 10 (21)	
PRESENT OUTPUT SIGNAL	
IND. LOCKED TW	XY
IND. UNLOCKED TW	XY
IND. ALIGNMENT	XY

000191

DIAG ATTACHMENT 10 (21)	
PRESENT OUTPUT SIGNAL	
IND. LOCKED TW	XY
IND. UNLOCKED TW	XY
IND. ALIGNMENT	XY

000191

### 8.4.9.10 ATTACH, menu 10

#### PRESENT OUTPUT SIGNAL, IND. LOCKED TW

Description: Voltage feed indicator light locked twistlock.

Circuit diagram: Wiring Twistlock group 7.9

Connection: digital out from D791-1/K1:39 to H563/1

Function: 7.9.1 Twistlocks

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### PRESENT OUTPUT SIGNAL, IND. UNLOCKED TW

Description: Voltage feed indicator light open twistlock.

Circuit diagram: Wiring Twistlock group 7.9

Connection: digital out from D791-1/K1:25 to H562/1

Function: 7.9.1 Twistlocks

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

<b>DIAG ATTACHMENT 10 (21)</b>	
PRESENT OUTPUT SIGNAL	
IND. LOCKED TW	XY
IND. UNLOCKED TW	XY
IND. ALIGNMENT	XY

000161000

**PRESENT OUTPUT SIGNAL, ALIGNMENT**

Description: Voltage feed indicator light alignment.

Circuit diagram: Wiring Twistlock group 7.9

Connection: digital out from D791-1/K1:29 to H564/2

Function: 7.9.1 Twistlocks

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

**8.4.9.11 ATTACH, menu 11****OUTPUT ROTATION C.W., REFERENCE**

Description: Status control current to control valve attachment for rotation clockwise.

Circuit diagram: Wiring Rotation, group 7.6

Connection: digital out from D791-1/K1:2 to solenoid valve Y6008/1

Function: 7.6.3 Control valve attachment

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

**OUTPUT ROTATION C.W., REQUIRED VALUE**

Description: Reference value for control current to control valve attachment for rotation clockwise.

Circuit diagram: Wiring Rotation, group 7.6

Connection: output signal, reference value out from D791-1/K1:16 to Y6008/2

Function: 7.6.3 Control valve attachment

Signal value: XXX = Current value: in mA for control of solenoid valve.

<b>DIAG ATTACHMENT 11 (21)</b>	
OUTPUT ROTATION C.W.	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000161000

<b>DIAG ATTACHMENT 11 (21)</b>	
OUTPUT ROTATION C.W.	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000161000

<b>DIAG ATTACHMENT 11 (21)</b>	
OUTPUT ROTATION C.W.	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000192

<b>DIAG ATTACHMENT 12 (21)</b>	
OUTPUT ROTATION C.C.W.	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000193

<b>DIAG ATTACHMENT 12 (21)</b>	
OUTPUT ROTATION C.C.W.	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000193

<b>DIAG ATTACHMENT 12 (21)</b>	
OUTPUT ROTATION C.C.W.	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000193

### OUTPUT ROTATION C.W., FEEDBACK

Description: Present control current to control valve attachment for rotation clockwise.

Circuit diagram: Wiring Rotation, group 7.6-

Connection: output signal, actual value out from D791-1/K1:16 to Y6008/2

Function: 7.6.3 Control valve attachment

Signal value: XXX = Measured current value in mA.

### 8.4.9.12 ATTACH, menu 12

#### OUTPUT ROTATION C.C.W., REFERENCE

Description: Status control current to control valve attachment for rotation counter-clockwise.

Circuit diagram: Wiring Rotation, group 7.6

Connection: digital out from D791-1/K1:3 to solenoid valve Y6009/1

Function: 7.6.3 Control valve attachment

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

#### OUTPUT ROTATION C.C.W., REQUIRED VALUE

Description: Reference value for control current to control valve attachment for rotation counter-clockwise.

Circuit diagram: Wiring Rotation, group 7.6

Connection: output signal, reference value out from D791-1/K1:17 to Y6009/2

Function: 7.6.3 Control valve attachment

Signal value: XXX = Current value: in mA for control of solenoid valve.

#### OUTPUT ROTATION C.C.W., FEEDBACK

Description: Present control current to control valve attachment for rotation clockwise.

Circuit diagram: Wiring Rotation, group 7.6

Connection: output signal, actual value out from D791-1/K1:17 to Y6009/2

Function: 7.6.3 Control valve attachment

Signal value: XXX = Measured current value in mA.

DIAG ATTACHMENT 13 (21)	
OUTPUT SPREADER OUT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000194

DIAG ATTACHMENT 13 (21)	
OUTPUT SPREADER OUT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000194

DIAG ATTACHMENT 13 (21)	
OUTPUT SPREADER OUT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000194

### 8.4.9.13 ATTACH, menu 13

#### OUTPUT SPREADER OUT, REFERENCE

Description: Status control current to control valve attachment for spreader out.

Circuit diagram: Wiring Spreading Valves group 7.5

Connection: digital out from D791-1/K1:4 to Y6018/1

Function: 7.5.3 Control valve attachment

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

#### OUTPUT SPREADER OUT, REQUIRED VALUE

Description: Reference value for control current to control valve attachment for output signal spreader out.

Circuit diagram: Wiring Spreading Valves group 7.5

Connection: output signal, reference value out from D791-1/K1:18 to Y6018/2

Function: 7.5.3 Control valve attachment

Signal value: XXX = Current value: in mA for control of solenoid valve.

#### OUTPUT SPREADER OUT, FEEDBACK

Description: Present control current to control valve attachment for spreader out.

Circuit diagram: Wiring Spreading Valves group 7.5

Connection: output signal, actual value out from D791-1/K1:18 to Y6018/2

Function: 7.5.3 Control valve attachment

Signal value: XXX = Measured current value in mA.

<b>DIAG ATTACHMENT 14 (21)</b>	
OUTPUT SPREADER IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000195

<b>DIAG ATTACHMENT 14 (21)</b>	
OUTPUT SPREADER IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000195

<b>DIAG ATTACHMENT 14 (21)</b>	
OUTPUT SPREADER IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000195

<b>DIAG ATTACHMENT 15 (X)</b>	
PRESENT OUTPUT SIGNAL	
TILT LOCKING 1	XY
TILT LOCKING 2	XY
BUZZER AUTO 20-40	XY

006875

### 8.4.9.14 ATTACH, menu 14

#### OUTPUT SPREADER IN, REFERENCE

Description: Status control current to control valve attachment for spreader in.

Circuit diagram: Wiring Spreading Valves group 7.5

Connection: digital out from D791-1/K1:5 to Y6019/1

Function: 7.5.3 Control valve attachment

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

#### OUTPUT SPREADER IN, REQUIRED VALUE

Description: Reference value for control current to control valve attachment for spreader in.

Circuit diagram: Wiring Spreading Valves group 7.5

Connection: output signal, reference value out from D791-1/K1:19 to Y6019/2

Function: 7.5.3 Control valve attachment

Signal value: XXX = Current value: in mA for control of solenoid valve.

#### OUTPUT SPREADER IN, FEEDBACK

Description: Present control current to control valve attachment for spreader in.

Circuit diagram: Wiring Spreading Valves group 7.5

Connection: output signal, actual value out from D791-1/K1:19 to Y6019/2

Function: 7.5.3 Control valve attachment

Signal value: XXX = Measured current value in mA.

### 8.4.9.15 ATTACH, menu 15

#### PRESENT OUTPUT SIGNAL, TILT LOCKING 1



Description: Voltage feed to lock valve tilt.

Circuit diagram: Circuit Tilt lock group 7.7

Connection: digital out from D791-1/K1:7 to Y6012-1/1

Function: 7.7.4 Lock valve tilt

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### PRESENT OUTPUT SIGNAL, TILT LOCKING 2



Description: Voltage feed to lock valve tilt.

Circuit diagram: Circuit Tilt lock group 7.7

Connection: digital out from D791-1/K1:9 to Y6012-2/1

Function: 7.7.4 Lock valve tilt

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### PRESENT OUTPUT SIGNAL, BUZZER AUTO 20-40



Description: Voltage feed to buzzer automatic spreading 20'-40'.

Circuit diagram: Wiring Spreading Auto grupp 7.5

Connection: digital out from D791-1/K1:28 to H9003/1

Function: 7.5 Spreading

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

<b>DIAG ATTACHMENT 15 (X)</b>
PRESENT OUTPUT SIGNAL
TILT LOCKING 1 XY
TILT LOCKING 2 XY
BUZZER AUTO 20-40 XY

006875

<b>DIAG ATTACHMENT 15 (X)</b>
PRESENT OUTPUT SIGNAL
TILT LOCKING 1 XY
TILT LOCKING 2 XY
BUZZER AUTO 20-40 XY

006875

DIAG ATTACHMENT 16 (21)	
OUTPUT TILT OUT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000197

DIAG ATTACHMENT 16 (21)	
OUTPUT TILT OUT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000197

DIAG ATTACHMENT 16 (21)	
OUTPUT TILT OUT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000197

### 8.4.9.16 ATTACH, menu 16

#### OUTPUT TILT OUT, REFERENCE



Description: Status control current to control valve attachment for tilt out.

Circuit diagram: Wiring Tilt + Levelling group 7.7

Connection:

Top lift attachment: digital out from D791-2/K1:4 to 6010/1

Combi attachment: digital out from D791-4/K1:2 to Y6010

Function: 7.7.5 Control valve attachment

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

#### OUTPUT TILT OUT, REQUIRED VALUE



Description: Reference value for control current to control valve attachment for tilt out.

Circuit diagram: Wiring Tilt + Levelling group 7.7

Connection:

Top lift attachment: output signal, reference value out from D791-2/K1:18 to Y6010/2

Combi attachment: output signal, reference value out from D791-4/K1:16 to Y6010/2

Function: 7.7.5 Control valve attachment

Signal value: XXX = Current value: in mA for control of solenoid valve.

#### OUTPUT TILT OUT, FEEDBACK



Description: Present control current to control valve attachment for tilt out.

Circuit diagram: Wiring Tilt + Levelling group 7.7

Connection:

Top lift attachment: output signal, actual value out from D791-2/K1:18 to Y6010/2

Combi attachment: output signal, actual value out from D791-4/K1:16 to Y6010/2

Function: 7.7.5 Control valve attachment

Signal value: XXX = Measured current value in mA.

DIAG ATTACHMENT 17 (21)	
OUTPUT TILT IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000198

DIAG ATTACHMENT 17 (21)	
OUTPUT TILT IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000198

DIAG ATTACHMENT 17 (21)	
OUTPUT TILT IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000198

### 8.4.9.17 ATTACH, menu 17

#### OUTPUT TILT IN, REFERENCE



Description: Status control current to control valve attachment for tilt in.

Circuit diagram: Wiring Tilt + Levelling group 7.7

Connection:

Top lift attachment: digital out from D791-2/K1:5 to Y6011/1

Combi attachment: digital out from D791-4/K1:3 to Y6011/1

Function: 7.7.5 Control valve attachment

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

#### OUTPUT TILT IN, REQUIRED VALUE



Description: Reference value for control current to control valve attachment for tilt in.

Circuit diagram: Wiring Tilt + Levelling group 7.7

Connection:

Top lift attachment: output signal, reference value out from D791-2/K1:19 to Y6011/2

Combi attachment: output signal, reference value out from D791-4/K1:17 to Y6011/2

Function: 7.7.5 Control valve attachment

Signal value: XXX = Current value: in mA for control of solenoid valve.

#### OUTPUT TILT IN, FEEDBACK



Description: Present control current to control valve attachment for tilt in.

Circuit diagram: Wiring Tilt + Levelling group 7.7

Connection:

Top lift attachment: output signal, actual value out from D791-2/K1:19 to Y6011/2

Combi attachment: output signal, actual value out from D791-4/K1:17 to Y6011/2

Function: 7.7.5 Control valve attachment

Signal value: XXX = Measured current value in mA.

<b>DIAG ATTACHMENT 18 (21)</b>	
PRESENT OUTPUT SIGNAL	
LOCK LEVELLING 1	XY
LOCK LEVELLING 2	XY

000100

### 8.4.9.18 ATTACH, menu 18

#### PRESENT OUTPUT SIGNAL, LOCK LEVELLING 1



Description: Voltage feed to lock valve leveling.

Circuit diagram: Wiring Tilt + Levelling group 7.7

Connection:

Top lift attachment: digital out from D791-2/K1:30 to Y6034-1/1

Combi attachment: digital out from D791-3/K1:15, to Y6034-1/1 and Y6034-2/1

Function: 7.8.6 Valve block leveling cylinders

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### PRESENT OUTPUT SIGNAL, LOCK LEVELLING 2



Description: Voltage feed to lock valve leveling.

Connection: Wiring Tilt + Levelling group 7.7

Top lift attachment: digital out from D791-2/K1:31 to Y6034-2/1

Combi attachment: digital out from D791-3/K1:15, to Y6034-1/1 and Y6034-2/1

Function: 7.8.6 Valve block leveling cylinders

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

<b>DIAG ATTACHMENT 18 (21)</b>	
PRESENT OUTPUT SIGNAL	
LOCK LEVELLING 1	XY
LOCK LEVELLING 2	XY

000100

DIAG ATTACHMENT 19 (21)	
OUTPUT LEVELLING RI	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000200

DIAG ATTACHMENT 19 (21)	
OUTPUT LEVELLING RI	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000200

DIAG ATTACHMENT 19 (21)	
OUTPUT LEVELLING RI	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000200

### 8.4.9.19 ATTACH, menu 19

#### OUTPUT LEVELLING RI, REFERENCE



Description: Status control current to control valve attachment for leveling right.

Circuit diagram: Wiring Tilt + Levelling group 7.7

Connection:

Top lift attachment: digital out from D791-2/K1:2 to Y6035/1

Combi attachment: digital out from D791-3/K1:2 to Y6035/1

Function: 7.8.3 Control valve attachment

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

#### OUTPUT LEVELLING RI, REQUIRED VALUE



Description: Reference value for control current to control valve attachment for leveling right.

Circuit diagram: Wiring Tilt + Levelling group 7.7

Connection:

Top lift attachment: output signal, reference value out from D791-2/K1:16 to Y6035/2

Combi attachment: output signal, reference value out from D791-3/K1:16 to Y6035/2

Function: 7.8.3 Control valve attachment

Signal value: XXX = Current value: in mA for control of solenoid valve.

#### OUTPUT LEVELLING RI, FEEDBACK



Description: Present control current to control valve attachment for leveling right.

Circuit diagram: Wiring Tilt + Levelling group 7.7

Connection:

Top lift attachment: output signal, actual value out from D791-2/K1:16 to Y6035/2

Combi attachment: output signal, actual value out from D791-3/K1:16 to Y6035/2

Function: 7.8.3 Control valve attachment

Signal value: XXX = Measured current value in mA.

<b>DIAG ATTACHMENT</b>	<b>20 (X)</b>
OUTPUT LEVELLING LE	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

006876

<b>DIAG ATTACHMENT</b>	<b>20 (X)</b>
OUTPUT LEVELLING LE	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

006876

<b>DIAG ATTACHMENT</b>	<b>20 (X)</b>
OUTPUT LEVELLING LE	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

006876

## 8.4.9.20 ATTACH, menu 20

### OUTPUT LEVELLING LE, REFERENCE



Description: Status control current to control valve attachment for leveling left.

Circuit diagram: Wiring Tilt + Levelling group 7.7

Connection:

Top lift attachment: digital out from D791-2/K1:3 to Y6036/2

Combi attachment: digital out from D791-3/K1:3 to Y6036/2

Function: 7.8.3 Control valve attachment

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

### OUTPUT LEVELLING LE, REQUIRED VALUE



Description: Reference value for control current to control valve attachment for leveling left.

Circuit diagram: Wiring Tilt + Levelling group 7.7

Connection:

Top lift attachment: output signal, reference value out from D791-2/K1:17 to Y6036/2

Combi attachment: output signal, reference value out from D791-3/K1:17 to Y6036/2

Function: 7.8.3 Control valve attachment

Signal value: XXX = Current value: in mA for control of solenoid valve.

### OUTPUT LEVELLING LE, FEEDBACK



Description: Present control current to control valve attachment for leveling left.

Circuit diagram: Wiring Tilt + Levelling group 7.7

Connection:

Top lift attachment: output signal, actual value out from D791-2/K1:17 to Y6036/2

Combi attachment: output signal, actual value out from D791-3/K1:17 to Y6036/2

Function: 7.8.3 Control valve attachment

Signal value: XXX = Measured current value in mA.

DIAG ATTACHMENT 21 (X)	
PRESENT INPUT SIGNALS	
ROTATION STOP	
SWITCH	X
SENSOR STOP	X

006877

DIAG ATTACHMENT 21 (X)	
PRESENT INPUT SIGNALS	
ROTATION STOP	
SWITCH	X
SENSOR STOP	X

006877

DIAG ATTACHMENT 22 (X)	
PRESENT INPUT SIGNAL	
LENGTH TO	
CONTAINER (cm)	XXXX
DAMP DOWN	X

006878

### 8.4.9.21 ATTACH, menu 21

#### ROTATION STOP, SWITCH



Description: Signal from switch rotation stop.

Circuit diagram: Circuit By-pass group 8.2

Connection: signal from S1014/1015/3 to digital in D790-1/K8:14

Function: 7.6 Rotation

Signal value:

1	Input signal active.
0	No signal.

#### ROTATION STOP, SENSOR STOP



Description: Signal from sensor rotation stop, at rotation 25°.

Circuit diagram: Wiring Rotation, group 7.6

Connection: signal from B 7225/C to digital in D791-1/K1:11

Function: 7.6.10 Sensor rotation stop

Signal value:

1	Input signal active.
0	No signal.

### 8.4.9.22 ATTACH, menu 22

#### PRESENT INPUT SIGNAL LENGTH TO, CONTAINER



Description: Current distance from attachment to container.

Circuit diagram: -

Connection: -

Function: 7.2 lift and lower

Signal value: XXXX = distance to container in cm.

<b>DIAG ATTACHMENT 22 (X)</b>	
PRESENT INPUT SIGNAL	
LENGTH TO	
CONTAINER (cm)	XXXX
DAMP DOWN	X

006878

**PRESENT INPUT SIGNAL LENGTH TO, DAMP DOWN**



Description: Status damping lower boom.

Circuit diagram:

Connection: -

Function: 7.2 Lift and lower

Signal value:

1	Damping active.
0	No damping.

**8.4.10 OP**

**OP, description**

This group handles the function of the overload system.

Confirm selection with function key for Enter.

<b>DIAGNOSIS</b>	
CAN/POWER LIGHTS CAB	
CLIMATE HYD ENGINE	
TRANSM BOOM ATTACH	
<b>OP</b>	EXTRA HIST

000204

**8.4.10.1 OP, menu 1**

**PRESENT INPUT SIGNAL, STEERING AXLE**

Description: Signal from sensor steering axle load right and left (mechanical overload system). It is sufficient that one sensor gives signal to activate warning for overloading.

Circuit diagram: Circuit OP + Scale group 8.2

Connection: signal from B7221R/C to digital in D797-R/K1:12 and B7221L/C digital in D797-R/K1:11

Function: 8.2.1.1 Sensor steering axle load

Signal value:

1 1	Input signal active left and right.
1 0	No signal left, input signal active right.
0 1	Input signal active left, no signal right.
0 0	No signal right and left.

<b>DIAG OP 1 (X)</b>	
PRESENT INPUT SIGNAL	
STEERING AXLE	X X
BOOM ANGLE	X
EXTENSION	X

008203

DIAG OP	1 (X)
PRESENT INPUT SIGNAL	
STEERING AXLE	X X
BOOM ANGLE	X
EXTENSION	X

008203

DIAG OP	1 (X)
PRESENT INPUT SIGNAL	
STEERING AXLE	X X
BOOM ANGLE	X
EXTENSION	X

008203

DIAG OP	2 (5)
PRESENT INPUT SIGNAL	
BY-PASS	X

000206

### PRESENT INPUT SIGNAL, BOOM ANGLE



Description: Status for boom angle for overload system indicates when boom angle is greater than 35°.

Circuit diagram: Circuit OP + Scale group 8.2

Connection: signal from B771/3 to analogue in D797-R/K1:21

Function: 8.2.1.2 Sensor boom angle

Signal value:

1	Input signal active. Boom angle greater than 35°.
0	No signal. Boom angle less than 35°.

### PRESENT INPUT SIGNAL, EXTENSION



Description: Signal from sensor boom length (position sensor boom length 1.5m). On machines with mechanical overloading system with analogue sensors or electrical overloading system, the menu is used to show status for boom extension for overload system.

Circuit diagram: Circuit OP + Scale group 8.2

Connection: signal from B777/C to analogue in (used as digital) D797-R/K1:22

Function: 8.2.1.3 Sensor boom length

Signal value:

1	Input signal active. Boom extension more than 1.5 m.
0	No signal. Boom extension less than 1.5 m.

## 8.4.10.2 OP, menu 2

### PRESENT INPUT SIGNAL, BY-PASS

Description: Signal from switch by-pass.

Circuit diagram: Circuit By-pass group 8.2

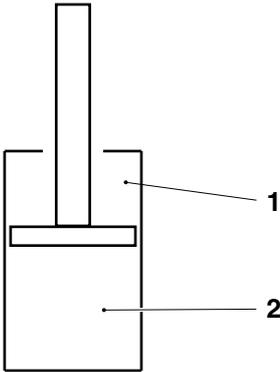
Connection: signal from S1005/1 to digital in D790-1/K8:3

Function: 7.1.3 Switch by-pass

Signal value:

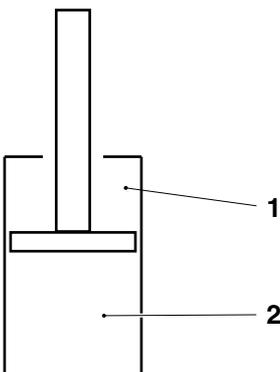
1	Input signal active. Signal is only active for max. 60 seconds.
0	No signal.

DIAG OP	3 (5)	
PRESENT INPUT SIGNAL		
LIFT CYL LE	RI	
C-	X.XXV	X.XXV
C+	X.XXV	X.XXV



1. Pressure C-
2. Pressure C+

DIAG OP	3 (5)	
PRESENT INPUT SIGNAL		
LIFT CYL LE	RI	
C-	X.XXV	X.XXV
C+	X.XXV	X.XXV



1. Pressure C-
2. Pressure C+

### 8.4.10.3 OP, menu 3

#### PRESENT INPUT SIGNAL LIFT CYL LE RI, C-



Description: Signal from sensor hydraulic pressure lift cylinder (C-, rod side). See also *PRESSURE LIFTING CYL, C-* page 66 (for pressure information).

Circuit diagram: Circuit OP + Scale group 8.2

Connection:

LE: signal from B768-L2/3 to analogue in D797-F/K1:22

RI: signal from B768-R2/3 to analogue in D797-F/K1:24

Function: 7.2.9 Sensor hydraulic pressure lift cylinder

Signal value: X.XXV = 0.50-4.50 V = Hydraulic oil pressure, 0.50 V corresponds to 0 MPa, 4.50 V corresponds to 25 MPa.

000207

#### PRESENT INPUT SIGNAL LIFT CYL LE RI, C+



Description: Signal from sensor hydraulic pressure lift cylinder (C+, piston side). See also *PRESSURE LIFTING CYL, C+* page 67 for pressure).

Circuit diagram: Circuit OP + Scale group 8.2

Connection:

LE: signal from B768-L1 to analogue in D797-F/K1:21

RI: signal from B768-R1 to analogue in D797-F/K1:23

Function: 7.2.9 Sensor hydraulic pressure lift cylinder

Signal value: X.XXV = 0.50-4.50 V = Hydraulic oil pressure, 0.50 V corresponds to 0 MPa, 4.50 V corresponds to 25 MPa.

000207

DIAG OP	4 (5)
PRESENT INPUT SIGNAL	
BOOM ANGLE	X.XXV
BOOM EXTENSION	X.XXV

000208

DIAG OP	4 (5)
PRESENT INPUT SIGNAL	
BOOM ANGLE	X.XXV
BOOM EXTENSION	X.XXV

000208

DIAG OP	5 (X)
ALLOWED LOAD	XXXXXkg
PRESENT LOAD	XXXXXkg
LOAD STR.AXLE	XXXXXkg
LOAD-CENTER	XX.XXm

006879

DIAG OP	5 (X)
ALLOWED LOAD	XXXXXkg
PRESENT LOAD	XXXXXkg
LOAD STR.AXLE	XXXXXkg
LOAD-CENTER	XX.XXm

006879

DIAG OP	5 (X)
ALLOWED LOAD	XXXXXkg
PRESENT LOAD	XXXXXkg
LOAD STR.AXLE	XXXXXkg
LOAD-CENTER	XX.XXm

006879

#### 8.4.10.4 OP, menu 4

##### PRESENT INPUT SIGNAL, BOOM ANGLE



Description: Signal from sensor boom angle.

Circuit diagram: Circuit OP + Scale group 8.2

Connection: signal from B771/3 to analogue in D797-R/K1:21

Function: 7.2.11 Sensor boom angle

Signal value: X.XXV = 0.50 - 4.50 V

##### PRESENT INPUT SIGNAL, BOOM EXTENSION



Description: Signal from sensor boom length (analogue sensor).

Circuit diagram: Circuit OP + Scale group 8.2

Connection: signal from B777/3 to analogue in D797-R/K1:22

Function: 7.3.11 Sensor boom length

Signal value: X.XXV = 0.03 - 4.50 V

#### 8.4.10.5 OP, menu 5

##### ALLOWED LOAD

Description: Allowed load at current load centre.

Circuit diagram: -

Connection: -

Function: 8.2.1 Overload system

Signal value: XXXX kg = Weight in kg.

##### PRESENT LOAD

Description: Calculated load.

Circuit diagram: -

Connection: -

Function: 8.2.1 Overload system

Signal value: XXXX kg = Weight in kg.

##### LOAD STR.ANGEL

Description: Calculated weight on steering axle.

Circuit diagram: -

Connection: -

Function: 8.2.1 Overload system

Signal value: XXXX kg = Weight in kg.

DIAG OP	5 (X)
ALLOWED LOAD	XXXXXkg
PRESENT LOAD	XXXXXkg
LOAD STR.AXLE	XXXXXkg
LOAD-CENTER	XX.XXm

006878

### LOAD-CENTER

Description: Horizontal distance from centre drive axle to load centre.

Circuit diagram: -

Connection: -

Function: 8.2.1 Overload system, 8.2.3 Load-centre limitation

Signal value: XX.XX m = distance in m.

### 8.4.10.6 OP, menu 6

#### BOOM ANGLE

Description: Current boom angle.

Circuit diagram: -

Connection: -

Function: 8.2.1 Overload system

Signal value: XXX = boom angle in °.

DIAG OP	6 (X)
BOOM ANGLE	XXX
EXTENSION	XXX
BOOM HEIGHT	XXX
BOOM HEIGHT-NOSE	XXX

006880

#### BOOM EXTENSION

Description: Current boom extension.

Circuit diagram: -

Connection: -

Function: 8.2.1 Overload system

Signal value: XXX = boom extension in dm.

DIAG OP	6 (X)
BOOM ANGLE	XXX
EXTENSION	XXX
BOOM HEIGHT	XXX
BOOM HEIGHT-NOSE	XXX

006880

#### BOOM HEIGHT

Description: Status for boom height at the boom's top edge, the machine's total height.

Circuit diagram: -

Connection: -

Function: 8.2.4 Height limitation

Signal value: XXX = height above ground in cm.

DIAG OP	6 (X)
BOOM ANGLE	XXX
EXTENSION	XXX
BOOM HEIGHT	XXX
BOOM HEIGHT-NOSE	XXX

006880

#### BOOM HEIGHT-NOSE

Description: Status for current height of the attachment's mounting point in the boom. Height is used to calculate the load's centre of gravity as a part of the overload system.

Circuit diagram: -

Connection: -

Function: 8.2.1 Overload system

Signal value: XXX = height above ground in cm.

DIAG OP	6 (X)
BOOM ANGLE	XXX
EXTENSION	XXX
BOOM HEIGHT	XXX
BOOM HEIGHT-NOSE	XXX

006880

## 8.4.11 EXTRA

### EXTRA, description



This menu consists of optional functions:

- Bottom lift attachment, COMBI
- Cab movement, SLIDING-CAB
- Support jacks, SUPPORT-JACKS
- Lever steering or mini-wheel, EL-STEERING

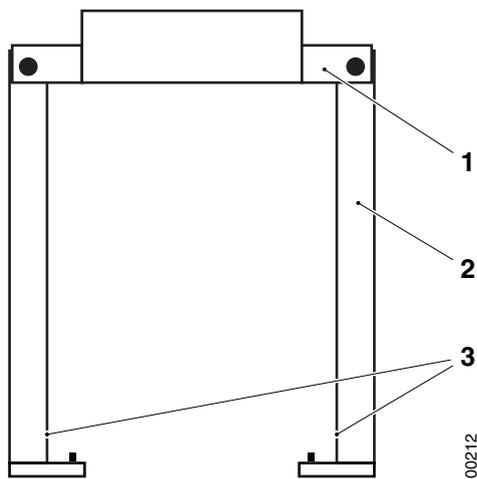
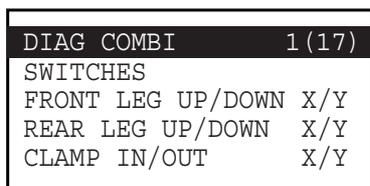
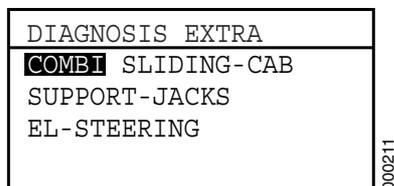
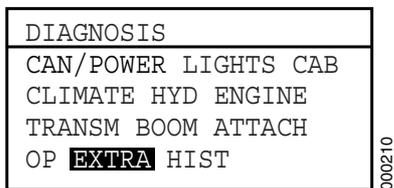
Confirm selection in main menu with function key for Enter.

#### 8.4.11.1 COMBI

##### COMBI, menu 1

This menu handles function of the bottom lift attachment.

Confirm selection with function key for Enter.



1. Knee
2. Leg
3. Clamping plate

#### SWITCHES, FRONT LEG UP/DOWN

Description: Signal from switch movement front leg (bottom lift).

Circuit diagram: Wiring Combi Att group 7.9

Connection:

Up: signal from S1006/1 to digital in D790-1/K9:3

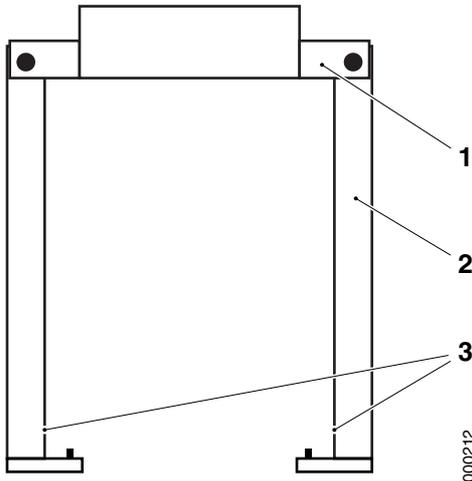
Down: signal from S1006/7 to digital in D790-1/K9:4

Function: 7.9.2 Lift legs

Signal value:

1/0	Input signal active, leg up
0/1	Input signal active, leg down.
0/0	No signal.

DIAG COMBI	1 (17)
SWITCHES	
FRONT LEG UP/DOWN	X/Y
REAR LEG UP/DOWN	X/Y
CLAMP IN/OUT	X/Y



1. Knee
2. Leg
3. Clamping plate

### SWITCHES, REAR LEG UP/DOWN

Description: Signal from switch movement rear leg (bottom lift).

Circuit diagram: Wiring Combi Att group 7.9

Connection:

Up: signal from S1007/1 to digital in D790-1/K9:5

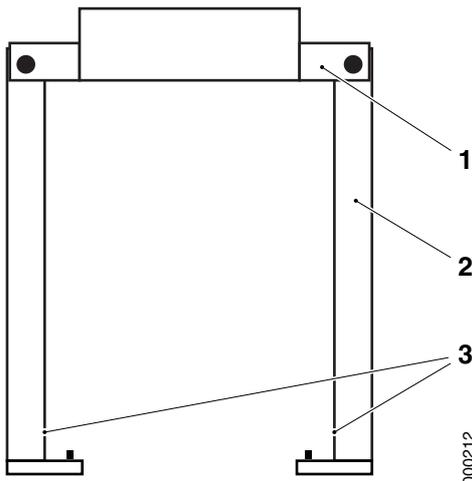
Down: signal from S1007/7 to digital in D790-1/K9:10

Function: 7.9.2 Lift legs

Signal value:

1/0	Input signal active, leg up
0/1	Input signal active, leg down.
0/0	No signal.

DIAG COMBI	1 (17)
SWITCHES	
FRONT LEG UP/DOWN	X/Y
REAR LEG UP/DOWN	X/Y
CLAMP IN/OUT	X/Y



1. Knee
2. Leg
3. Clamping plate

### SWITCHES, CLAMP IN/OUT

Description: Signal from switch clamping/releasing legs (bottom lift).

Circuit diagram: Wiring Combi Att group 7.9

Connection:

Together: signal from S1008/1 to analogue in (used as digital) D790-1/K9:8

Apart: signal from S1008/7 to analogue in (used as digital) D790-1/K9:9

Function: 7.9.2 Lift legs

Signal value:

1/0	Input signal active, leg up
0/1	Input signal active, leg down.
0/0	No signal.

**COMBI, menu 2****PRESENT INPUT SIGNAL CLAMPING SENSORS, FRONT LEGS**

Description: Signal from sensor clamping position front (leg against load).

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: signal from B7215L/C to digital in D791-3/K1:36

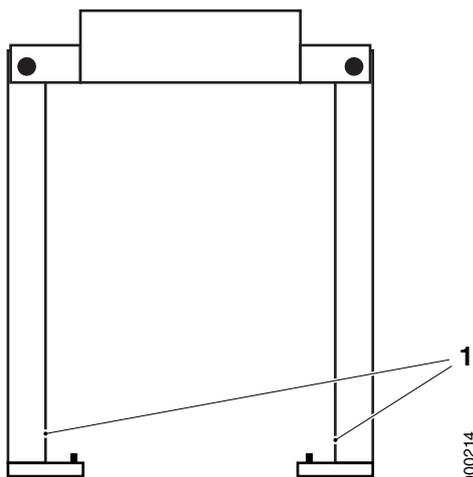
RI: signal from B7215 R/C to digital in D791-4/K1:36

Function: 7.9.2.15 Sensor clamping position

Signal value:

1	Input signal active.
0	No signal.

DIAG COMBI	2 (17)
PRESENT INPUT SIGNAL	
CLAMPING SENSORS	
FRONT LEGS	LE X RI X
REAR LEGS	LE X RI X



1. Sensor clamping position

**PRESENT INPUT SIGNAL CLAMPING SENSORS, REAR LEGS**

Description: Signal from sensor clamping position rear (leg against load).

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: signal from B7216L/C to digital in D791-3/K1:37

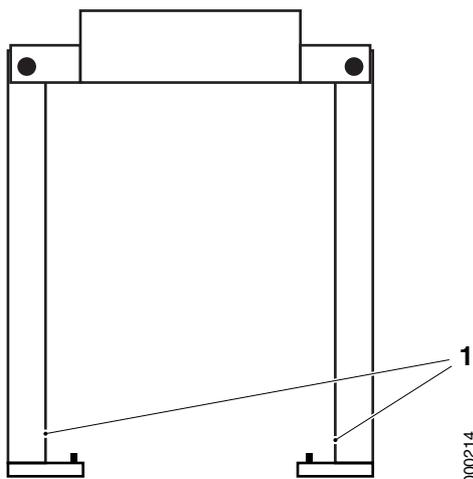
RI: signal from B7216R/C to digital in D791-4/K1:37

Function: 7.9.2.15 Sensor clamping position

Signal value:

1	Input signal active.
0	No signal.

DIAG COMBI	2 (17)
PRESENT INPUT SIGNAL	
CLAMPING SENSORS	
FRONT LEGS	LE X RI X
REAR LEGS	LE X RI X



1. Sensor clamping position

**COMBI, menu 3**

**PRESENT INPUT SIGNAL ALIGNMENT SENSORS, FRONT LEGS**

Description: Signal from sensor alignment front (load secured).

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: signal from B7213L/C to digital in D791-3/K1:13

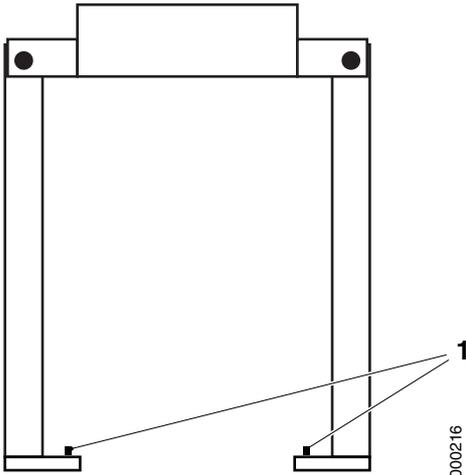
RI: signal from B7213R/C to digital in D791-4/K1:13

Function: 7.9.2.14 Sensor alignment

Signal value:

1	Input signal active.
0	No signal.

DIAG COMBI	3 (17)
PRESENT INPUT SIGNAL	
ALIGNMENT SENSORS	
FRONT LEGS	LE X RI X
REAR LEGS	LE X RI X



1. Sensor alignment

**PRESENT INPUT SIGNAL ALIGNMENT SENSORS, REAR LEGS**

Description: Signal from sensor alignment rear (load secured).

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: signal from B7214L/C to digital in D791-3/K1:20

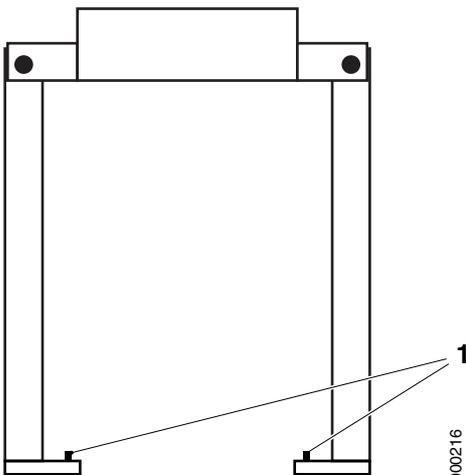
RI: signal from B7214R/C to digital in D791-4/K1:20

Function: 7.9.2.14 Sensor alignment

Signal value:

1	Input signal active.
0	No signal.

DIAG COMBI	3 (17)
PRESENT INPUT SIGNAL	
ALIGNMENT SENSORS	
FRONT LEGS	LE X RI X
REAR LEGS	LE X RI X



1. Sensor alignment

DIAG COMBI	4 (17)
PRESENT INPUT SIGNAL	
END POS SENSORS FRONT	
KNEE	LE X RI X
LEG	LE X RI X

000217

**COMBI, menu 4****PRESENT INPUT SIGNAL END POS SENSORS FRONT, KNEE**

Description: Signal from sensor knee front.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: signal from B7217L/C to digital in D791-3/K1:21

RI: signal from B7217R/C to digital in D791-4/K1:21

Function: 7.9.2.10 Sensor knee

Signal value:

1	Input signal active. Moving.
0	No signal.

**PRESENT INPUT SIGNAL END POS SENSORS FRONT, LEG**

Description: Signal from sensor lift leg front.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: signal from B7219L/C to digital in D791-3/K1:23

RI: signal from B7219R/C to digital in D791-4/K1:23

Function: 7.9.2.13 Sensor lift leg

Signal value:

1	Input signal active. Moving.
0	No signal.

DIAG COMBI	4 (17)
PRESENT INPUT SIGNAL	
END POS SENSORS FRONT	
KNEE	LE X RI X
LEG	LE X RI X

000217

**COMBI, menu 5****PRESENT INPUT SIGNAL END POS SENSORS REAR, KNEE**

Description: Signal from sensor knee rear.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: signal from B7218L/C to digital in D791-3/K1:22

RI: signal from B7218R/C to digital in D791-4/K1:22

Function: 7.9.2.10 Sensor knee

Signal value:

1	Input signal active. Moving.
0	No signal.

DIAG COMBI	5 (17)
PRESENT INPUT SIGNAL	
END POS SENSORS REAR	
KNEE	LE X RI X
LEG	LE X RI X

000218

DIAG COMBI	5 (17)
PRESENT INPUT SIGNAL	
END POS SENSORS REAR	
KNEE	LE X RI X
LEG	LE X RI X

000218

**PRESENT INPUT SIGNAL END POS SENSORS REAR, LEG**

Description: Signal from sensor lift leg rear

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: signal from B7220L/C to digital in D791-3/K1:24

RI: signal from B7220R/C to digital in D791-4/K1:24

Function: 7.9.2.13 Sensor lift leg

Signal value:

1	Input signal active. Moving.
0	No signal.

**COMBI, menu 6****PRESENT INPUT SIGNAL LEGS IN DRIVE, POSITION**

Description: Signal from sensor operating position.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: signal from B7212L/C to digital in D791-3/K1:40

RI: signal from B7212R/C to digital in D791-4/K1:40

Function: 7.9.2.9 Sensor operating position

Signal value:

1	Input signal active.
0	No signal.

DIAG COMBI	6 (17)
PRESENT INPUT SIGNAL	
LEGS IN DRIVE	
POSITION	LE X RI X

000219

DIAG COMBI				7 (17)
INDICATION LAMPS				
ALIGNMENT				
FRONT	LE XY	RI XY		
REAR	LE XY	RI XY		

00020

## COMBI, menu 7

### INDICATOR LIGHTS ALIGNMENT, FRONT

Description: Voltage feed to indicator light alignment front.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: digital out from D791-3/K1:29 to H566L/1

RI: digital out from D791-3/K1:10 to H566R/1

Function: 7.9.2 Lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

### INDICATOR LIGHTS ALIGNMENT, REAR

Description: Status for Voltage feed to indicator light alignment rear.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: digital out from D791-3/K1:39 to H567L/1

RI: digital out from D791-3/K1:25 to H567R/1

Function: 7.9.2 Lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG COMBI				7 (17)
INDICATION LAMPS				
ALIGNMENT				
FRONT	LE XY	RI XY		
REAR	LE XY	RI XY		

00020

DIAG COMBI	8 (17)
INDICATION LAMPS	
CLAMP	
FRONT	XY
REAR	XY

000221

DIAG COMBI	8 (17)
INDICATION LAMPS	
CLAMP	
FRONT	XY
REAR	XY

000221

## COMBI, menu 8

### INDICATOR LIGHTS CLAMP, FRONT

Description: Status for Voltage feed to indicator light clamping position front.

Circuit diagram: Wiring Combi Att group 7.9

Connection: digital out from D791-4/K1:29 to H578/1

Function: 7.9.2 Lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

### INDICATOR LIGHTS CLAMP, REAR

Description: Status for Voltage feed to indicator light clamping position rear.

Circuit diagram: Wiring Combi Att group 7.9

Connection: digital out from D791-4/K1:39 to H579/1

Function: 7.9.2 Lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG COMBI	9 (17)
INDICATION LAMPS	
FRONT LEGS UP	XY
FRONT LEGS DOWN	XY

000222

DIAG COMBI	9 (17)
INDICATION LAMPS	
FRONT LEGS UP	XY
FRONT LEGS DOWN	XY

000222

## COMBI, menu 9

### INDICATOR LIGHTS, FRONT LEGS UP

Description: Status for Voltage feed to indicator light front legs raised.

Circuit diagram: Wiring Combi Att group 7.9

Connection: digital out from D791-4/K1:10 to H580/1

Function: 7.9.2 Lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

### INDICATOR LIGHTS, FRONT LEGS DOWN

Description: Status for Voltage feed to indicator light front legs lowered.

Circuit diagram: Wiring Combi Att group 7.9

Connection: digital out from D791-4/K1:25 to H581/1

Function: 7.9.2 Lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG COMBI	10 (17)
PRESENT OUTPUT SIGNAL	
FRONT LEGS DOWN	
KNEE	LE XY RI XY
LEGS	LE XY RI XY

000223

**COMBI, menu 10**

**PRESENT OUTPUT SIGNAL FRONT LEGS DOWN, KNEE**

Description: Status for voltage feed to Control valve lift leg, solenoid valve front knee out.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: digital out from D791-3/K1:5 to Y6056L/1

RI: digital out from D791-4/K1:5 to Y6056R/1

Function: 7.9.2.3 Control valve lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG COMBI	10 (17)
PRESENT OUTPUT SIGNAL	
FRONT LEGS DOWN	
KNEE	LE XY RI XY
LEGS	LE XY RI XY

000223

**PRESENT OUTPUT SIGNAL FRONT LEGS DOWN, LEGS**

Description: Status for voltage feed to Control valve lift leg, solenoid valve front leg down.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: digital out from D791-3/K1:32to Y6013L/1

RI: digital out from D791-4/K1:32 to Y6013R/1

Function: 7.9.2.3 Control valve lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG COMBI	11 (17)
PRESENT OUTPUT SIGNAL	
FRONT LEGS UP	
KNEE	LE XY RI XY
LEGS	LE XY RI XY

000224

## COMBI, menu 11

### PRESENT OUTPUT SIGNAL FRONT LEGS UP, KNEE

Description: Status for Voltage feed to control valve lift leg, solenoid valve front knee in.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: digital out from D791-3/K1:4 to Y6057L/1

RI: digital out from D791-4/K1:4 to Y6057R/1

Function: 7.9.2.3 Control valve lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

### PRESENT OUTPUT SIGNAL FRONT LEGS UP, LEGS

Description: Status for Voltage feed to control valve lift leg, solenoid valve front leg up.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: digital out from D791-3/K1:33 to Y6060L/1

RI: digital out from D791-4/K1:33 to Y6060R/1

Function: 7.9.2.3 Control valve lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG COMBI	11 (17)
PRESENT OUTPUT SIGNAL	
FRONT LEGS UP	
KNEE	LE XY RI XY
LEGS	LE XY RI XY

000224

DIAG COMBI	12 (17)
PRESENT OUTPUT SIGNAL	
REAR LEGS DOWN	
KNEE	LE XY RI XY
LEGS	LE XY RI XY

000225

**COMBI, menu 12**

**PRESENT OUTPUT SIGNAL REAR LEGS DOWN, KNEE**

Description: Status for Voltage feed to control valve lift leg, solenoid valve rear knee out.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: digital out from D791-3/K1:31 to Y6058L/1

RI: digital out from D791-4/K1:31 to Y6058R/1

Function: 7.9.2.3 Solenoid valve lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG COMBI	12 (17)
PRESENT OUTPUT SIGNAL	
REAR LEGS DOWN	
KNEE	LE XY RI XY
LEGS	LE XY RI XY

000225

**PRESENT OUTPUT SIGNAL REAR LEGS DOWN, LEGS**

Description: Status for Voltage feed to control valve lift leg, solenoid valve rear leg down.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: digital out from D791-3/K1:7 to Y6014L/1

RI: digital out from D791-4/K1:7 to Y6014R/1

Function: 7.9.2.3 Control valve lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG COMBI	13 (17)
PRESENT OUTPUT SIGNAL	
REAR LEGS UP	
KNEE	LE XY RI XY
LEGS	LE XY RI XY

000226

### COMBI, menu 13

#### PRESENT OUTPUT SIGNAL REAR LEGS UP, KNEE

Description: Status for Voltage feed to control valve lift leg, solenoid valve rear knee in.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: digital out from D791-3/K1:30 to Y6059L/1

RI: digital out from D791-4/K1:30 to Y6059R/1

Function: 7.9.2.3 Control valve lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

#### PRESENT OUTPUT SIGNAL REAR LEGS UP, LEGS

Description: Status for Voltage feed to control valve lift leg, solenoid valve rear leg up.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: digital out from D791-3/K1:9 to Y6061L/1

RI: digital out from D791-4/K1:9 to Y6061R/1

Function: 7.9.2.3 Control valve lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG COMBI	13 (17)
PRESENT OUTPUT SIGNAL	
REAR LEGS UP	
KNEE	LE XY RI XY
LEGS	LE XY RI XY

000226

DIAG COMBI 14 (17)		
SEQUENCE MODE		
	LE	RI
FRONT	X	X
REAR	X	X

000227

DIAG COMBI 14 (17)		
SEQUENCE MODE		
	LE	RI
FRONT	X	X
REAR	X	X

000227

## COMBI, menu 14

### SEQUENCE MODE, FRONT

Description: Current sequence mode for movement of front legs.

Circuit diagram: Wiring Combi Att group 7.9

Connection: -

Function: 7.9.2 Lift legs

Signal value:

0	Sequence error
1	Leg up (0), knee in (0).
2	Leg up (0), knee moving (1).
3	Leg up (0), knee out (0).
4	Leg moving (1), knee out (0).
5	Leg down (0), knee out (0). No signal.

### SEQUENCE MODE, REAR

Description: Current sequence mode for movement of rear legs.

Circuit diagram: Wiring Combi Att group 7.9

Connection: -

Function: 7.9.2 Lift legs

Signal value:

0	Sequence error
1	Leg up (0), knee in (0).
2	Leg up (0), knee moving (1).
3	Leg up (0), knee out (0).
4	Leg moving (1), knee out (0).
5	Leg down (0), knee out (0). No signal.

DIAG COMBI	15 (X)
PRESENT OUTPUT SIGNAL CLAMP	
IN	LE XY RI XY
OUT	LE XY RI XY

006881

## COMBI, menu 15

### PRESENT OUTPUT SIGNAL CLAMP, OUT

Description: Status for voltage feed to Control valve lift leg, solenoid valve clamp apart.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: digital out from D791-3/K1:12 to Y6055L/1

RI: digital out from D797-4/K1:12 to Y6055R/1

Function: 7.9.2.3 Control valve lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

### PRESENT OUTPUT SIGNAL CLAMP, IN

Description: Status for voltage feed to Control valve lift leg, solenoid valve clamp in.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: digital out from D791-3/K1:11 to Y6054L/1

RI: digital out from D797-4/K1:11 to Y6054R/1

Function: 7.9.2.3 Control valve lift legs

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG COMBI	15 (X)
PRESENT OUTPUT SIGNAL CLAMP	
IN	LE XY RI XY
OUT	LE XY RI XY

006881

DIAG COMBI	16 (17)
PRESENT OUTPUT SIGNAL DRIVE POSITION	
LE XY	RI XY

000229

**COMBI, menu 16****PRESENT OUTPUT SIGNAL DRIVE POSITION**

Description: Status for voltage feed to solenoid valve operating position.

Circuit diagram: Wiring Combi Att group 7.9

Connection:

LE: digital out from D791-3/K1:42 to Y6053L

RI: digital out from D797-4/K1:42 to Y6053R

Function: 7.9.2.5 Valve block operating position

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG COMBI	17 (17)
FORCE CONTROL (+/-)	
"VALVE"	

000230

**COMBI, menu 17****FORCE CONTROL (+/-), VALVE**

Description: Forced operation of the solenoid valves that control the lift legs. Select solenoid valve with the +/- keys and activate valve with Enter-key.

0: no valve selected

1: Y6056L (knee out left front)

2: Y6057L (knee in left front)

3: Y6013L (leg down left front)

4: Y6060L (leg up left front)

5: Y6056R (knee out right front)

6: Y6057R (knee in right front)

7: Y6013R (leg down right front)

8: Y6060R (leg up right front)

9: Y6058L (knee out left rear)

10: Y6059L (knee in left rear)

11: Y6014K (leg down left rear)

12: Y6061L (leg up left rear)

13: Y6058R (knee out right rear)

14: Y6059R (knee in right rear)

15: Y6014R (leg down right rear)

16: Y6061R (leg up right rear)

17: Y6054L (clamp in left)

18: Y6055L (clamp apart left)

19: Y6054R (clamp in right)

20: Y6055R (clamp apart right)

Circuit diagram: Wiring Combi Att group 7.9

Connection: -

Function: 7.9.2.3 Control valve lift legs

Signal value: -

### 8.4.11.2 SLIDING-CAB

#### SLIDING CAB, menu 1

This group handles hydraulic sliding cab and hydraulic cab lift/lower. Menu texts are created for hydraulic sliding cab.

Confirm selection function key for Enter.

DIAGNOSIS EXTRA
COMBI <b>SLIDING-CAB</b>
SUPPORT-JACKS
EL-STEERING

000231

DIAG SLID-CAB	1 (4)
SWITCHES	
FORWARD	X
REVERSE	X
OPENED DOORS	X

000215

#### SWITCHES, FORWARD

Description: Signal from switch hydraulic sliding cab (forward) or switch cab lift and lowering (up).

Circuit diagram: Wiring Sliding/Vertically adjustable Cab group 9.10

Connection: from S177/1 to digital in D790-1/K8:7

Function: 9.10.4 Sliding cab, 9.10.5 Cab lift and lower

Signal value:

1	Input signal active.
0	No signal.

#### SWITCHES, REVERSE

Description: Signal from switch hydraulic sliding cab (rearward) or switch cab lift and lowering (down).

Circuit diagram: Wiring Sliding/Vertically adjustable Cab group 9.10

Connection: from S177/7 to digital in D790-1/K8:6

Function: 9.10.4 Sliding cab, 9.10.5 Cab lift and lower

Signal value:

1	Input signal active.
0	No signal.

DIAG SLID-CAB	1 (4)
SWITCHES	
FORWARD	X
REVERSE	X
OPENED DOORS	X

000215

DIAG SLID-CAB	1 (4)
SWITCHES	
FORWARD	X
REVERSE	X
OPENED DOORS	X

000215

### SWITCHES, OPENED DOORS

Description: Signal from door switches, condition that doors are closed.

Circuit diagram: Circuit Lighting group 9.6

Connection: from S266-LE/2 or S266-RI/2 to digital in D790-1/K11:3

Function: 9.10.2 Doors

Signal value:

1	Input signal active. Door open.
0	No signal. Doors closed.

### SLIDING CAB, menu 2

#### PRESENT INPUT SIGNAL, LOW SPEED

Description: Signal from sensor damping end-position, sliding cab or cab lift and lowering.

Circuit diagram: Wiring Sliding/Vertically adjustable Cab group 9.10

Connection: from B769-2/3 to digital in D790-1/K10:6

Function: 9.10.4.8 Sensor damping end-position, 9.10.5.9 Sensor damping end-position

Signal value:

1	Input signal active.
0	No signal.

#### PRESENT INPUT SIGNAL, CAB SPEED (LIFT)

Description: Signal from sensor lowered cab (cab lift and lowering).

Circuit diagram: Wiring Sliding/Vertically adjustable Cab group 9.10

Connection: from B 777-2/3 to analogue in (used as digital) D797- O/ K1:21

Function: 9.10.5.8 Sensor lowered cab

Signal value:

1	Input signal active.
0	No signal.

DIAG SLID-CAB	2 (4)
PRESENT INPUT SIGNAL	
LOW SPEED	X
CAB DOWN (LIFT)	X

000232

DIAG SLID-CAB	2 (4)
PRESENT INPUT SIGNAL	
LOW SPEED	X
CAB DOWN (LIFT)	X

000232

DIAG SLID-CAB	3 (4)
OUTPUT FORWARD	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000233

### SLIDING CAB, menu 3

#### OUTPUT FORWARD, REFERENCE

Description: Status for control current to control valve option, solenoid valve sliding cab forward.

Circuit diagram: Wiring Sliding/Vertically adjustable Cab group 9.10

Connection: digital out from D797-O/K1:2 till Y6016/1

Function: 9.10.4.4 Control valve option frame

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

#### OUTPUT FORWARD, REQUIRED VALUE

Description: Reference value for control current to control valve option, solenoid valve sliding cab forward.

Circuit diagram: Wiring Sliding/Vertically adjustable Cab group 9.10

Connection: output signal reference value out from D797-O/K1:16 till Y6016/2

Function: 9.10.4.4 Control valve option frame

Signal value: XXX = Current value: in mA for control of solenoid valve.

DIAG SLID-CAB	3 (4)
OUTPUT FORWARD	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000233

#### OUTPUT FORWARD, FEEDBACK

Description: Present control current to control valve option, solenoid valve sliding cab forward.

Circuit diagram: Wiring Sliding/Vertically adjustable Cab group 9.10

Connection: output signal, actual value out from D797-O/K1:16 till Y6016/2

Function: 9.10.4.4 Control valve option frame

Signal value: XXX = Measured value in mA.

DIAG SLID-CAB	3 (4)
OUTPUT FORWARD	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000233

<b>DIAG SLID-CAB</b>	<b>4 (4)</b>
OUTPUT REVERSE	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000234

<b>DIAG SLID-CAB</b>	<b>4 (4)</b>
OUTPUT REVERSE	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000234

<b>DIAG SLID-CAB</b>	<b>4 (4)</b>
OUTPUT REVERSE	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000234

## SLIDING CAB, menu 4

### OUTPUT REVERSE, REFERENCE

Description: Status for control current to control valve option, solenoid valve sliding cab backward.

Circuit diagram: Wiring Sliding/Vertically adjustable Cab group 9.10

Connection: digital out from D797-O/K1:3 to Y6017/1

Function: 9.10.4.4 Control valve option frame

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

### OUTPUT REVERSE, REQUIRED VALUE

Description: Reference value for control current to control valve option, solenoid valve sliding cab backward.

Circuit diagram: Wiring Sliding/Vertically adjustable Cab group 9.10

Connection: output signal, reference value out from D797-O/K1:17 to Y6017/2

Function: 9.10.4.4 Control valve option frame

Signal value: XXX = Current value: in mA for control of solenoid valve.

### OUTPUT REVERSE, FEEDBACK

Description: Present control current to control valve option, solenoid valve sliding cab backward.

Circuit diagram: Wiring Sliding/Vertically adjustable Cab group 9.10

Connection: output signal, actual value out from D797-O/K1:17 to Y6017/2

Function: 9.10.4.4 Control valve option frame

Signal value: XXX = Measured value in mA.

DIAGNOSIS EXTRA
COMBI SLIDING-CAB
<b>SUPPORT-JACKS</b>
EL-STEERING

000235

DIAG S-JACKS	1 (4)
SWITCHES	
UP	X
DOWN	X

000213

DIAG S-JACKS	1 (4)
SWITCHES	
UP	X
DOWN	X

000213

DIAG S-JACKS	2 (4)
PRESENT INPUT SIGNALS	
UP	LE X RI X
DOWN	LE X RI X

000236

### 8.4.11.3 SUPPORT-JACKS

#### SUPPORT JACKS, menu 1

This group handles functions for support jacks.

Confirm selection function key for Enter.

#### SWITCHES, UP

Description: Signal from switch support jacks (up).

Circuit diagram: Wiring Hyd Support jacks group 7.10

Connection: from S1013/1 to digital in D790-1/K8:9

Function: 7.10.1 Support jacks

Signal value:

1	Input signal active.
0	No signal.

#### SWITCHES, DOWN

Description: Signal from switch support jacks (down).

Circuit diagram: Wiring Hyd Support jacks group 7.10

Connection: from S1013/7 to digital in D790-1/K8:8

Function: 7.10.1 Support jacks

Signal value:

1	Input signal active.
0	No signal.

#### SUPPORT JACKS, menu 2

#### PRESENT INPUT SIGNALS, UP

Description: Signal from sensor support jacks up.

Circuit diagram: Wiring Hyd Support jacks group 7.10

Connection:

LE: from B7222L/A to digital in D797-O/K1:13

RI: from B7222 R/A to digital in D797-O/K1:27

Function: 7.10.1.5 Sensor support jacks up

Signal value:

1	Input signal active.
0	No signal.

DIAG S-JACKS 2 (4)			
PRESENT INPUT SIGNALS			
UP	LE X	RI X	
DOWN	LE X	RI X	

000236

### PRESENT INPUT SIGNALS, DOWN

Description: Signal from sensor support jacks down.

Circuit diagram: Wiring Hyd Support jacks group 7.10

Connection:

- LE: from B7223L/A to digital in D797-O/K1:20
- RI: from B7223R/A to digital in D797-O/K1:41

Function: 7.10.1.6 Sensor support jacks down

Signal value:

1	Input signal active.
0	No signal.

### SUPPORT JACKS, menu 3

#### OUTPUT VALVE S-J UP

Description: Voltage feed to control valve option frame, solenoid valve support jack up.

Circuit diagram: Wiring Hyd Support jacks group 7.10

Connection: digital out from D797-O/K1:30 to Y6063/1

Function: 7.10.1.2 Control valve option frame

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

DIAG S-JACKS 3 (4)			
OUTPUT VALVE			
S-J UP		XY	
S-J DOWN		XY	

000237

<b>DIAG S-JACKS</b>	<b>3 (4)</b>
OUTPUT VALVE	
S-J UP	XY
S-J DOWN	XY

000237

### OUTPUT VALVE S-J DOWN

Description: Voltage feed to control valve option frame, solenoid valve support jack down.

Circuit diagram: Wiring Hyd Support jacks group 7.10

Connection: digital out from D797-O/K1:31 to Y6064/1

Function: 7.10.1.2 Control valve option frame

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

### SUPPORT JACKS, menu 4

#### INDICATOR LIGHT, DOWN

Description: Status for voltage feed to indicator light support jacks down.

Circuit diagram: Wiring Hyd Support jacks group 7.10

Connection: digital out from D790-1/K7:11 to H574/1

Function: 7.10.1 Support jacks

Signal value:

00	No output signal, open circuit in circuit.
01	No output signal, circuit OK or short-circuiting. Short-circuiting can only be detected when the output signal is active.
10	Output signal active, short-circuiting.
11	Output signal active, circuit OK or open circuit. Open circuit can only be detected when the output signal is active.

<b>DIAG S-JACKS</b>	<b>4 (4)</b>
INDICATOR LAMP	
DOWN	XY

000238

DIAGNOSIS EXTRA
COMBI SLIDING-CAB
SUPPORT-JACKS
<b>EL-STEERING</b>

000239

DIAG STEERING	1 (5)
PRESENT INPUT SIGNAL	
SIGNAL 1	X.XXV
SIGNAL 2	X.XXV

001972

DIAG STEERING	1 (5)
PRESENT INPUT SIGNAL	
SIGNAL 1	X.XXV
SIGNAL 2	X.XXV

001972

DIAG STEERING	2 (5)
SWITCHES	
ON/OFF	X
FORWARD	X
REVERSE	X

000240

## 8.4.11.4 EL-STEERING

### EL-STEERING, menu 1

This group handles functions for lever steering/mini-wheel steering.

Confirm selection function key for Enter.

### PRESENT INPUT SIGNAL, SIGNAL 1

Description: Signal from mini-wheel (signal 1) or steering lever.

Circuit diagram: Circuit Steering joystick/mini-wheel group 5.2, Wiring Micro lever/wheel and Combi Att group 5.2

Connection:

Top lift attachment: from R825/H1 to digital in D790-1/K9:8

Combi attachment: from R825/H1 to digital in D790-3/K1:21

Function: 5.2 Power-steering system

Signal value: X.XXV = 0.50 - 4.50 V

### PRESENT INPUT SIGNAL, SIGNAL 2

Description: Signal from mini-wheel (signal 2). (Only applies to mini-wheel)

Circuit diagram: Circuit Steering joystick/mini-wheel group 5.2, Wiring Micro lever/wheel and Combi Att group 5.2

Connection:

Top lift attachment: from R825/H2 to digital in D790-1/K9:9

Combi attachment: from R825/H2 to digital in D790-3/K1:22

Function: 5.2 Power-steering system

Signal value: X.XXV = 0.50 - 4.50 V

### EL-STEERING, menu 2

#### SWITCHES, ON/OFF

Description: Signal from switch mini-wheel/steering lever.

Circuit diagram: Circuit Steering joystick/mini-wheel group 5.2, Wiring Micro lever/wheel and Combi Att group 5.2

Connection:

Top lift attachment: from S113/1 to digital in D790-1/K9:5

Combi attachment: from S113/1 to digital in D790-3/K1:27

Function: 5.2 Power-steering system

Signal value:

1	Input signal active.
0	No signal.

DIAG STEERING	2 (5)
SWITCHES	
ON/OFF	X
FORWARD	X
REVERSE	X

000240

DIAG STEERING	2 (5)
SWITCHES	
ON/OFF	X
FORWARD	X
REVERSE	X

000240

DIAG S-JACKS	3 (X)
PRESENT INPUT SIGNAL	
HORN	X
STEER.WHEEL CUT OFF	X

006882

### SWITCHES, FORWARD

Description: Signal from mini-wheel or steering lever (travel direction selector forward).

Circuit diagram: Circuit Steering joystick/mini-wheel group 5.2, Wiring Micro lever/wheel and Combi Att group 5.2

Connection:

Top lift attachment: from S160-2/1 to digital in D790-1/K9:4

Combi attachment: from S160-2/1 to digital in D790-3/K1:20

Function: 5.2 Power-steering system

Signal value:

1	Input signal active.
0	No signal.

### SWITCHES, REVERSE

Description: Signal from mini-wheel or steering lever (travel direction selector reverse).

Circuit diagram: Circuit Steering joystick/mini-wheel group 5.2, Wiring Micro lever/wheel and Combi Att group 5.2

Connection:

Top lift attachment: from S160-2/7 to digital in D790-1/K9:3

Combi attachment: from S160-2/7 to digital in D790-3/K1:13

Function: 5.2 Power-steering system

Signal value:

1	Input signal active.
0	No signal.

### EL-STEERING, menu 3

#### PRESENT INPUT SIGNAL, HORN

Description: Signal from mini-wheel or steering lever (audible signal).

Circuit diagram: Circuit Steering joystick/mini-wheel group 5.2, Wiring Micro lever/wheel and Combi Att group 5.2

Connection:

Top lift attachment: from S149-2/1 to digital in D790-1/K9:10

Combi attachment: from S149-2/1 to digital in D790-3/K1:41

Function: 5.2 Power-steering system

Signal value:

1	Input signal active.
0	No signal.

DIAG S-JACKS		3 (X)
PRESENT INPUT SIGNAL		
HORN		X
STEER.WHEEL CUT OFF		X

006882

**PRESENT INPUT SIGNAL, STEER.WHEEL CUT OFF**

Description: Signal from sensor steering angle.

Circuit diagram: Circuit Steering joystick/mini-wheel group 5.2, Wiring Micro lever/wheel and Combi Att group 5.2

Connection: from B720/2 to digital in D790-2/K8:2

Function: 5.2.12 Sensor steering angle

Signal value:

1	Input signal active.
0	No signal.

**EL-STEERING, menu 4****OUTPUT STEERING LEFT, REFERENCE**

Description: Status for control current to control valve option frame, solenoid valve steering left.

Circuit diagram: Circuit Steering joystick/mini-wheel group 5.2, Wiring Micro lever/wheel and Combi Att group 5.2

Connection: output signal, reference value out from D797-O/K1:4 to Y636L/1

Function: 5.2.10 Control valve option frame

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

**OUTPUT STEERING LEFT, REQUIRED VALUE**

Description: Reference value for control current to control valve option frame, solenoid valve steering left.

Circuit diagram: Circuit Steering joystick/mini-wheel group 5.2, Wiring Micro lever/wheel and Combi Att group 5.2

Connection: output signal, reference value out from D797-O/K1:18 to Y636L/2

Function: 5.2.10 Control valve option frame

Signal value: XXX = Current value: in mA for control of solenoid valve.

DIAG STEERING		4 (5)
OUTPUT STEERING LEFT		
REFERENCE		XY
REQUIRED VALUE		XXX
FEEDBACK		XXX

000242

DIAG STEERING		4 (5)
OUTPUT STEERING LEFT		
REFERENCE		XY
REQUIRED VALUE		XXX
FEEDBACK		XXX

000242

<b>DIAG STEERING</b>	<b>4 (5)</b>
OUTPUT STEERING LEFT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000242

<b>DIAG STEERING</b>	<b>5 (5)</b>
OUTPUT STEERING RIGHT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000243

<b>DIAG STEERING</b>	<b>5 (5)</b>
OUTPUT STEERING RIGHT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000243

<b>DIAG STEERING</b>	<b>5 (5)</b>
OUTPUT STEERING RIGHT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000243

### OUTPUT STEERING LEFT, FEEDBACK

Description: Present control current to control valve option frame, solenoid valve steering left.

Circuit diagram: Circuit Steering joystick/mini-wheel group 5.2, Wiring Micro lever/wheel and Combi Att group 5.2

Connection: output signal, reference value out from D 797-0/K1:18 to Y636L/2

Function: 5.2.10 Control valve option frame

Signal value: XXX = Current value: in mA for control of solenoid valve.

### EL-STEERING, menu 5

#### OUTPUT STEERING RIGHT, REFERENCE

Description: Status for control current to control valve option frame, solenoid valve steering left.

Circuit diagram: Circuit Steering joystick/mini-wheel group 5.2, Wiring Micro lever/wheel and Combi Att group 5.2

Connection: output signal, reference value out from D797-O/K1:5 to Y636R/1

Function: 5.2.10 Control valve option frame

Signal value:

01	No output signal. Error detection only possible when output signal is active.
10	Output signal active, short-circuiting or open circuit.
11	Output signal active, circuit OK.

#### OUTPUT STEERING RIGHT, REQUIRED VALUE

Description: Reference value for control current to control valve option frame, solenoid valve steering left.

Circuit diagram: Circuit Steering joystick/mini-wheel group 5.2, Wiring Micro lever/wheel and Combi Att group 5.2

Connection: output signal, reference value out from D797-O/K1:19 to Y636R/2

Function: 5.2.10 Control valve option frame

Signal value: XXX = Current value: in mA for control of solenoid valve.

#### OUTPUT STEERING RIGHT, FEEDBACK

Description: Present control current to control valve option frame, solenoid valve steering left.

Circuit diagram: Circuit Steering joystick/mini-wheel group 5.2, Wiring Micro lever/wheel and Combi Att group 5.2

Connection: output signal, reference value out from D797-O/K1:19 to Y636R/2

Function: 5.2.10 Control valve option frame

Signal value: XXX = Current value: in mA for control of solenoid valve.

DIAGNOSIS
CAN/POWER LIGHTS CAB
CLIMATE HYD ENGINE
TRANSM BOOM ATTACH
OP EXTRA <b>RMI</b>

007442

DIAG RMI	1 (3)
MIU SW VER	XXXX.XXXX
MIU TIME	XXXX.XX.XX

007439

DIAG RMI	1 (3)
MIU SW VER	XXXX.XXXX
MIU TIME	XXXX.XX.XX

007439

DIAG RMI	2 (3)
SIGNAL QUALITY	
GSM XXX	GPRS XXX
WLAN XXX	RADIO XXX
SMS XXX:UNS	.DATA XXX

007440

## 8.4.13 RMI

### RMI, description



This group handles the function of RMI (Remote Machine Interface).

Confirm selection function key for Enter.

#### 8.4.13.1 RMI, menu 1

##### MIU SW VER



Description: Software version in RMI interface.

Circuit diagram: -

Connection: -

Function: 11.6.5 RMI (Remote Machine Interface)

Signal value: xxxx.xxxx = software number.

##### MIU TIME



Description: Date setting in RMI interface.

Circuit diagram: -

Connection: -

Function: 11.6.5 RMI (Remote Machine Interface)

Signal value: xxxx.xx.xx = Date in format YYYY.MM.DD.

#### 8.4.13.2 RMI, menu 2

##### SIGNAL QUALITY, GSM



Description: Signal strength of GSM signal through receiver in the RMI interface.

Circuit diagram: Wiring RMI group 8.2

Connection: -

Function: 11.6.5 RMI (Remote Machine Interface)

Signal value: XXX = 0-100 = Signal strength, 0-100%.

DIAG RMI	2 (3)
SIGNAL QUALITY	
GSM XXX	GPRS XXX
WLAN XXX	RADIO XXX
SMS XXX:UNS.DATA	XXX

007440

**SIGNAL QUALITY, GPRS**

Description: Signal strength of GPRS signal through receiver in the RMI interface.

Circuit diagram: Wiring RMI group 8.2

Connection: -

Function: 11.6.5 RMI (Remote Machine Interface)

Signal value: XXX = 0-100 = Signal strength, 0-100%.

**SIGNAL QUALITY, WLAN**

Description: Signal strength of WLAN signal through receiver in the RMI interface.

Circuit diagram: Wiring RMI group 8.2

Connection: -

Function: 11.6.5 RMI (Remote Machine Interface)

Signal value: XXX = 0-100 = Signal strength, 0-100%.

**SIGNAL QUALITY, RADIO**

Description: Signal strength of RADIO signal through receiver in the RMI interface.

Circuit diagram: Wiring RMI group 8.2

Connection: -

Function: 11.6.5 RMI (Remote Machine Interface)

Signal value: XXX = 0-100 = Signal strength, 0-100%.

**SIGNAL QUALITY, SMS**

Description: Signal strength of SMS signal through receiver in the RMI interface.

Circuit diagram: Wiring RMI group 8.2

Connection: -

Function: 11.6.5 RMI (Remote Machine Interface)

Signal value: XXX = 0-100 = Signal strength, 0-100%.

DIAG RMI	2 (3)
SIGNAL QUALITY	
GSM XXX	GPRS XXX
WLAN XXX	RADIO XXX
SMS XXX:UNS.DATA	XXX

007440

DIAG RMI	2 (3)
SIGNAL QUALITY	
GSM XXX	GPRS XXX
WLAN XXX	RADIO XXX
SMS XXX:UNS.DATA	XXX

007440

DIAG RMI		2 (3)
SIGNAL QUALITY		
GSM	XXX	GPRS XXX
WLAN	XXX	RADIO XXX
SMS	XXX:UNS	.DATA XXX

007440

DIAG RMI		3 (3)
ERROR	XX.XX.XX.XX	
ERR.VALID	XX.XX.XX.XX	
ACT.ERR.	XX.XX.XX.XX	

007441

DIAG RMI		3 (3)
ERROR	XX.XX.XX.XX	
ERR.VALID	XX.XX.XX.XX	
ACT.ERR.	XX.XX.XX.XX	

007441

DIAG RMI		3 (3)
ERROR	XX.XX.XX.XX	
ERR.VALID	XX.XX.XX.XX	
ACT.ERR.	XX.XX.XX.XX	

007441

## SIGNAL QUALITY, UNS.DATA



Description: Amount of unsend data in line in transmitter part in the RMI interface.

Circuit diagram: Wiring RMI group 8.2

Connection: -

Function: 11.6.5 RMI (Remote Machine Interface)

Signal value: XXX = 0-100 = Data amount in percent of transmitter buffer, 0-100%.

### 8.4.13.3 RMI, menu 3

#### ERROR



Description: Internal error code for the RMI interface

Circuit diagram: Wiring RMI group 8.2

Connection: -

Function: 11.6.5 RMI (Remote Machine Interface)

Signal value: XX.XX.XX.XX = Error code

#### ERR.VALID



Description: Internal error code for the RMI interface

Circuit diagram: Wiring RMI group 8.2

Connection: -

Function: 11.6.5 RMI (Remote Machine Interface)

Signal value: XX.XX.XX.XX = Error code

#### ACT.ERR



Description: Internal error code for the RMI interface

Circuit diagram: Wiring RMI group 8.2

Connection: -

Function: 11.6.5 RMI (Remote Machine Interface)

Signal value: XX.XX.XX.XX = Error code

## 8.5 Setup

### Settings, general

Settings are integral functions to adapt the functions to the unique individual machine. The settings are made via menus in the display. Settings are divided into initiation and calibration.

#### Initiation

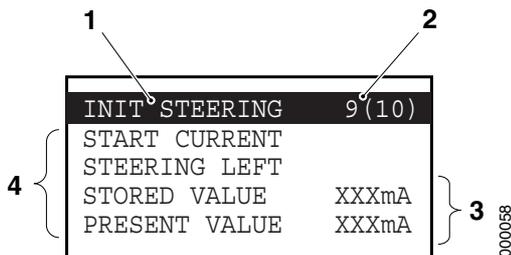
Initiation is performed before the machine is used in work and it involves setting start and stop currents for the steering and hydraulic functions. This is done to compensate for mechanical and electrical tolerances (variations between different machines).

#### Calibration

Calibration is performed before the machine is used in work, before replacement of control units and in some cases with service or replacing components. Calibration is performed so that certain functions work correctly and display the correct values.

### 8.5.1 Initiation

#### Initiation, description



Example of initiation menu, start current for lift function.

1. Menu group
2. Menu number (in brackets, total number of menus)
3. Values
4. Current variable

## DANGER

**The settings influence the functions. Adjustments may impair the function. If uncertain, contact Kalmar Industries Service.**

### NOTE

*Initiation does not need to be performed in one process but each step can be performed separately, independently of other steps.*

In order that hydraulic functions shall work satisfactorily and safely, certain values must be set to operate the machine, this is known as initiation.

Initiation is made up of several menus grouped by function. Each individual menu sets a specific variable. The menus have similar structures and use common terminology, which is described here:

#### PRESENT

Displays the stored value when the menu is opened. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Go back with the R-key.

#### STORED

States the stored value for the current variable.

### START CURRENT

Specifies the start current to the solenoid valve for the selected function. The start current is the lowest current that can be actuated. In practice, this controls how slowly a function can be operated. On functions with analogue control activation (variable), e.g. lift, this is the current that is triggered when the lever leaves the zero position. On certain functions with digital activation (off/on) which are soft-started, this is the current which is triggered immediately the function is activated.

### END CURRENT

Specifies the max. current to the solenoid valve for the selected function. The max. current is the highest current that can be triggered. In practice, it controls how quickly a function can be operated. On functions with analogue control activation (controllable), e.g. lift, this is the current when the lever is in the end position. On certain functions with digital activation (off/on) which are soft-started, this is the current which is triggered after the ramp time when the function is activated. The interval between START CURRENT and END CURRENT is the active range for controlling the solenoid valve.

### PROC DAMPING

Specifies how much the control current shall be reduced during damping. The interval is specified as 0-100% of the active range between START CURRENT and END CURRENT.

#### Overview, initiations

Function	Menu
1 Engine, speed limitation (limitation of engine speed  )	INIT DRIVE-TRAIN, menu 9 page 174
1 Engine, automatic shut-down on idling 	INIT DRIVE-TRAIN, menu 11 page 175
2 Transmission, starting gear	INIT DRIVE-TRAIN, menu 1 page 172
2 Transmission, speed limit shifting forward - reverse	INIT DRIVE-TRAIN, menu 2 page 172
2 Transmission, engine speed limit shifting forward - reverse	INIT DRIVE-TRAIN, menu 3 page 172
2 Transmission, engine speed limit shifting neutral - gear	INIT DRIVE-TRAIN, menu 4 page 173
2 Transmission, engine speed limit kickdown to 1st	INIT DRIVE-TRAIN, menu 5 page 173
2 Transmission, speed limit declutch	INIT DRIVE-TRAIN, menu 6 page 174
2 Transmission, speed limitation (gear lock-out) 	INIT DRIVE-TRAIN, menu 10 page 174
2 Transmission, automatic engine speed reduction for shift forward - reverse 	INIT DRIVE-TRAIN, menu 12 page 175
5.2 Power-assisted steering system (product option joystick control or mini-wheel), lever response	INIT STEERING, menu 1 page 167

<b>Function</b>	<b>Menu</b>
5.2 Power-assisted steering system (product option joystick control or mini-wheel), speed dependent	<i>INIT STEERING, menu 2 page 168</i> <i>INIT STEERING, menu 3 page 168</i> <i>INIT STEERING, menu 4 page 169</i> <i>INIT STEERING, menu 5 page 169</i> <i>INIT STEERING, menu 6 page 170</i>
5.2 Power-assisted steering system (product option joystick control or mini-wheel), steering angle right	<i>INIT STEERING, menu 7 page 170</i> <i>INIT STEERING, menu 8 page 170</i>
5.2 Power-assisted steering system (product option joystick control or mini-wheel), steering angle left	<i>INIT STEERING, menu 9 page 171</i> <i>INIT STEERING, menu 10 page 171</i>
7.2 Lift and lower, boom up	<i>INIT BOOM, menu 1 page 154</i> <i>INIT BOOM, menu 2 page 154</i>
7.2 Lift and lower, boom down Note: The current value is for unladen machines. When loaded, the current value is controlled by the limited lowering speed.	<i>INIT BOOM, menu 3 page 155</i> <i>INIT BOOM, menu 4 page 155</i>
7.2 Lift and lower, lift speed during operation	<i>INIT BOOM, menu 9 page 157</i>
7.2 Lift and lower, damping with container (top lift)	<i>INIT ATTACH, menu 15 page 163</i>
7.2 Lift and lower, damping with container (bottom lift)	<i>INIT ATTACH, menu 16 page 163</i>
7.3 Extension, boom out	<i>INIT BOOM, menu 5 page 155</i> <i>INIT BOOM, menu 6 page 156</i>
7.3 Extension, boom in Note: The current value is for unladen machines. When loaded, the current value is controlled by the limited lowering speed.	<i>INIT BOOM, menu 7 page 156</i> <i>INIT BOOM, menu 8 page 156</i>
7.5 Spreading, out	<i>INIT ATTACH, menu 9 page 161</i> <i>INIT ATTACH, menu 10 page 161</i> <i>INIT ATTACH, menu 11 page 161</i>
7.5 Spreading, in	<i>INIT ATTACH, menu 12 page 162</i> <i>INIT ATTACH, menu 13 page 162</i> <i>INIT ATTACH, menu 14 page 163</i>
7.6 Rotation, clockwise	<i>INIT ATTACH, menu 1 page 158</i> <i>INIT ATTACH, menu 2 page 158</i>
7.6 Rotation, anticlockwise	<i>INIT ATTACH, menu 3 page 159</i> <i>INIT ATTACH, menu 4 page 159</i>
7.7 Tilt	<i>INIT ATTACH, menu 5 page 159</i> <i>INIT ATTACH, menu 6 page 160</i>
7.8 Levelling	<i>INIT ATTACH, menu 7 page 160</i> <i>INIT ATTACH, menu 8 page 160</i>
8.2.3 Load-centre limitation	<i>INIT BOOM, menu 10 page 157</i>

Function	Menu
8.2.4 Height limitation	<i>INIT BOOM, menu 11 page 157</i>
9.10.4 Sliding cab, forward	<i>INIT SLID-CAB, menu 1 page 164</i>
9.10.5 Cab lift and lower, up	<i>INIT SLID-CAB, menu 2 page 165</i> <i>INIT SLID-CAB, menu 3 page 165</i>
9.10.4 Sliding cab, backward	<i>INIT SLID-CAB, menu 4 page 165</i>
9.10.5 Cab lift and lower, down	<i>INIT SLID-CAB, menu 5 page 166</i> <i>INIT SLID-CAB, menu 6 page 166</i>

### Initiate hydraulic function, work instructions

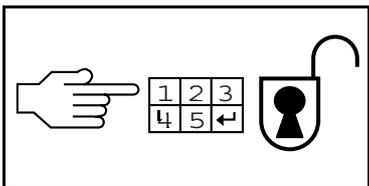
To select a hydraulic function to initiate, proceed as follows:

Initiation is performed in the same way for all hydraulic functions.

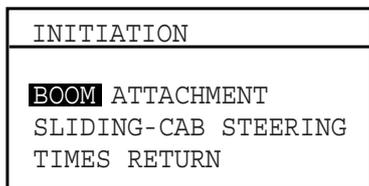
- 1 Navigate to service menu.
- 2 Press Enter.



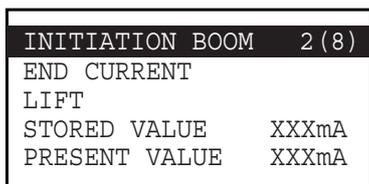
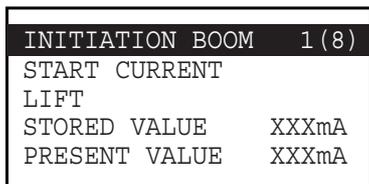
000056



000060



000057



000061

- 3 State code for initiation.

Code is obtained from Kalmar Industries Support.

### NOTE

*The code determines which service menu is activated (Diagnostic test, Initiation or Calibration).*

- 4 Select group by scrolling with the arrow keys (1 and 2) and confirm with Enter.

Each initiation comprises a sequence of several menus. The first menu for the selected initiation appears on the display. Select the desired menu with the arrow keys (1 and 2).

- 5 Change the current value with the plus and minus keys.

### NOTE

*The current values can only be adjusted within certain selected limits.*

- 6 Use the function key for Enter to store required setting of current value, "STORED".

INITIATION	
<b>BOOM</b>	ATTACHMENT
	SLIDING-CAB STEERING
	DRIVE-TRAIN

000651

INIT BOOM 1 (11)	
START CURRENT	
LIFT	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005042

INIT BOOM 2 (11)	
END CURRENT	
LIFT	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005043

## 8.5.1.1 BOOM

### INIT BOOM

This function menu group handles initiation of the boom functions lift, lower and extension.



## DANGER

**The settings affect the functions lift, lower and extension. Adjustments can impair the function. Contact Kalmar Industries Service in the event of uncertainty.**

### NOTE

*Initiation does not need to be performed in one process but each step can be performed separately, independently of other steps.*

#### INIT BOOM, menu 1

##### START CURRENT, LIFT

Description: Start current for activation of solenoid valve lift (Y6005).

PRESENT VALUE: indicates current value for start current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for start current.

Function: 7.2.5 Control valve lift, lower and extension

Component: Solenoid valve lift (Y6005)

Signal value: XXXmA = 0 - 999 mA

#### INIT BOOM, menu 2

##### END CURRENT, LIFT

Description: Control current at full lever angle for activation of solenoid valve lift (Y6005).

PRESENT VALUE: indicates current value for maximum current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for maximum current.

Function: 7.2.5 Control valve lift, lower and extension

Component: Solenoid valve lift (Y6005)

Signal value: XXXmA = 0 - 999 mA

<b>INIT BOOM</b>	<b>3 (11)</b>
START CURRENT LOWER	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005044

<b>INIT BOOM</b>	<b>4 (11)</b>
END CURRENT LOWER	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005045

<b>INIT BOOM</b>	<b>5 (11)</b>
START CURRENT BOOM OUT	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005046

**INIT BOOM, menu 3****START CURRENT, LOWER**

Description: Start current for activation of solenoid valve lower (Y6004).

PRESENT VALUE: indicates current value for start current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE indicates stored value for start current.

Function: 7.2.5 Control valve lift, lower and extension

Component: Solenoid valve lower (Y6004)

Signal value: XXXmA = 0 - 999 mA

**INIT BOOM, menu 4****END CURRENT, LOWER**

Description: Control current at full lever angle for activation of solenoid valve lower (Y6004).

PRESENT VALUE: indicates current value for maximum current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for maximum current.

Function: 7.2.5 Control valve lift, lower and extension

Component: Solenoid valve lower (Y6004)

Signal value: XXXmA = 0 - 999 mA

**INIT BOOM, menu 5****START CURRENT, BOOM OUT**

Description: Start current for activation of solenoid valve boom out (Y6006).

PRESENT VALUE: indicates current value for start current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for start current.

Function: 7.2.5 Control valve lift, lower and extension

Component: Solenoid valve boom out (Y6006)

Signal value: XXXmA = 0 - 999 mA

<b>INIT BOOM</b>	<b>6 (11)</b>
END CURRENT	
BOOM OUT	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005047

<b>INIT BOOM</b>	<b>7 (11)</b>
START CURRENT	
BOOM IN	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005048

<b>INIT BOOM</b>	<b>8 (11)</b>
END CURRENT	
BOOM IN	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005049

**INIT BOOM, menu 6****END CURRENT, BOOM OUT**

Description: Control current at full lever angle for activation of solenoid valve boom out (Y6006).

PRESENT VALUE: indicates current value for maximum current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for maximum current.

Function: 7.2.5 Control valve lift, lower and extension

Component: Solenoid valve boom out (Y6006)

Signal value: XXXmA = 0 - 999 mA

**INIT BOOM, menu 7****START CURRENT, BOOM IN**

Description: Start current for activation of solenoid valve boom in (Y6007).

PRESENT VALUE: indicates current value for start current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for start current.

Function: 7.2.5 Control valve lift, lower and extension

Component: Solenoid valve boom in (Y6007)

Signal value: XXXmA = 0 - 999 mA

**INIT BOOM, menu 8****END CURRENT, BOOM IN**

Description: Control current at full lever angle for activation of solenoid valve boom in (Y6007).

PRESENT VALUE: indicates current value for maximum current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE indicates stored value for maximum current.

Function: 7.2.5 Control valve lift, lower and extension

Component: Solenoid valve boom in (Y6007)

Signal value: XXXmA = 0 - 999 mA

INIT BOOM	9 (11)
OUTPUT LIFT AT F/R (PROC)	
STORED VALUE	XXX
PRESENT VALUE	XXX

004930

INIT BOOM	10 (11)
OPTION LC-LIMIT	
STORED VALUE	XX.XX
PRESENT VALUE	XX.XX

004931

INIT BOOM	11 (11)
OPTION HEIGHT-LIMIT	
STORED VALUE	XX.XX
PRESENT VALUE	XX.XX

004932

**INIT BOOM, menu 9****OUTPUT LIFT AT F/R**

Description: Lift speed with engaged gear, in percent of max. lift speed.

PRESENT VALUE: Indicates the current value for lift speed. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE indicates stored value for lift speed.

Function: 7.2 Lift and lower

Component: -

Signal value: XXX = lift speed in percent of max. value.

**INIT BOOM, menu 10****OPTION LC-LIMIT**

Description: Limit value for load-centre limitation in metres. Distance from drive axle's centre.

**NOTE**

*On machines with cab lift and lower, a load-centre less than the cab's most forward point cannot be selected.*

PRESENT VALUE: Indicates the current value for load-centre. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE indicates stored value load-centre.

Function: 8.2.3 Load-centre limitation

Component: -

Signal value: XX.XX = load-centre limitation in metres.

**INIT BOOM, menu 11****OPTION HEIGHT-LIMIT**

Description: Limit value for height limitation in metres. Distance to boom's highest point.

PRESENT VALUE: Indicates the current value for height limitation. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE indicates stored value for height limitation.

Function: 8.2.4 Height limitation

Component: -

Signal value: XX.XX = height limitation in metres.

INITIATION	
BOOM	<b>ATTACHMEN</b>
SLIDING-CAB	STEERING
DRIVE-TRAIN	

001157

INIT ATTACH		1 (14)
START CURRENT		
ROTATION CW		
STORED VALUE	XXXmA	
PRESENT VALUE	XXXmA	

005091

INIT ATTACH		2 (14)
END CURRENT		
ROTATION CW		
STORED VALUE	XXXmA	
PRESENT VALUE	XXXmA	

005092

## 8.5.1.2 ATTACHMENT

### INIT ATTACH

This function handles initiation of the attachment functions rotation, controllable tilt and controllable levelling.



## DANGER

**The settings affect the functions rotation, controllable tilt and controllable levelling. Adjustments can impair the function. Contact Kalmar Industries Service in the event of uncertainty.**

### NOTE

*Initiation does not need to be performed in one process but each step can be performed separately, independently of other steps.*

### INIT ATTACH, menu 1

#### START CURRENT, ROTATION CW

Description: Start current for activation of solenoid valve rotation clockwise (Y6008).

PRESENT VALUE: indicates current value for start current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for start current.

Function: 7.6.3 Control valve attachment

Component: Solenoid valve rotation clockwise (Y6008)

Signal value: XXXmA = 0 - 999 mA

### INIT ATTACH, menu 2

#### END CURRENT, ROTATION CW

Description: Control current at full lever angle for activation of solenoid valve rotation anticlockwise (Y6009).

PRESENT VALUE: indicates current value for maximum current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for maximum current.

Function: 7.6.3 Control valve attachment

Component: Solenoid valve anticlockwise (Y6009)

Signal value: XXXmA = 0 - 999 mA

<b>INIT ATTACH</b>	<b>3 (14)</b>
START CURRENT	
ROTATION CCW	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005093

<b>INIT ATTACH</b>	<b>4 (14)</b>
END CURRENT	
ROTATION CCW	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005094

<b>INIT ATTACH</b>	<b>5 (14)</b>
START CURRENT	
TILT	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005095

**INIT ATTACH, menu 3****START CURRENT, ROTATION CCW**

Description: Start current for activation of solenoid valve rotation anti-clockwise (Y6009).

PRESENT VALUE: indicates current value for start current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for start current.

Function: 7.6.3 Control valve attachment

Component: Solenoid valve rotation anticlockwise (Y6009)

Signal value: XXXmA = 0 - 999 mA

**INIT ATTACH, menu 4****END CURRENT, ROTATION CCW**

Description: Control current at full lever angle for activation of solenoid valve rotation anticlockwise (Y6009).

PRESENT VALUE: indicates current value for maximum current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for maximum current.

Function: 7.6.3 Control valve attachment

Component: Solenoid valve anticlockwise (Y6009)

Signal value: XXXmA = 0 - 999 mA

**INIT ATTACH, menu 5****START CURRENT, TILT**

Description: Start current for activation of solenoid valve rotation tilt in (Y6010) and solenoid valve tilt out (Y6011).

PRESENT VALUE: indicates current value for start current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for start current.

Function: 7.7.5 Control valve attachment

Component: Solenoid valve rotation tilt in (Y6010), solenoid valve tilt out (Y6011).

Signal value: XXXmA = 0 - 999 mA

<b>INIT ATTACH</b>	<b>6 (14)</b>
END CURRENT	
TILT	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005096

<b>INIT ATTACH</b>	<b>7 (14)</b>
START CURRENT	
LEVELLING	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005097

<b>INIT ATTACH</b>	<b>8 (14)</b>
END CURRENT	
LEVELLING	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005098

**INIT ATTACH, menu 6****END CURRENT, TILT**

Description: Control current at full lever angle for activation of solenoid valve rotation tilt in (Y6010), solenoid valve tilt out (Y6011).

PRESENT VALUE: indicates current value for maximum current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for maximum current.

Function: 7.7.5 Control valve attachment

Component: Solenoid valve rotation tilt in (Y6010), solenoid valve tilt out (Y6011).

Signal value: XXXmA = 0 - 999 mA

**INIT ATTACH, menu 7****START CURRENT, LEVELLING**

Description: Start current for activation of solenoid valve levelling right (Y6035) and solenoid valve levelling left (Y6036).

PRESENT VALUE: indicates current value for start current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for start current.

Function: 7.8.3 Control valve attachment

Component: Solenoid valve levelling right (Y6035), solenoid levelling left (Y6036)

Signal value: XXXmA = 0 - 999 mA

**INIT ATTACH, menu 8****END CURRENT, LEVELLING**

Description: Control current at full lever angle for activation of solenoid valve levelling right (Y6035) and solenoid valve levelling left (Y6036).

PRESENT VALUE: indicates current value for maximum current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for maximum current.

Function: 7.8.3 Control valve attachment

Component: Solenoid valve levelling right (Y6035), solenoid levelling left (Y6036)

Signal value: XXXmA = 0 - 999 mA

<b>INIT ATTACH</b>	<b>9 (14)</b>
START CURRENT	
SPREADER OUT 20' -40'	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

0060300

<b>INIT ATTACH</b>	<b>10 (14)</b>
END CURRENT	
SPREADER OUT 20' -40'	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

0051000

<b>INIT ATTACH</b>	<b>11 (14)</b>
DAMP CURRENT	
SPREADER OUT 20' -40'	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

1015100

**INIT ATTACH, menu 9****START CURRENT, SPREADER OUT 20'-40'**

Description: Start current for the activation of the solenoid valve for spreading out (Y6018).

PRESENT VALUE: Indicates the current value for max. current. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE indicates stored value for max. current.

Function: 7.5.3 Control valve attachment

Component: Solenoid valve spreading out (6018)

Signal value: XXXmA = 0 - 999 mA.

**INIT ATTACH, menu 10****END CURRENT, SPREADER OUT 20'-40'**

Description: Control current on full lever actuation for the activation of the solenoid valve for spreading out (Y6018).

PRESENT VALUE: Indicates the current value for max. current. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE indicates stored value for max. current.

Function: 7.5.3 Control valve attachment

Component: Solenoid valve spreading out (Y6018)

Signal value: XXXmA = 0 - 999 mA

**INIT ATTACH, menu 11****DAMP CURRENT, SPREADING, OUT 20'-40'**

Description: Control current to solenoid valve spreading out (Y6018) for damping.

PRESENT VALUE: Indicates the current value for max. current. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE indicates stored value for max. current.

Function: 7.8.3 Control valve attachment

Component: Solenoid valve spreading out (Y6018)

Signal value: XXXmA = 0 - 999 mA

<b>INIT ATTACH</b>	<b>12 (14)</b>
START CURRENT	
SPREADER IN 40' -20'	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005102

<b>INIT ATTACH</b>	<b>13 (14)</b>
END CURRENT	
SPREADER IN 40' -20'	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005103

**INIT ATTACH, menu 12****START CURRENT, SPREADER IN 40'-20'**

Description: Start current for the activation of the solenoid valve for spreading in (Y6019).

PRESENT VALUE: Indicates the current value for max. current. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE indicates stored value for max. current.

Function: 7.5.3 Control valve attachment

Component: Solenoid valve spreading in (6019)

Signal value: XXXmA = 0 - 999 mA.

**INIT ATTACH, menu 13****END CURRENT, SPREADER IN 40'-20'**

Description: Control current on full lever actuation for the activation of the solenoid valve for spreading in (Y6019).

PRESENT VALUE: Indicates the current value for max. current. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE indicates stored value for max. current.

Function: 7.5.3 Control valve attachment

Component: Solenoid valve spreading in (Y6019).

Signal value: XXXmA = 0 - 999 mA

<b>INIT ATTACH</b>	<b>14 (14)</b>
DAMP CURRENT	
SPREADER IN 40' -20'	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005104

<b>INIT ATTACH</b>	<b>15 (X)</b>
OPT DAMP BOOM DOWN	
TOP LIFT (cm)	
STORED VALUE	XXXX
PRESENT VALUE	XXXX

006756

<b>INIT ATTACH</b>	<b>16 (X)</b>
OPT DAMP BOOM DOWN	
BOTTOM LIFT (cm)	
STORED VALUE	XXXX
PRESENT VALUE	XXXX

006842

**INIT ATTACH, menu 14****DAMP CURRENT, SPREADING, IN 40'-20'**

Description: Control current to solenoid valve spreading in (Y6019) for damping.

PRESENT VALUE: Indicates the current value for max. current. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE indicates stored value for max. current.

Function: 7.8.3 Control valve attachment

Component: Solenoid valve spreading in (Y6019).

Signal value: XXXmA = 0 - 999 mA

**INIT ATTACH, menu 15****OPT DAMP BOOM DOWN, TOP LIFT (cm)**

Description: Distance setting for activation of damping of lowering speed for top lift, distance between attachment and trailer.

PRESENT VALUE: Indicates the current value for distance. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE indicates stored value for distance.

Function:

Component:

Signal value: XXXX = distance in cm.

**INIT ATTACH, menu 16****OPT DAMP DOWN, BOTTOM LIFT (cm)**

Description: Distance setting for activation of damping of lowering speed for bottom lift, distance between attachment and trailer.

PRESENT VALUE: Indicates the current value for distance. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE indicates stored value for distance.

Function:

Component:

Signal value: XXXX = distance in cm

INITIATION	
BOOM ATTACHMENT	
<b>SLIDING-CAB</b>	STEERING
DRIVE-TRAIN	

001645

### 8.5.1.3 SLIDING-CAB

#### INIT SLIDING-CAB

This function handles initiation of hydraulic sliding cab or hydraulic cab lift.

Sliding cab is smooth started by means of the control current to the solenoid valves being increased from a low start value to a maximum level. When the cab reaches an end position the speed is dampened by means of the control current being reduced.

## DANGER

**The settings affect the functions rotation, controllable tilt and controllable levelling. Adjustments can impair the function. Contact Kalmar Industries Service in the event of uncertainty.**

### NOTE

*Initiation does not need to be performed in one process but each step can be performed separately, independently of other steps.*

#### INIT SLID-CAB, menu 1

##### START CURRENT, FORWARD

Description: Start current to solenoid valve sliding cab forward (Y6016) at activation of sliding cab. The control current controls the start speed for sliding cab forward.

PRESENT VALUE: indicates current value for start current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

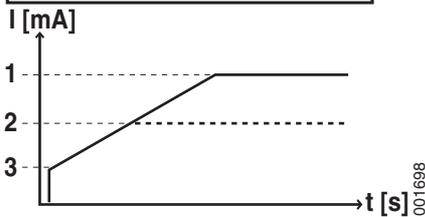
STORED VALUE: indicates stored value for start current.

Function: 9.10.4.3 Control valve option frame

Component: Solenoid valve sliding cab forward (Y6016)

Signal value: XXXmA = 0 - 999 mA

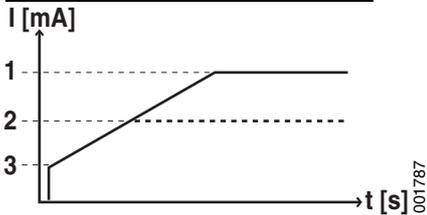
INIT SLID-CAB	1 (6)
START CURRENT FORWARD	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA



001698

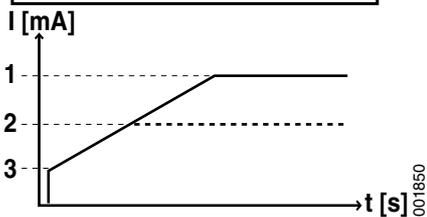
1. Maximum current (END CURRENT)
2. Damping (PROC DAMPING)
3. Start current (START CURRENT)

<b>INIT SLID-CAB 2 (6)</b>	
END CURRENT	
FORWARD	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA



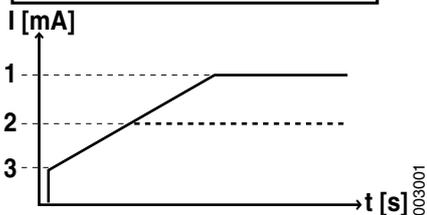
1. Maximum current (END CURRENT)
2. Damping (PROC DAMPING)
3. Start current (START CURRENT)

<b>INIT SLID-CAB 3 (6)</b>	
PROC DAMPING	
FORWARD	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA



1. Maximum current (END CURRENT)
2. Damping (PROC DAMPING)
3. Start current (START CURRENT)

<b>INIT SLID-CAB 4 (6)</b>	
START CURRENT	
REVERSE	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA



1. Maximum current (END CURRENT)
2. Damping (PROC DAMPING)
3. Start current (START CURRENT)

**INIT SLID-CAB, menu 2**

**END CURRENT, FORWARD**

Description: Start current to solenoid valve sliding cab forward (Y6016) after full ramp time at activation of switch for sliding cab. This current controls sliding cab maximum speed forward.

PRESENT VALUE: indicates current value for maximum current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for maximum current.

Function: 9.10.4.3. Control valve option frame

Component: Solenoid valve sliding cab forward (Y6016)

Signal value: XXXmA = 0 - 999 mA

**INIT SLID-CAB, menu 3**

**PROC DAMPING, FORWARD**

Description: Percentage damping of control current to solenoid valve sliding cab forward (Y6016) when the cab reaches end position forward.

PRESENT VALUE: indicates current value for damping. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for start current.

Function: 9.10.4.3 Control valve option frame

Component: Solenoid valve sliding cab forward (Y6016)

Signal value: XXX = 0 - 100%. 100% means no damping i.e. maximum current. 0% means full damping i.e. start current

**INIT SLID-CAB, menu 4**

**START CURRENT, REVERSE**

Description: Start current to solenoid valve sliding cab backward (Y6017) at activation of sliding cab. The control current controls the start speed for sliding cab backward.

PRESENT VALUE: indicates current value for start current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

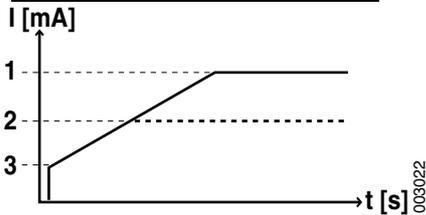
STORED VALUE: indicates stored value for start current.

Function: 9.10.4.3 Control valve option frame

Component: Solenoid valve sliding cab backward (Y6017)

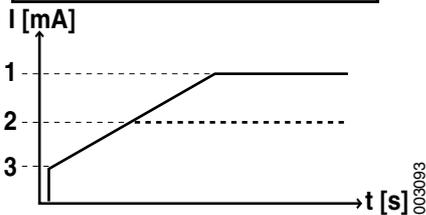
Signal value: XXXmA = 0 - 999 mA

INIT SLID-CAB	5 (6)
END CURRENT	
REVERSE	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA



1. Maximum current (END CURRENT)
2. Damping (PROC DAMPING)
3. Start current (START CURRENT)

INIT SLID-CAB	6 (6)
PROC DAMPING	
REVERSE	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA



1. Maximum current (END CURRENT)
2. Damping (PROC DAMPING)
3. Start current (START CURRENT)

### INIT SLID-CAB, menu 5

#### END CURRENT, REVERSE

Description: Start current to solenoid valve sliding cab backward (Y6017) after full ramp time at activation of switch for sliding cab. This current controls sliding cab maximum speed backward.

PRESENT VALUE: indicates current value for maximum current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for maximum current.

Function: 9.10.4.3. Control valve option frame

Component: Solenoid valve sliding cab forward (Y6017)

Signal value: XXXmA = 0 - 999 mA

### INIT SLID-CAB, menu 6

#### PROC DAMPING, REVERSE

Description: Percentage damping of control current to solenoid valve sliding cab backward (Y6017) when the cab reaches end position backward.

PRESENT VALUE: indicates current value for damping. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for start current.

Function: 9.10.4.3 Control valve option frame

Component: Solenoid valve sliding cab backward (Y6017)

Signal value: XXX = 0 - 100%. 100% means no damping i.e. maximum current. 0% means full damping i.e. start current

INITIATION	
BOOM ATTACHMENT	
SLIDING-CAB	<b>STEERING</b>
DRIVE-TRAIN	

002954

### 8.5.1.4 STEERING

#### INIT STEERING

This function handles initiation of joystick control or mini-wheel.


DANGER

**The settings affect the function of joystick control or mini-wheel. Adjustments can impair the function. Contact Kalmar Industries Service in the event of uncertainty.**

#### NOTE

*Initiation does not need to be performed in one process but each step can be performed separately, independently of other steps.*

#### INIT STEERING, menu 1

##### CHARACTER OF THE STEERING LEVER

Description: Indicates the responsiveness of the lever steering in accordance with 32 predefined curves (0-31) 0 means that linear wheel angle is equal in relation to lever angle during the whole lever movement. 31 means that the wheel angle is small at the beginning of the lever movement and large at the end.

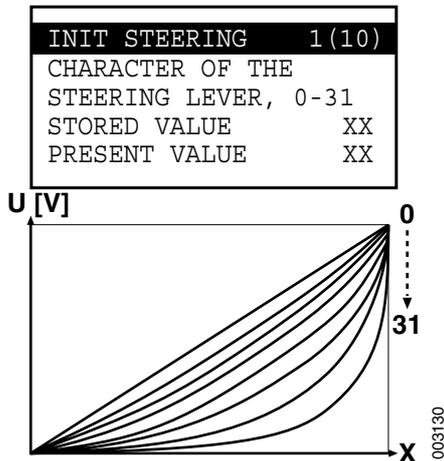
PRESENT VALUE: indicates current curve. Change curve with the plus or minus keys. Save the set curve with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates saved curve.

Function: 5.2 Power-assisted steering system (product option joystick control or mini-wheel)

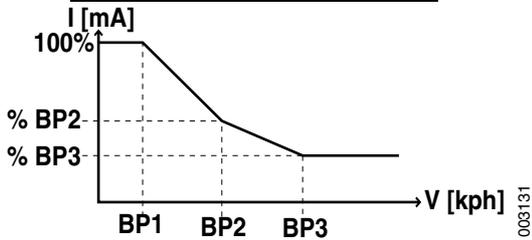
Component: -

Signal value: XX = 0-31.



Y = Output signal to solenoid valve  
X = Lever movement

<b>INIT STEERING 2 (10)</b>	
BRAKE POINT BP1 (kph)	
STORED VALUE	XX.X
PRESENT VALUE	XX.X



003131

- I [mA] = control current to solenoid valve
- V [kph] = machine's speed in km/h
- BP1 = speed setting for break point 1
- BP2 = speed setting for break point 2
- BP3 = speed setting for break point 3
- %BP2 = per cent of control current to solenoid valve at BP2
- %BP2 = per cent of control current to solenoid valve at BP2

**INIT STEERING, menu 2**

**BREAK POINT BP1**

Description: Speed for break point 1. The break points are used to adapt the steering angle in accordance with the machine's speed. This means that both responsive steering at low speeds and stable steering at higher speeds can be obtained.

PRESENT VALUE: indicates current speed setting for break point 1. Change the speed with the plus or minus keys. Save the set speed with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

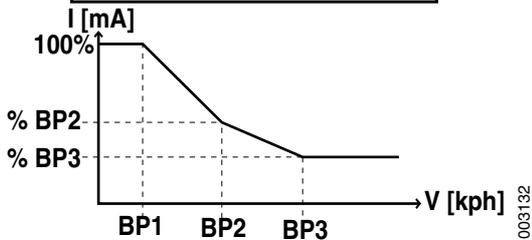
STORED VALUE: indicates saved speed for break point 1.

Function: 5.2 Power-assisted steering system (product option joystick control or mini-wheel)

Component: -

Signal value: XX.X = speed for BP1 in km/h.

<b>INIT STEERING 3 (10)</b>	
BRAKE POINT BP2 (kph)	
STORED VALUE	XX.X
PRESENT VALUE	XX.X



003132

- I [mA] = control current to solenoid valve
- V [kph] = machine's speed in km/h
- BP1 = speed setting for break point 1
- BP2 = speed setting for break point 2
- BP3 = speed setting for break point 3
- %BP2 = per cent of control current to solenoid valve at BP2
- %BP2 = per cent of control current to solenoid valve at BP2

**INIT STEERING, menu 3**

**BREAK POINT BP2**

Description: Speed for break point 2. The break points are used to adapt the steering angle in accordance with the machine's speed. This means that both responsive steering at low speeds and stable steering at higher speeds can be obtained.

PRESENT VALUE: indicates current speed setting for break point 2. Change the speed with the plus or minus keys. Save the set speed with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

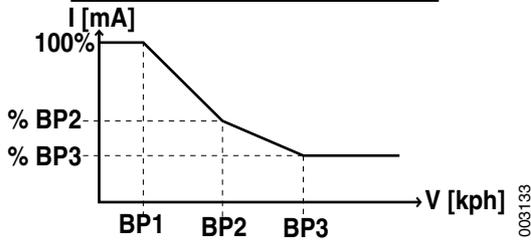
STORED VALUE: indicates saved speed for break point 2.

Function: 5.2 Power-assisted steering system (product option joystick control or mini-wheel)

Component: -

Signal value: XX.X = speed for BP2 in km/h.

<b>INIT STEERING</b>	<b>4 (10)</b>
BRAKE POINT BP3 (kph)	
STORED VALUE	XX.X
PRESENT VALUE	XX.X



I [mA] = control current to solenoid valve  
 V [kph] = machine's speed in km/h  
 BP1 = speed setting for break point 1  
 BP2 = speed setting for break point 2  
 BP3 = speed setting for break point 3  
 %BP2 = per cent of control current to solenoid valve at BP2  
 %BP2 = per cent of control current to solenoid valve at BP2

**INIT STEERING, menu 4**

**BREAK POINT BP3**

Description: Speed for break point 3. The break points are used to adapt the steering angle in accordance with the machine's speed. This means that both responsive steering at low speeds and stable steering at higher speeds can be obtained.

PRESENT VALUE: indicates current speed setting for break point 1. Change the speed with the plus or minus keys. Save the set speed with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

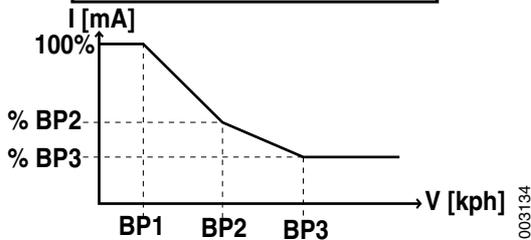
STORED VALUE: indicates saved speed for break point 3.

Function: 5.2 Power-assisted steering system (product option joystick control or mini-wheel)

Component: -

Signal value: XX.X = speed for BP3 in km/h.

<b>INIT STEERING</b>	<b>5 (10)</b>
PROC REDUCTION AT BP2	
STORED VALUE	XXX
PRESENT VALUE	XXX



I [mA] = control current to solenoid valve  
 V [kph] = machine's speed in km/h  
 BP1 = speed setting for break point 1  
 BP2 = speed setting for break point 2  
 BP3 = speed setting for break point 3  
 %BP2 = per cent of control current to solenoid valve at BP2  
 %BP2 = per cent of control current to solenoid valve at BP2

**INIT STEERING, menu 5**

**PROC REDUCTION, AT PB2**

Description: Percentage reduction of control current to solenoid valve steering right (Y636R) and solenoid valve steering left (Y636L) at BP2.

PRESENT VALUE: indicates current value reduction. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

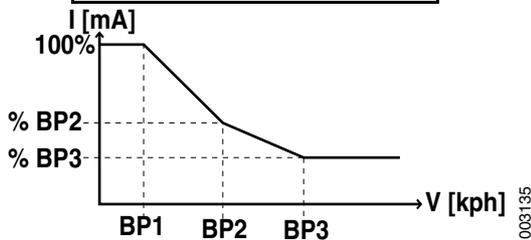
STORED VALUE: indicates stored value reduction.

Function: 5.2 Power-assisted steering system (product option joystick control or mini-wheel)

Component: -

Signal value: XXX = 0 - 100%. 100% means no damping i.e. maximum current. 0% means full damping i.e. start current.

<b>INIT STEERING</b>	<b>6 (10)</b>
PROC REDUCTION	
AT BP3	
STORED VALUE	XXX
PRESENT VALUE	XXX



I [mA] = control current to solenoid valve

V [kph] = machine's speed in km/h

BP1 = speed setting for break point 1

BP2 = speed setting for break point 2

BP3 = speed setting for break point 3

%BP2 = per cent of control current to solenoid valve at BP2

%BP3 = per cent of control current to solenoid valve at BP3

<b>INIT STEERING</b>	<b>7 (10)</b>
START CURRENT	
STEERING RIGHT	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

<b>INIT STEERING</b>	<b>8 (10)</b>
END CURRENT	
STEERING RIGHT	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

### INIT STEERING, menu 6

#### PROC REDUCTION, AT BP3

Description: Percentage reduction of control current to solenoid valve steering right (Y636R) and solenoid valve steering left (Y636L) at BP3.

PRESENT VALUE: indicates current value reduction. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value reduction.

Function: 5.2 Power-assisted steering system (product option joystick control or mini-wheel)

Component: -

Signal value: XXX = 0 - 100%. 100% means no damping i.e. maximum current. 0% means full damping i.e. start current.

### INIT STEERING, menu 7

#### START CURRENT, STEERING RIGHT

Description: Start current to solenoid valve steering right (Y636R).

PRESENT VALUE: indicates current value for start current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for start current.

Function: 5.2.10 Control valve joystick control or mini-wheel

Component: Solenoid valve steering right (Y636R)

Signal value: XXXmA = 0 - 999 mA

### INIT STEERING, menu 8

#### END CURRENT, STEERING RIGHT

Description: Control current to solenoid valve steering right (Y636R) at full lever angle.

PRESENT VALUE: indicates current value for maximum current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for maximum current.

Function: 5.2.10 Control valve joystick control or mini-wheel

Component: Solenoid valve steering right (Y636R)

Signal value: XXXmA = 0 - 999 mA

<b>INIT STEERING</b>	<b>9 (10)</b>
START CURRENT	
STEERING LEFT	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

003138

<b>INIT STEERING</b>	<b>10 (10)</b>
END CURRENT	
STEERING LEFT	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

006704

<b>INITIATION</b>
BOOM ATTACHMENT
SLIDING-CAB STEERING
<b>DRIVE-TRAIN</b>

003140

**INIT STEERING, menu 9****START CURRENT, STEERING LEFT**

Description: Start current to solenoid valve steering right (Y636L).

PRESENT VALUE: indicates current value for start current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for start current.

Function: 5.2.10 Control valve joystick control or mini-wheel

Component: Solenoid valve steering right (Y636L)

Signal value: XXXmA = 0 - 999 mA

**INIT STEERING, menu 10****END CURRENT, STEERING LEFT**

Description: Control current to solenoid valve steering right (Y636L) at full lever angle.

PRESENT VALUE: indicates current value for maximum current. Adjust the value with the plus or minus keys. Store set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates stored value for maximum current.

Function: 5.2.10 Control valve joystick control or mini-wheel

Component: Solenoid valve steering right (Y636L)

Signal value: XXXmA = 0 - 999 mA

**8.5.1.5 DRIVETRAIN****INIT DRIVE-TRAIN**

This function handles initiation of transmission.

**NOTE**

*Initiation does not need to be performed in one process but each step can be performed separately, independently of other steps.*

*The machine must be stationary with applied parking brake to enable access to the menus.*

*After changes have been made, the ignition must be turned off and on for the changes to be saved and start to apply.*

INIT DRIVE-TRN	1 (6)
START IN 2:ND	
0=NO 1=YES	
STORED VALUE	XXX
PRESENT VALUE	XXX

003151

INIT DRIVE-TRN	2 (12)
VEHICLE SPEED F-R	
STORED VALUE	XXX
PRESENT VALUE	XXX

005051

INIT DRIVE-TRN	3 (12)
ENGINE SPEED F-R	
STORED VALUE	XXX
PRESENT VALUE	XXX

005052

### INIT DRIVE-TRAIN, menu 1

#### START IN 2ND

Description: Setting to get transmission to start in 2nd gear instead of in 1st. Kick-down to 1st takes place as needed.

PRESENT VALUE: Indicates the current setting. Change the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE: indicates saved setting.

Function: 2 Transmission

Component: -

Signal value: XXX = 1= yes, XXX = 0 = no

### INIT DRIVE-TRAIN, menu 2

#### VEHICLE SPEED F-R

Description: Setting of highest permitted speed for shifting between forward and reverse.

PRESENT VALUE: indicates current setting. Change the value with the plus or minus keys. Save set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates saved setting.

Function: 2 Transmission

Component: -

Signal value: XXX = speed in km/h

### INIT DRIVE-TRAIN, menu 3

#### ENGINE SPEED F-R

Description: Setting of highest permitted engine speed for shifting between forward and reverse.

### NOTE

*If the rpm is set lower than the engine's idle rpm, shifting will not be allowed.*

PRESENT VALUE: Indicates the current setting. Change the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE: indicates saved setting.

Function: 2 Transmission

Component: -

Signal value: XXX = engine speed (rpm)

INIT DRIVE-TRN 4 (12)		005063
ENGINE SPEED N-DIR		
STORED VALUE	XXX	
PRESENT VALUE	XXX	

**INIT DRIVE-TRAIN, menu 4****ENGINE SPEED N-DIR**

Description: Setting of highest permitted engine speed for shifting from neutral to gear.

**NOTE**

*This setting applies before the setting in INIT DRIVE-TRAIN, menu 3 page 172. If the rpm is set lower in this menu than that in menu 3, then this rpm will also apply for shifting of travel direction. This takes place since the transmission must shift to neutral when travel direction is changed.*

PRESENT VALUE: Indicates the current setting. Change the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE: indicates saved setting.

Function: 2 Transmission

Component: -

Signal value: XXX = engine speed (rpm)

**INIT DRIVE-TRAIN, menu 5****ENGINE SPEED, KICKDOWN 1ST**

Description: Setting of the lowest engine rpm when conditions for kick-down to 1st gear are to be checked.

**NOTE**

*If the rpm is set too low, kick-down may take place before the machine has used the engagement on the selected gear.*

*If the rpm is set too high, kick-down takes place slowly or not at all.*

PRESENT VALUE: Indicates the current setting. Change the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE: indicates saved setting.

Function: 2 Transmission

Component: -

Signal value: XXX = speed (km/h)

INIT DRIVE-TRN 5 (12)		005064
ENGINE SPEED		
KICK DOWN 1:ST		
STORED VALUE	XXX	
PRESENT VALUE	XXX	

INIT DRIVE-TRN	6 (12)
VEHICLE SPEED	
DECLUTCH	
STORED VALUE	XXX
PRESENT VALUE	XXX

006065

**INIT DRIVE-TRAIN, menu 6****VEHICLE SPEED, DECLUTCH**

Description: Setting of highest permitted speed for declutch of the transmission.

PRESENT VALUE: indicates current setting. Change the value with the plus or minus keys. Save set value with the Enter key. Go to the next menu with the arrow keys. Go back from initiation using the R key.

STORED VALUE: indicates saved setting.

Function: 2 Transmission

Component: -

Signal value: XXX = speed (km/h)

**INIT DRIVE-TRAIN, menu 7**

Not used.

**INIT DRIVE-TRAIN, menu 8**

Not used.

**INIT DRIVE-TRAIN, menu 9****OPTION SPEED LIMIT**

Description: Setting of speed limit.

PRESENT VALUE: Indicates the current value. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE: indicates saved setting.

Function: 2 Transmission

Component: -

Signal value: XXX = speed (km/h)

**INIT DRIVE-TRAIN, menu 10****OPTION HIGHEST GEAR AT SPEED LIMIT**

Description: Setting of the highest permitted gear (speed limitation by gear lock-out).

PRESENT VALUE: Indicates the current value. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE: indicates saved setting.

Function: 2 Transmission

Component: -

Signal value: XXX = gear

INIT DRIVE-TRN	9 (12)
OPTION SPEED LIMIT	
(KM/H)	
STORED VALUE	XXX
PRESENT VALUE	XXX

004935

INIT DRIVE-TRN	10 (12)
OPTION HIGHEST GEAR	
AT SPEED LIMIT	
STORED VALUE	XXX
PRESENT VALUE	XXX

966936

INIT DRIVE-TRN	11 (12)
OPTION ENGINE SHUT DOWN AT IDLE (sec)	
STORED VALUE	XXX
PRESENT VALUE	XXX

004937

INIT DRIVE-TRN	12 (12)
F-R WITHOUT ENGINE SPEED REDUCTION	
STORED VALUE	XXX
PRESENT VALUE	XXX

004938

**INIT DRIVE-TRAIN, menu 11****OPTION ENGINE SHUT DOWN**

Description: Setting of idling time before automatic engine shut-down.

PRESENT VALUE: Indicates the current value. Adjust the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE: indicates saved setting.

Function: 1 Engine

Component: -

Signal value: XXX = time in seconds before engine shut-down.

**INIT DRIVE-TRAIN, menu 12****F-R WITHOUT ENGINE SPEED REDUCTION**

Description: Activation or shut-off of automatic rpm deceleration when shifting travel direction forward - reverse. This makes it possible to change travel direction without releasing the gas pedal. The rpm is lowered to the rpm set in menu 3, see *INIT DRIVE-TRAIN, menu 3 page 172*, unless no value has been stated in menu 3, then the rpm is reduced to idle.

PRESENT VALUE: Indicates the current setting. Change the value with the plus and minus keys. Save the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE: indicates saved setting.

Function: 2 Transmission

Component: -

Signal value:

X = 1, activated

X = 0, deactivated

## 8.5.2 Calibration

### Calibration, description

Certain functions require calibration in order to operate correctly, the control and monitoring system has integral calibrations for these functions.

#### SCALE

This menu handles calibration of sensors to weight indication.

There are two variants of weight indicator, fixed or dynamic scale, see section 7 *Load handling*, group 7.10.2 *Weight indicator*. The current option on the machine is programmed and does not need selection, see:

*Weight indicator, calibration (product alternative fixed scale) page 178*



*Weight indicator, calibrating (product alternative dynamic scale) page*

*180*

#### EL-STEERING

This menu handles calibration of lever steering for joystick control, see:

*Joystick control, calibration page 182*

### NOTE

*Calibration does not need to be performed in one process but each step can be performed separately, independently of other steps.*

#### DRIVE-TRAIN

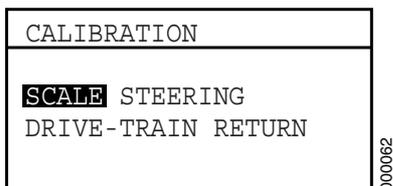
This function handles calibrations for engine and transmission. The menu loop contains two different calibrations which are not connected to each other, see:

*Accelerator pedal, calibration page 183*

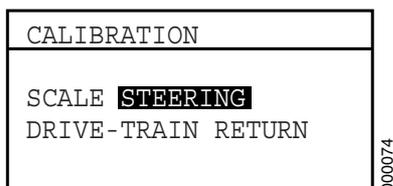
*Tab 2 Transmission, group 2.8 Control system transmission*

### NOTE

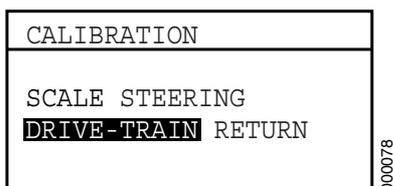
*Calibration does not need to be performed in one process but each step can be performed separately, independently of other steps.*



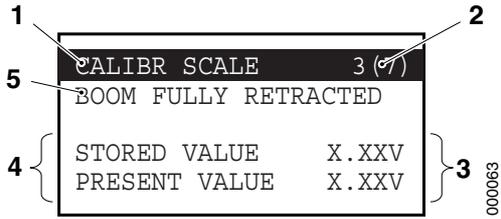
000062



000074



000078



- 1. Menu group
- 2. Sequence number (in brackets, indicates total number of sequences)
- 3. Signal value
- 4. STORED indicates stored value, PRESENT indicates current value of the signal to be calibrated
- 5. Heading of menu figure

**Calibration menu, explanation**

The figure shows an example of a menu, here for calibration of boom extension inner position. The table indicates what a description contains (which follows in the next section):

Designation: Example	Description
Variable (position 4): BOOM FULLY RETRACTED	Name of the affected input signal/control signal.
Description: Setting of sensor boom length (R777) for boom extension in inner position. CALIBR VALUE: Indicates stored signal value from boom length (R777) for boom extension in inner position. PRESENT VALUE: Indicates current signal value from sensor boom length (R777).	A short description of what is calibrated and the meaning of the variables.
Function: 7.3.11 Sensor boom length	Name of current function.
Component: Sensor boom angle (R777)	Indicates the component whose signal is the basis for calibration.

**Calibration, work instructions**

Calibration consists of a number of menus, different numbers depending on function. All menus are similar in construction and therefore the descriptions are similar.

To select a function to calibrate, proceed as follows:

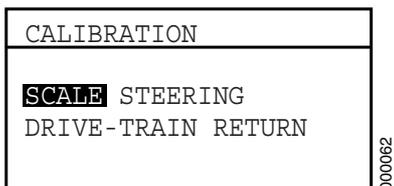
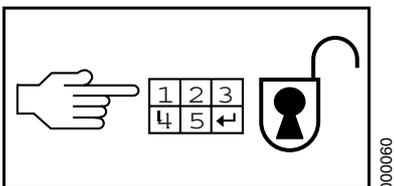
- 1 Navigate to service menu.
- 2 Press Enter.
- 3 State code for calibration.  
Code is obtained from Kalmar Industries Support.

**NOTE**

*The code determines which service menu is activated (Diagnostic test, Initiation or Calibration).*

- 4 Select group by scrolling with the arrow keys (1 and 2) and confirm with Enter.

Each calibration consists of a sequence of a number of menus. The first menu for the selected calibration appears in the display. Select the next menu due with key 1 and 2 (arrow function).



### 8.5.2.1 Calibrate SCALE

#### Weight indicator, calibration (product alternative fixed scale)



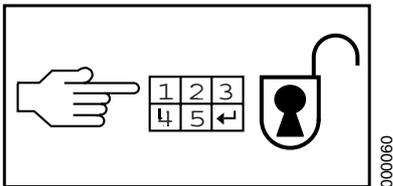
#### NOTE

*It is very important for accuracy that all steps are performed in the given order.*

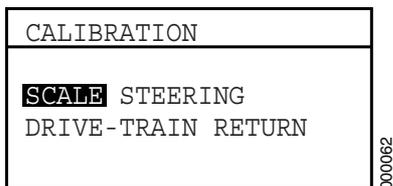
- 1 Park the machine on level ground without load and centre the attachment.
- 2 Navigate to the service menu and press ENTER.



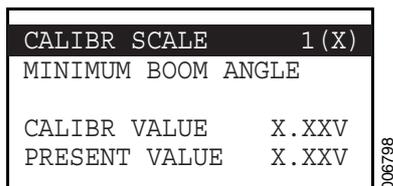
000056



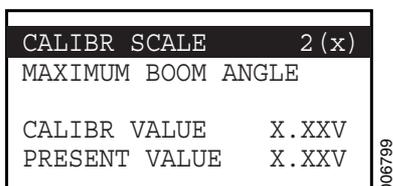
000060



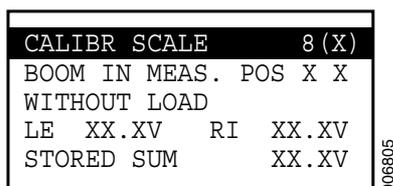
000062



006798



006799



006805

- 3 Enter the code for calibration.

The code is obtained from Kalmar Industries Support.

#### NOTE

*The code decides which service menu is activated (Diagnostic test, Initiation or Calibration).*

- 4 Scroll to SCALE with the arrow keys and press ENTER.

Every calibration consists of a sequence of menus. Scroll between the menus with the arrow keys.

- 5 Lower the boom to the lowest position (0°).

- 6 CALIBR SCALE, menu 1 save the setting with ENTER.

- 7 Lift the boom to its highest angle.

- 8 Scroll to CALIBR SCALE, menu 2 and save the setting with ENTER.

- 9 Scroll to CALIBR SCALE, menu 8.

- 10 Place the boom in measuring position, see tab 7 Load handling, group 7.10.2 Weight indicator.

"BOOM IN MEAS. POS" shall show " '1' '1' ", this indicates that measuring position is reached for " 'Extension' 'Lift' ".

- 11 Wait approx. five seconds to stabilize the pressure.

CALIBR SCALE		9 (X)
BOOM IN MEAS. POS	X X	
WITH LOAD		XX.XT
LE XX.XV	RI	XX.XV
STORED SUM		XX.XV

0089300

CALIBR SCALE		10 (X)
PRESS BUTTON		
LOAD		XX.XT

0089300

- 12 Save the setting with ENTER.

## NOTE

*New values can only be saved when the boom is in measuring position.*

*Negative values indicate switched contacts on the pressure sensors.*

*Great variations between right and left indicate error in the sensors' signals.*

- 13 Scroll to CALIBR SCALE, menu 9.
- 14 Lift a known reference load and place the boom in measuring position.  
"BOOM IN MEAS. POS" shall show " '1' '1' ", this indicates that measuring position is reached for " 'Extension' 'Lift' ".  
15 Wait approx. five seconds to stabilize the pressure.
- 16 Enter the weight of the reference load with + and - keys. Save the setting with ENTER.

## NOTE

*New values can only be saved when the boom is in measuring position.*

### Checking calibration

- 17 Scroll to CALIBR SCALE, menu 10.
- 18 Lift a reference weight and check that the control and monitoring system calculates the correct weight that the machine lifts, LOAD.  
The weight is given in tons, with one decimal.  
If the weight is not right, repeat steps 13-16.
- 19 Operate the machine without load, stop the machine and check that LOAD = 00.0 ± 0.5 ton.

## NOTE

*Check when stationary. (Operation generates dynamic forces.)*

- 20 Back out of the calibration with the R-key.

## Weight indicator, calibrating (product alternative dynamic scale)

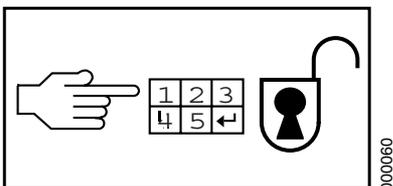
### NOTE

*It is very important for accuracy that all steps are performed in the given order.*

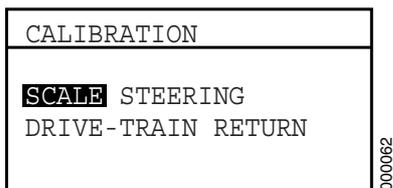
- 1 Park the machine on level ground without load and centre the attachment.
- 2 Navigate to the service menu and press ENTER.



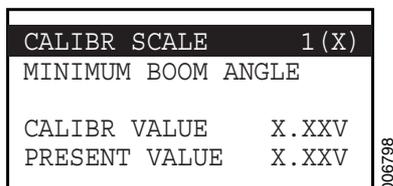
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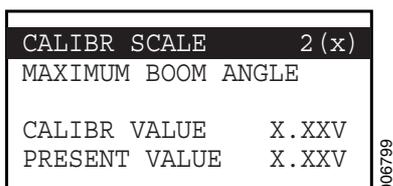
000060



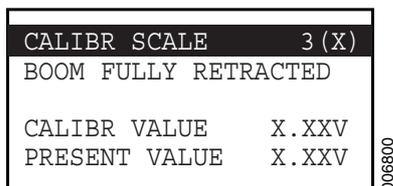
000062



006798



006799



006800

- 3 Enter the code for calibration.  
The code is obtained from Kalmar Industries Support.

### NOTE

*)The code decides which service menu is activated (Diagnostic test, Initiation or Calibration).*

- 4 Scroll to SCALE with the arrow keys and press ENTER.  
Every calibration consists of a sequence of menus. Scroll between the menus with the arrow keys.
- 5 Lower the boom to the lowest position (0°).
- 6 CALIBR SCALE, menu 1 and save the setting with ENTER.
- 7 Lift the boom to its highest angle.
- 8 Scroll to CALIBR SCALE, menu 2 and save the setting with ENTER.
- 9 Retract the boom completely.
- 10 Scroll to CALIBR SCALE, menu 3 and save the setting with ENTER.

CALIBR SCALE		4 (X)
BOOM FULLY EXTENDED		
CALIBR VALUE	X.XXV	
PRESENT VALUE	X.XXV	

006801

CALIBR SCALE		5 (X)
LOAD SENSOR BOOM		
RETRACTED	LE	RI
CALIBR	XXXX	XXXX
PRESENT	XXXX	XXXX

006802

CALIBR SCALE		6 (X)
LOAD SENSOR BOOM		
EXTENDED	LE	RI
CALIBR	XXXX	XXXX
PRESENT	XXXX	XXXX

006803

CALIBR SCALE		7 (X)
ALLOWED LOAD	XXXXXXKg	
PRESENT LOAD	XXXXXXKg	
LOAD STR.AXLE	XXXXXXKg	
LOAD-CENTER	XXX.XXm	

006804

- 11 Extend the boom completely.
- 12 Scroll to CALIBR SCALE, menu 4 and save the setting with ENTER.
- 13 Lower and retract the boom completely.
- 14 Raise the boom approx. 4 cm (on the lift cylinders).
- 15 Lower the boom carefully approx. 2 cm (on the lift cylinders).
- 16 Wait approx. five seconds to stabilize the pressure.
- 17 Scroll to CALIBR SCALE, menu 5 and save the setting with ENTER.

## NOTE

*Negative values indicate switched contacts on the pressure sensors.*

*Great variations between right and left indicate error in the sensors' signals.*

- 18 Extend the boom completely.
- 19 Wait approx. five seconds to stabilize the pressure.
- 20 Scroll to CALIBR SCALE, menu 6 and save the setting with ENTER.

## Checking calibration

- 21 Scroll to CALIBR SCALE, menu 7.
- 22 Lift a reference load and check that the control and monitoring system calculates the correct weight that the machine lifts LOAD.  
PRESENT LOAD = Reference load  $\pm$  250 kg. Weight is given in kg.  
If the weight is not right, repeat calibration.
- 23 Operate the machine without load, stop the machine and check that PRESENT LOAD = 00000  $\pm$  250 kg.

## NOTE

*Check when stationary. (Operation generates dynamic forces.)*

- 24 Back out of the calibration with the R-key.

## 8.5.2.2 Calibrate STEERING

### Joystick control, calibration



#### NOTE

*Calibration does not need to be performed in one process but each step can be performed separately, independently of other steps.*

- 1 Start key in operating position.

#### CALIBR STEERING, menu 1

- 2 Go into the calibration menus and select CALIBR STEERING, menu 1, see *Calibration, work instructions page 177*

##### STEERING LEVER CENTER POSITION

Description: Setting of centre position for Controls, joystick control (R825).

PRESENT VALUE: indicates current signal value from Controls, joystick control (R825).

STORED VALUE: indicates stored signal value from Controls, joystick control (R825).

Component: Controls, joystick control (R825).

Function: 5.1.3 Lever steering

- 3 Move lever steering to required centre position.
- 4 Store the position with function key for Enter.

#### CALIBR STEERING, menu 2

- 5 Select CALIBR STEERING, menu 2.

##### STEERING LEVER LEFT POSITION

Description: Setting of position for maximum angle left on Controls, joystick control (R825).

PRESENT VALUE: indicates current signal value from Controls, joystick control (R825).

STORED VALUE: indicates stored signal value from Controls, joystick control (R825).

Component: Controls, joystick control (R825).

Function: 5.1.3 Lever steering

- 6 Move lever steering to required position for maximum angle left.
- 7 Store the position with function key for Enter.

CALIBR STEERING 1 (3)	
STEERING LEVER CENTER POSITION	
CALIBR VALUE	X.XXV
PRESENT VALUE	X.XXV

000075

CALIBR STEERING 2 (3)	
STEERING LEVER LEFT POSITION	
CALIBR VALUE	X.XXV
PRESENT VALUE	X.XXV

000076

<b>CALIBR STEERING 3 (3)</b>	
STEERING LEVER RIGHT POSITION	
CALIBR VALUE	X.XXV
PRESENT VALUE	X.XXV

000077

**CALIBR STEERING, menu 3****8 STEERING LEVER RIGHT POSITION**

Description: Setting of position for maximum angle right on Controls, joystick control (R825).

PRESENT VALUE: indicates current signal value from Controls, joystick control (R825).

STORED VALUE: indicates stored signal value from Controls, joystick control (R825).

Component: Controls, joystick control (R825).

Function: 5.1.3 Lever steering

- 9 Move lever steering to required position for maximum angle right.
- 10 Store the position with function key for Enter.

**8.5.2.3 Calibrate DRIVE-TRAIN****Accelerator pedal, calibration**

- 1 Start key in operating position, engine switched off.

**DRIVE-TRAIN, menu 1**

- 2 Go into the calibration menus and select DRIVE-TRAIN, menu 1, see *Calibration, work instructions page 177*

**ACCELERATOR, RELEASE THE PEDAL**

Description: setting accelerator pedal zero position.

CALIBR VALUE: Indicates current calibrated control value from Accelerator pedal (R690).

PRESENT VALUE: indicates current signal value from Accelerator pedal (R690).

Function: 1.1.2 Throttle pedal

Component: Accelerator pedal (R690).

- 3 Release the accelerator pedal.
- 4 Store the position with function key for Enter.

**DRIVE-TRAIN, menu 2****5 ACCELERATOR, THE PEDAL TO FLOOR**

Description: Setting of maximum acceleration position for Accelerator pedal (R690).

CALIBR VALUE: Indicates current calibrated control value from Accelerator pedal (R690).

PRESENT VALUE: indicates current signal value from Accelerator pedal (R690).

Function: 1.1.2 Throttle pedal

Component: Accelerator pedal (R690).

- 6 Press the accelerator pedal down fully and keep it down until the position is stored.
- 7 Store the position with function key for Enter.

<b>CALIBR DRIVE-TRN 1 (4)</b>	
ACCELERATOR, RELEASE THE PEDAL	
CALIBR VALUE	X.XXV
PRESENT VALUE	X.XXV

000079

<b>CALIBR DRIVE-TRN 2 (4)</b>	
ACCELERATOR, THE PEDAL TO FLOOR	
CALIBR VALUE	X.XXV
PRESENT VALUE	X.XXV

000080

## Transmission, calibrating

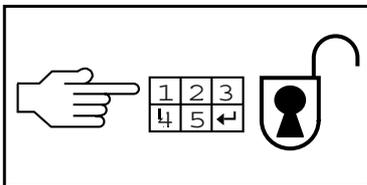


# DANGER

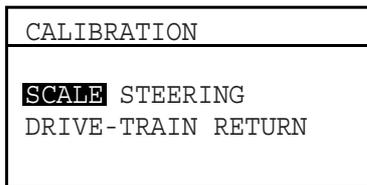
**Do not leave the machine during calibration. The machine may start to move.**



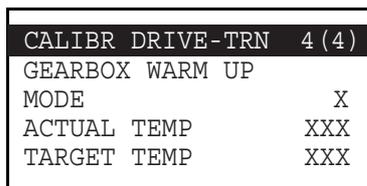
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000060



000082



000082

- 1 Park the machine on level ground, engage neutral position and apply the parking brake. Run the engine at idling speed.
- 2 To select the function to calibrate, first navigate to the service menu. Then press Enter.

- 3 Enter code for calibration.

The code is obtained via Kalmar Industries Support.

### NOTE

*The code determines which service menu shall be activated (Diagnostics, Initiation or Calibration).*

- 4 Select group by scrolling with the arrow keys (1 and 2) and confirm DRIVE-TRAIN with Enter.

- 5 Scroll with the arrow keys (1 and 2) and select DRIVE-TRAIN, menu 4.

- 6 Check that the oil temperature is at least 61 °C.

If the oil temperature is too low go to DRIVE-TRAIN, menu 4.

- A. Apply the footbrake so that the machine is stationary.
- B. Select travel direction forward and apply maximum acceleration for 20 seconds.
- C. Engage neutral position and apply maximum acceleration for 10 seconds, run the engine at idling speed.
- D. Repeat steps B and C until the oil is hot.

The engine speed may be reduced towards the end of heating because the oil from the gearbox is too hot. If this occurs, maintain neutral position and maintain an engine speed of 1200 rpm for 20 seconds.

When the temperature is correct, MODE is changed from 0 to 1.

<b>CALIBR DRIVE-TRN 3 (4)</b>			
CLUTCH TUNING			
PHASE	X	SUB-PH	X
CLUTCH	X	STATUS	X
ACTION	X	XXXXrpm	

000081

7 Select DRIVE-TRAIN, menu, 3.

**GEARBOX TUNING**

Description: Calibration of transmission couplings.

<b>PHASE:</b>	Indicates current phase in the calibration. 0. Prefilling of coupling 1. Calibration of coupling 4. Calibration complete 5. Calibration incorrect
<b>CLUTCH :</b>	Indicates which clutch shall be calibrated. F. Clutch forward R. Clutch reverse 1. Clutch gear 1 2. Clutch gear 2 3. Clutch gear 3 4. Clutch gear 4
<b>ACTION:</b>	Indicates action from mechanics (in the event of a fault) 0. No action (normal condition if no fault). 1. Increase throttle application. 2. Reduce throttle application. 3. Select neutral position. 4. Select travel direction forward. 5. Stop the vehicle. (Press the brake if the machine starts to move.) 6. Heat the transmission, see step 4. 7. No action, the engine is controlled via the transmission control unit. 8. Keep the accelerator pedal in its current position. 9. Check error codes.
<b>SUB-PH:</b>	Internal value for sub-phase 1 or 0.
<b>STATUS:</b>	Calibration status. 0. Calibration not in progress. 3. Calibration in progress

8 Check that the gear control is in neutral position.

9 Start calibration by pressing Enter.

- 10 Calibration starts (takes approx. 15 minutes) and engine speed is raised to approx. 770 rpm.

The transmission will activate different gears during calibration.

### **NOTE**

*If the machine starts to move during calibration then use the footbrake to keep the machine stationary.*

## **IMPORTANT**

**Calibration can be aborted at any time by selecting travel direction reverse.**

- 11 When the engine speed decreases to idling and PHASE = 4 then calibration is complete.
- 12 Turn off the ignition to store the values.

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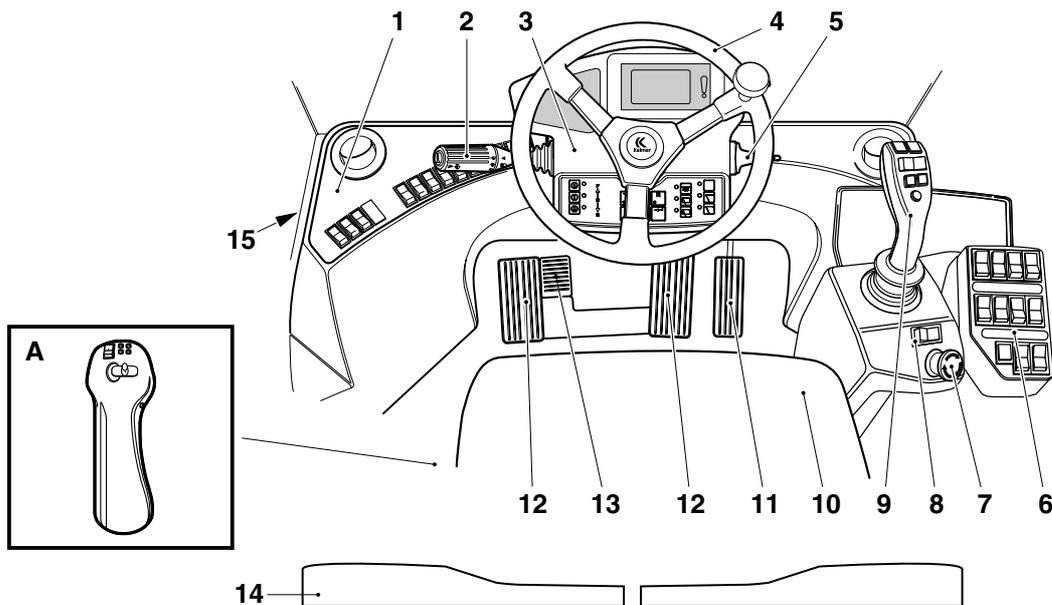


# 9 Frame, body, cab and accessories

## 9.1 Controls and instrumentation

### Controls and instruments, overview

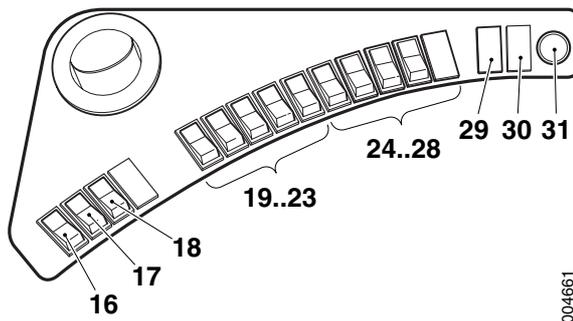
#### Overview



- 1 Left instrument panel
- 2 Gear and multi-function lever (S162)
- 3 Steering wheel panel
- 4 Steering wheel
- 5 Switch direction indicators (S161)
- 6 Panel for load handling functions
- 7 Switch control switch (S250)
- 8 Switch parking brake (S107)
- 9 Control lever (S815)
- 10 Operator's seat
- 11 Accelerator pedal (B690)
- 12 Brake pedal
- 13 Declutch pedal (S220-1)
- 14 Electrical distribution box with fuses
- 15 Hour meter (P708)

A Joystick or mini-wheel 

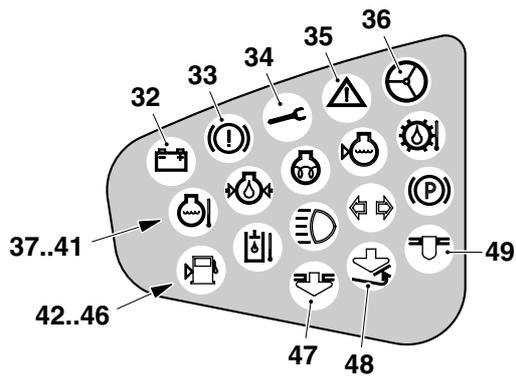
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Left instrument panel

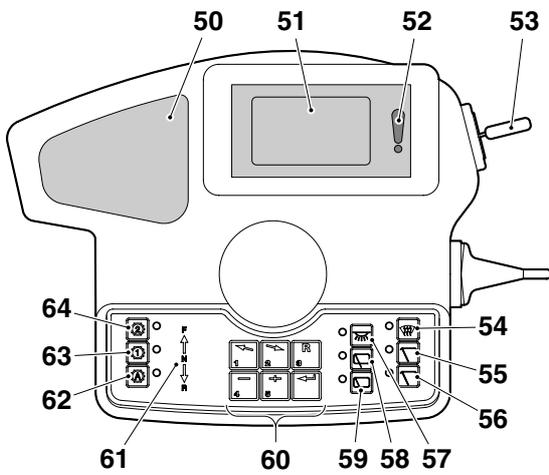
**Left instrument panel**

- 16 Switch fan (S118)
- 17 Switch temperature (S139)
- 18 Switch air distribution (S117)
- 19 Switch work lights cab roof (S105-1)
- 20 Switch work lights attachment (S105-2)
- 21 Switch work lights boom (S105-3)
- 22 Switch rotating beacon (S110)
- 23 Switch hazard lights (S109)
- 24 Switch headlights (S100)
- 25 Switch seat heater (S143)
- 26 Spare
- 27 Spare
- 28 Switch pause heater
- 29 Spare
- 30 Spare
- 31 Socket 24 VDC



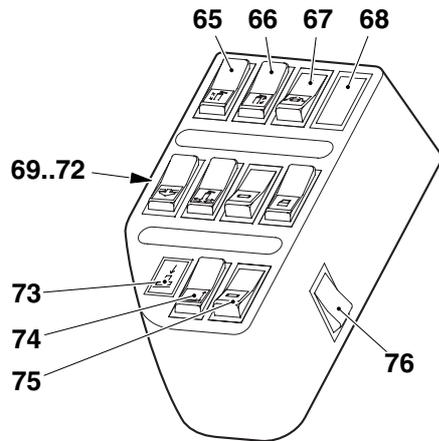
**Steering wheel panel**

- 32 Warning light low battery charging
- 33 Warning light low brake pressure
- 34 Indicator active error codes
- 35 Warning light by-pass of hydraulic functions
- 36 Indicator light activated joystick or mini-wheel steering 
- 37 Warning light high coolant temperature
- 38 Warning light low oil pressure in engine
- 39 Indicator light preheating
- 40 Warning light low coolant level engine
- 41 Warning light high oil temperature in transmission
- 42 Warning light low fuel level
- 43 Warning light high temperature hydraulic oil
- 44 Indicator light high beams
- 45 Indicator light direction indicators
- 46 Indicator light parking brake
- 47 Indicator light locked twistlocks
- 48 Indicator light alignment
- 49 Indicator light unlocked twistlocks
- 50 Panel warning and indicator lights
- 51 Display control and monitoring system
- 52 Indicator control and monitoring system
- 53 Ignition (S150)
- 54 Switch defroster
- 55 Switch windshield wiper roof, interval
- 56 Switch windshield wiper roof, continuous
- 57 Switch interior lighting
- 58 Switch windshield wiper rear, interval
- 59 Switch windshield wiper rear, continuous
- 60 Function keys control and monitoring system
- 61 Travel direction indicator, Forward Neutral Reverse
- 62 Switch shifting program A, automatic shifting
- 63 Switch shifting program 1, locked to 1st gear
- 64 Switch shifting program 2, locked to 2nd gear



Steering wheel panel with panel for warning and indicator lights

000399



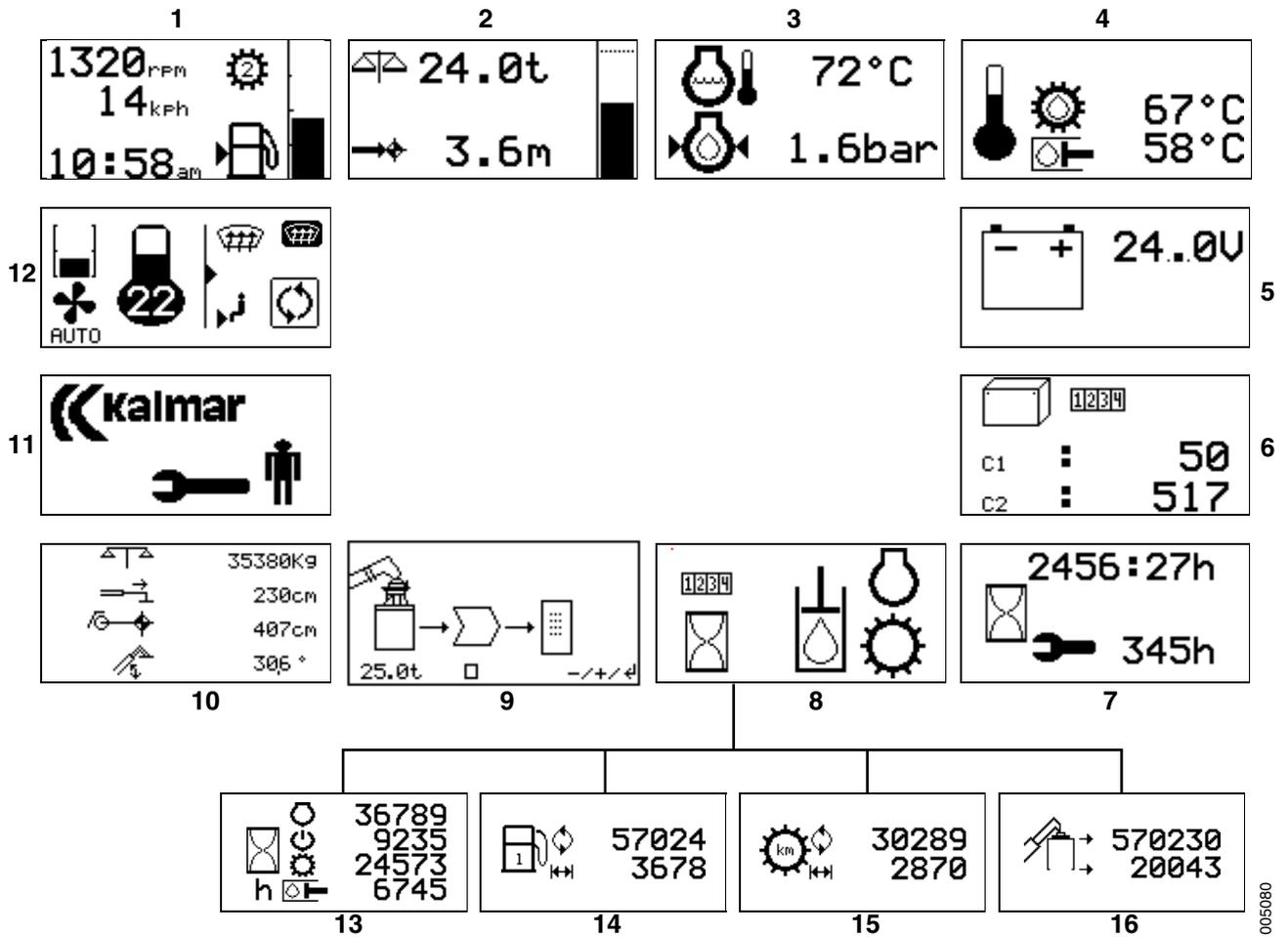
Panel for load handling functions

**Panel for load handling functions**

- 65 Switch lowering front legs (S1006)
- 66 Switch lowering rear legs (S1007)
- 67 Switch by-passing rotation stop (S1014)   
Switch by-passing height limitation (S1015)   
Switch by-passing LC-limitation (load centre) (S1015)
- 68 Spare
- 69 Switch lock twistlocks (S1003)
- 70 Switch clamp/release clamping position legs (S1008)   
Switch overheight-legs (S1031)
- 71 Switch stop at 30' or 35' (S1004)
- 72 Switch hydraulic sliding cab (S177)   
Switch hydraulic cab lift and lowering (S177)
- 73 Indicator light support jacks down (H517)
- 74 Switch support jacks (S1013)
- 75 Switch automatic spreading 20'-40' (S1012)
- 76 Switch by-passing (S1005)

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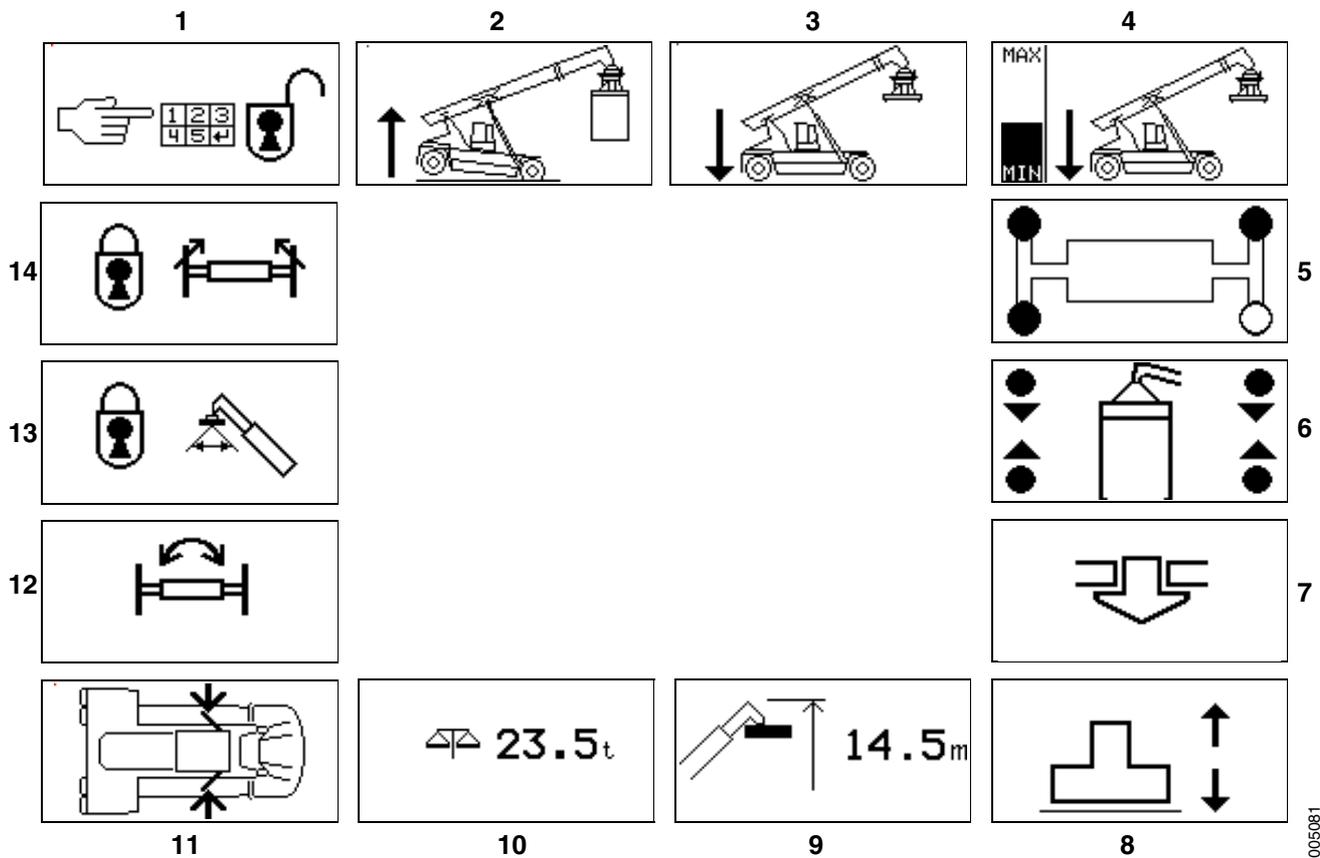
Operating menus, overview



005080

- |   |  |
|---|--|
| 1. Operating menu engine and transmission     | 9. Operating menu printer <b>+</b>                       |
| 2. Operating menu dynamic scale <b>+</b>      | 10. Operating menu checking dynamic scale <b>+</b>       |
| 3. Operating menu engine                      | 11. Operating menu service                               |
| 4. Operating menu transmission and hydraulics | 12. Operating menu heating and air conditioning          |
| 5. Operating menu electrical system           | 13. Operating menu statistics, operating hours <b>+</b>  |
| 6. Operating menu container counter <b>+</b>  | 14. Operating menu statistics, fuel consumption <b>+</b> |
| 7. Operating menu service interval <b>+</b>   | 15. Operating menu statistics, driving distance <b>+</b> |
| 8. Operating menu statistics <b>+</b>         | 16. Operating menu statistics, lift statistics <b>+</b>  |

## Event menus overview



005081

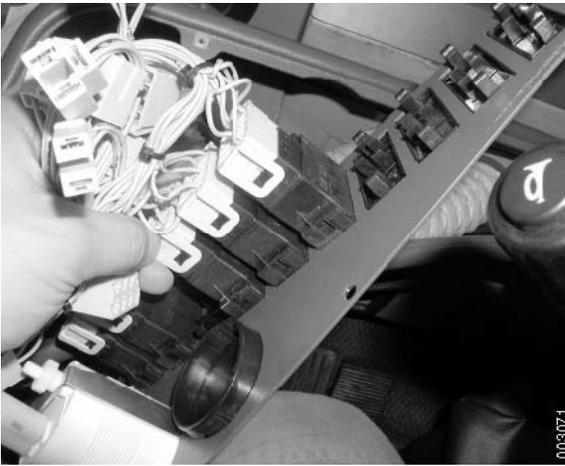
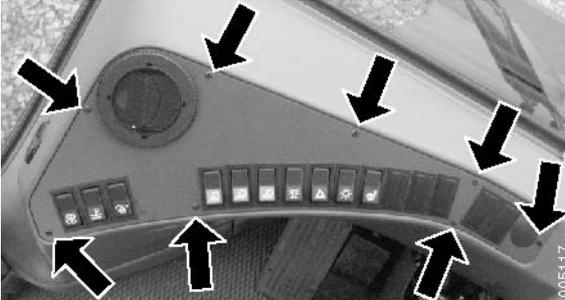
1. Event menu start interlock
2. Event menu overload forward
3. Event menu overload on steering axle
4. Event menu overload on steering axle
5. Event menu alignment top lift
6. Event menu alignment bottom lift
7. Event menu twistlocks
8. Event menu support jacks
9. Event menu height limitation
10. Event menu fixed scale
11. Event menu open door
12. Event menu rotation stop
13. Event menu tilt lock
14. Event menu levelling lock
15. Event menu automatic spreading 20'-40'

## Switch, replacement

### NOTE

*The instructions apply universally for the switches.*

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the dashboard panel.

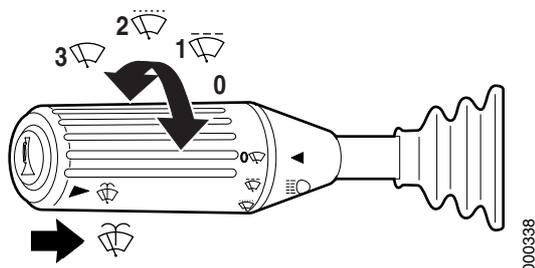


- 3 Detach the connector from the switch.
- 4 Remove the switch from the dashboard panel. Bend in the hooks using a screwdriver.
- 5 Replace the switch.

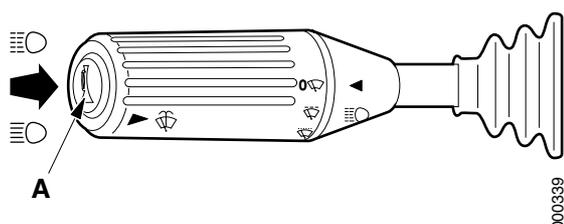
## 9.1.1 Gear and multi-function lever

### Gear and multi-function lever, description

The following functions are handled by the gear and multi-function lever (position 2).



Movement	Function:
Forward/ Reverse	Travel direction (for selecting shifting program and travel direction, see section 2 <i>Transmission</i> ).
Inward, handle	Washing of windshield, roof window and rear window.  The signal can be checked from the diagnostic menu, see section 8 <i>Control system</i> , group 8.4.3.1 <i>CAB</i> , menu 1.
Rotation	Windshield wiper front.  0 – No wiping front windshield. If wiper rear or roof are active, these run at slow interval wiping.  1 – Slow interval wiping front windshield, controls slow interval wiping for roof window and rear window.  2 – Fast interval wiping front windshield, controls fast interval wiping for roof window and rear window.  3 – Continuous wiping front windshield. If wiper rear or roof are active, these run at fast interval wiping.  The signal can be checked from the diagnostic menu, see section 8 <i>Control system</i> , group 8.4.3.2 <i>CAB</i> , menu 2.



Upward	Light signal
Downward	High beams (on/off)  With headlights on: Gear and multi-function lever is used to switch between high and low beams.  With headlights off: Gear and multi-function lever is used to flash with the headlights.  The signal can be checked from the diagnostic menu, see section 8 <i>Control system</i> , group 8.4.2.6 <i>LIGHTS</i> , menu 6.
Inward, button	Horn (position A).  The signal can be checked from the diagnostic menu, see section 8 <i>Control system</i> , group 8.4.3.5 <i>CAB</i> , menu 5.



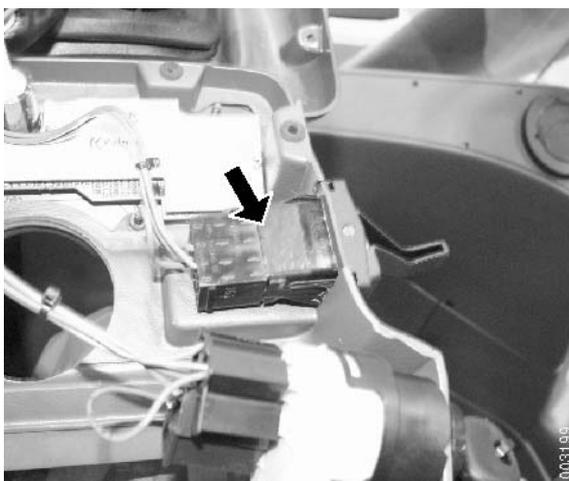
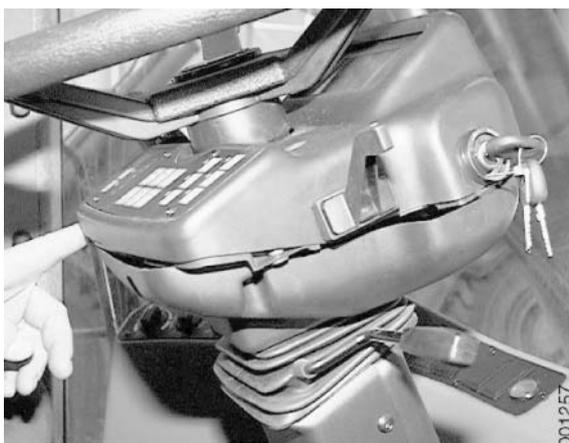
### Gear and multi-function lever, replacement

- 1 Separate the dashboard panel.  
6 attaching bolts and 2 bolts to the steering column.  
Remove the steering wheel, see *Dashboard panel, replacement page 110*.
- 2 Undo the attaching bolts (2 x hexagonal socket bolts).
- 3 Disconnect the connector from Control unit KIT (D790-2).
- 4 Fit a new lever and refit the dashboard panel.

## 9.1.22 Switch travel direction indicator

### Switch, direction indicators, replacement

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the steering wheel and separate the dashboard panel.
- 3 Detach the wiring harness from the direction indicator.
- 4 Press the clips on the direction indicator together and detach it from the dashboard panel.
- 5 Replace the direction indicator, fitting it in the reverse order.



## 9.2 Protection and emergency equipment

### 9.2.1 Manoeuvre switch

#### Operation breaker, description

See tab 11 *Common electric*, group 11.5.1.4 *Manoeuvre switch voltage*.

### 9.2.2 Seat belt

#### Seat belt, description



The seat belt is a two or three point type depending on which seat the machine is equipped with. The seat belt is mounted on the seat.

### 9.2.3 Fire extinguisher

#### Fire extinguisher, description



The fire extinguisher is located by the steps on the left frame member. There are user instructions on the fire extinguisher.

### 9.2.4 Buzzer

#### Seat buzzer, description

See *Sensor operator in seat*, description page 23.

## 9.3 Seat

### Seats, general

There are three versions of operator's seat:

- *Seats, description (product alternative standard seat) page 15*
- *Seats, description (product alternative Bege 9120) page 16*
- *Seats, description (product alternative Isringhausen 6800) page 17*



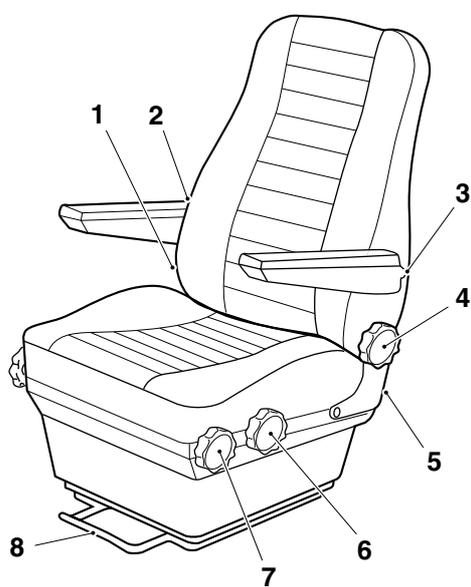
As an option, the machine can be equipped with a fold-down passenger seat to the left of the operator.

### Seats, description (product alternative standard seat)

The seat's function is to give the operator a good sitting position and contribute to a good work environment. The cab's seat has several adjustment possibilities and meets high comfort standards.

The seat has the following equipment:

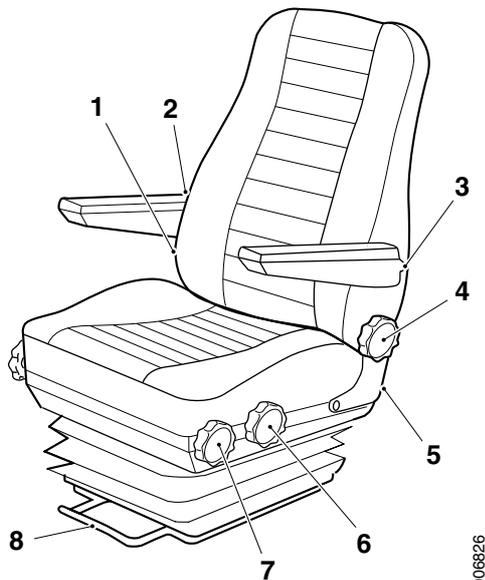
- mechanical adjustment
- armrest right
- armrest left
- seat heating
- seat belt
- head restraint
- seat heating



006825

Controls standard seats

1. Adjustment lower back support
2. Adjustment armrest right
3. Adjustment armrest left
4. Adjustment angle backrest
5. Adjustment suspension position
6. Adjustment seat angle
7. Adjustment seat height
8. Length adjustment



006826

#### Controls Bege 9120

1. Adjustment lower back support
2. Adjustment armrest right
3. Adjustment armrest left
4. Adjustment angle backrest
5. Adjustment suspension position
6. Adjustment seat angle
7. Adjustment seat height
8. Length adjustment

### Seats, description (product alternative Bege 9120)



Bege 9120 is the same seat as the standard seat, but is equipped with air suspension. Air suspension automatically adjusts seat height and suspension to operator's weight. Air suspension is supplied by a special compressor installed on the underside of the cab.

The seat's function is to give the operator a good sitting position and contribute to a good work environment. The cab's seat has several adjustment possibilities and meets high comfort standards.

The seat has the following equipment:

- mechanical adjustment
- air suspension (with external compressor)
- armrest right
- armrest left
- seat heating
- seat belt
- head restraint

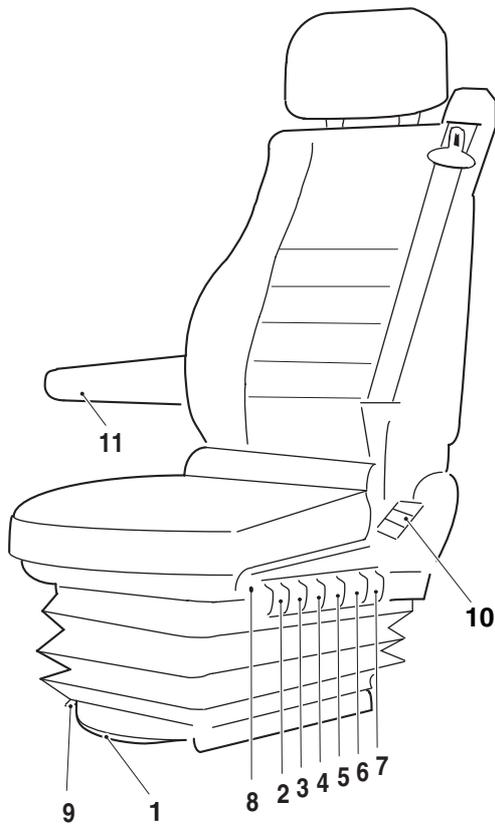
## Seats, description (product alternative Isringhausen 6800)



The seat's function is to give the operator a good sitting position and contribute to a good work environment. The cab's seat has several adjustment possibilities and meets high comfort standards.

Isringhausen 6800 seat has the following equipment:

- head restraint
- armrest
- air suspension (with external compressor)
- air-adjusted lower back (lumbar) support
- seat belt
- seat heating



004691

### Controls Isringhausen 6800

1. Length adjustment
2. Adjustment seat cushion
3. Lowering seat height
4. Seat cushion's angle
5. Elevating seat height
6. Backrest's angle
7. Adjustment damping
8. Seat heating
9. Level damping off/on
10. Adjustment lower back support
11. Armrest

## Seat, changing

- 1 Machine in service position, see tab *B Safety*.
- 2 Slide back the seat to its rear position, remove the front attaching bolts.



- 3 Slide the seat to its front position, remove the rear attaching bolts.
- 4 Disconnect the seat's connectors from the machine's cabling.
- 5 Remove the seat.
- 6 Fit in the reverse order.



### 9.3.1 Seat cushion

#### Seat cushion, description

The function of the seat cushion is to provide good comfort for the operator. Beneath the seat cushion is the driver's seat frame and buzzer switch. Heating elements may be included (⊕).

For location, see *Seats, general page 15*.

#### Seat cushion, changing (product alternative BE-GE)

- 1 Machine in service position, see tab *B Safety*.
- 2 Loosen the rubber bellows by removing the plastic clips (position 1).
- 3 Unhook the upholstery's rails (position 2) from the seat frame (position 3) and remove the upholstery.
- 4 Remove the padding (position 4).

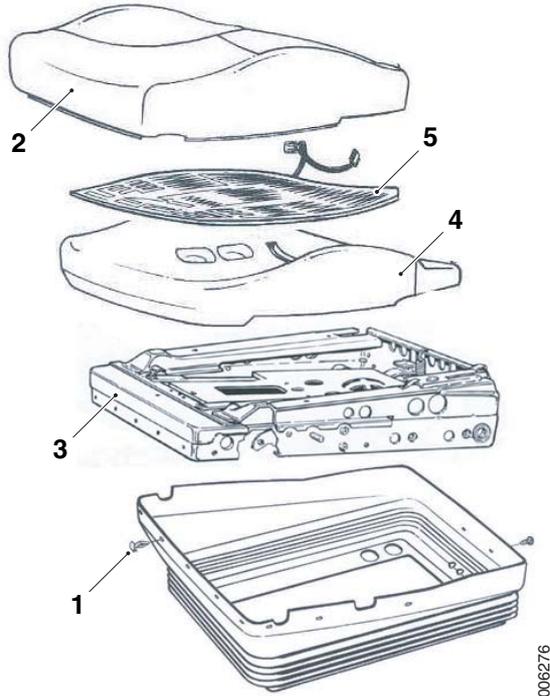
⊕ If the seat is equipped with seat heater.

Unplug the connector for the heating coil before the padding is removed.

#### NOTE

*The seat's heating coil is glued to the padding. Be careful if the padding is to be replaced but the heating coil is to be reused, or if only the coil is to be replaced.*

- 5 Assemble in reverse order.



006276

1. Plastic clips rubber bellows
2. Upholstery
3. Seat frame
4. Padding
5. Heating coil

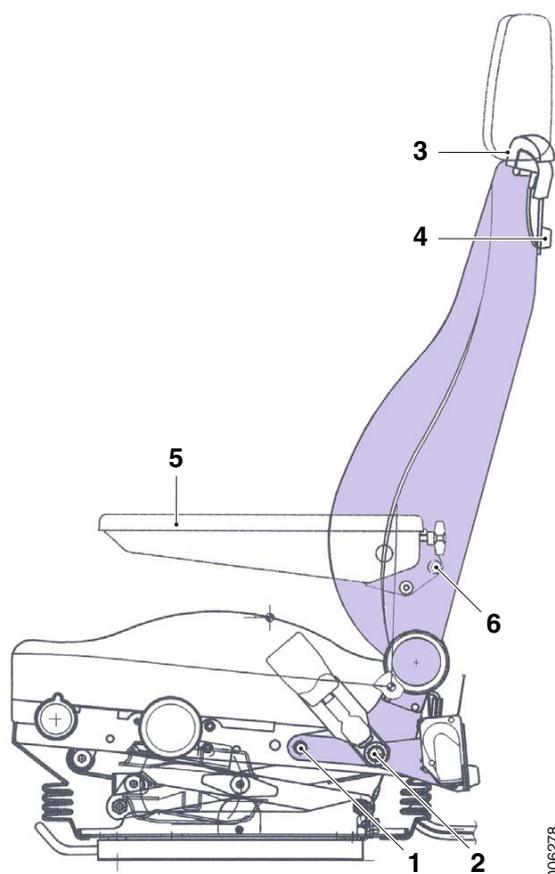
### 9.3.2 Back cushion

#### Back cushion, description

The function of the backrest cushion is to provide good comfort for the operator. Beneath the backrest cushion is the driver's seat frame.

Heating elements may be included (⊕).

For location, see *Seats, general page 15*.

**Back cushion, changing (product alternative BE-GE)**

1. Attaching bolt backrest
2. Attaching bolt seatbelt
3. Cover belt guide
4. Attaching bolt belt guide
5. Armrest
6. Attaching bolt armrest.

- 1 Machine in service position, see tab *B Safety*
- 2 Loosen the rubber bellows on the back of the seat by removing the plastic clips and fold down the bellows. See *Seat cushion, changing (product alternative BE-GE) page 19*.
- 3 Remove the backrest by first removing the attaching bolts (position 1) on the right and left side of the seat and then remove the attaching bolts for the seatbelt (position 2) on the right and left side of the seat.
- 4 **+** If the seat is equipped with 3-point seatbelt.  
Remove the belt guide (position 3) by removing the cover and the attaching bolt (position 4).
- 5 **+** If the seat is equipped with armrest (position 5).  
Remove the armrest by removing the attaching bolts (position 6).
- 6 Place the backrest on the seat and install the attaching bolts (position 1), do not tighten. Then install the attaching bolts for the seatbelt (position 2).  
Tighten the attaching bolts for the seatbelt (position 2) with torque **42 Nm**, then tighten the attaching bolts (position 1) with torque **33 Nm**.
- 7 **+** If the seat is equipped with 3-point seatbelt or armrest.  
Cut holes in the upholstery for seatbelt and armrest on the new backrest before armrest or seatbelt is installed.
- 8 Fit in the reverse order.

**9.3.3 Heating coils****Heating coils, description**

The heating coil's function is to warm the back and seat cushions in the operator's seat. The heating coil is located under the upholstery on the seat.

Heating coil (E803) is supplied with voltage during heating of Control unit cab (D790-1) via relay seat heater (K383). The signal can be checked with diagnostic menu, see section *8 Control system, group 8.4.3.8 CAB, menu 8*.

**Heating coil, changing (product alternative BE-GE)**

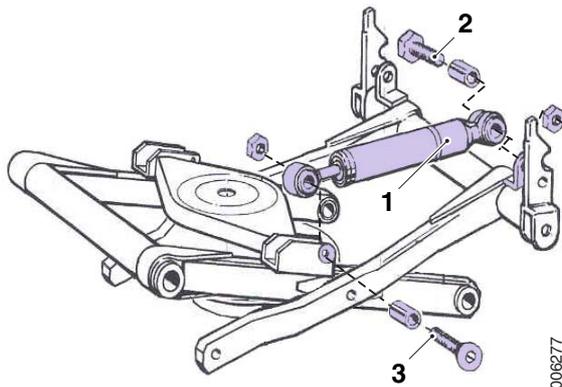
See *Seat cushion, changing (product alternative BE-GE) page 19*.

### 9.3.4 Shock absorbers

#### Bumper, description

Shock absorbers are integrated in the suspension unit in the seat's bracket and are self-adjusting, that is, they adjust themselves according to the operator's body weight.

#### Shock absorber, changing (product alternative BE-GE)



006277

1. Shock absorber
2. Attaching bolt
3. Attaching bolt

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the operator's seat from the bracket and lift it out of the machine. See *Seat, changing page 18*.
- 3 Remove the seat cushion, see *Seat cushion, changing (product alternative BE-GE) page 19*.
- 4 Remove the back cushion, see *Back cushion, changing (product alternative BE-GE) page 20*.
- 5 Remove the shock absorber's attaching bolts (position 2 and 3).
- 6 Replace shock absorber (position 1).
- 7 Assemble in reverse order.

### 9.3.5 Air suspension

#### Air suspension, description



The air-suspended operator's seat consists of a seat with rubber bellows and compressor. Air-suspension is self-adjusting, that is, adjust automatically to the operator's body weight. The compressor provides air for the suspension unit.

#### 9.3.5.1 Compressor air-suspended seat

##### Compressor air-suspended seat, description

###### Bege 9120:

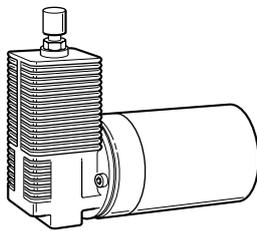


The compressor is part of the air suspension driver's seat and is located inside the seat's suspension unit.

###### Isringhausen 6800:



The compressor is an external part for the air-suspended operator's seat that is installed on the cab floor's underside.



Compressor air-suspended seat

001621

### 9.3.6 Mechanical seat adjustment

#### Mechanical seat adjustment, description

Seat adjustment is all mechanical and is adapted by the operator with different controls to obtain a good sitting position.

See:

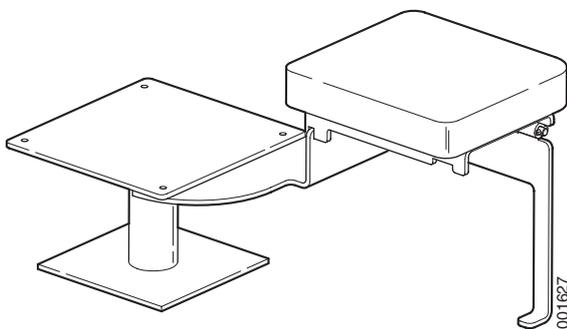
- *Seats, description (product alternative standard seat) page 15*
- *Seats, description (product alternative Bege 9120) page 16*
- *Seats, description (product alternative Isringhausen 6800) page 17*

### 9.3.7 Passenger seat

#### Passenger seat, description



The passenger seat is collapsible (vertically) and is located on the left-hand side of the driver's seat.



Passenger seat with bracket

### 9.3.8 Armrest

#### Arm rest, description

The arm rest is fixed to the backrest and is individually adjustable vertically (around the attachment point). Depending on options there is also an arm rest for the left-hand side:

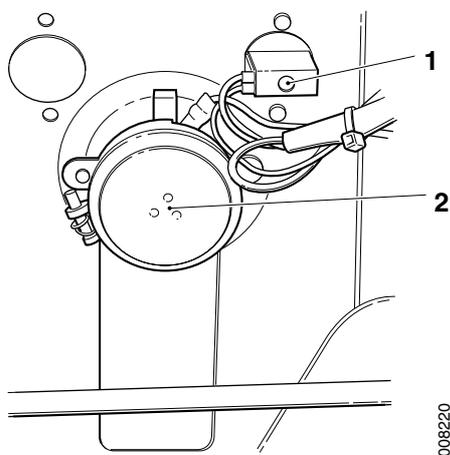
- Mini-wheel
- Joystick control

### 9.3.9 Sensor driver in seat

#### Sensor operator in seat, description

Sensor operator in seat (S230) senses if the operator's seat's suspension is pressed down, which indicates to the control and monitoring system that the operator is sitting in the operator's seat. This is used to give the control and monitoring system possibility to indicate with buzzer operator in seat (H853) if the operator leaves the seat without applying the parking brake.

Sensor operator in seat (S230) is supplied with voltage by and sends voltage signal to Control unit cab (D790-1). The signal can be checked with diagnostic menu, see section 8 *Control system*, group 8.4.3.6 *CAB, menu 6*.



008220

Seat seen from below

1. Sensor operator in seat (S230)
2. Buzzer (H853)

## 9.4 HVAC

### Heating, ventilation and air conditioning, description

The heater unit controls the heating and ventilation of the cab. The cab can also be equipped with climate control unit (+).

The temperature in the cab is thermostat-controlled by control unit, cab (D790-1). The cab temperature is controlled against set temperature. The temperature can be set between 16 and 28 °C. The unit is operated with controls on the instrument panel.

#### Heater unit (EHC)

The heater unit (EHC) handles heating and ventilation. (The heater unit cannot perform cooling.)

The heater unit uses heat from the engine's cooling system via a heating element to heat the outer air. Outer air is forced by the fan through the heating element, on through ducts in the cab's interior to be directed against e.g. the windscreen (defroster) or to the feet.

#### Climate control unit (ECC)

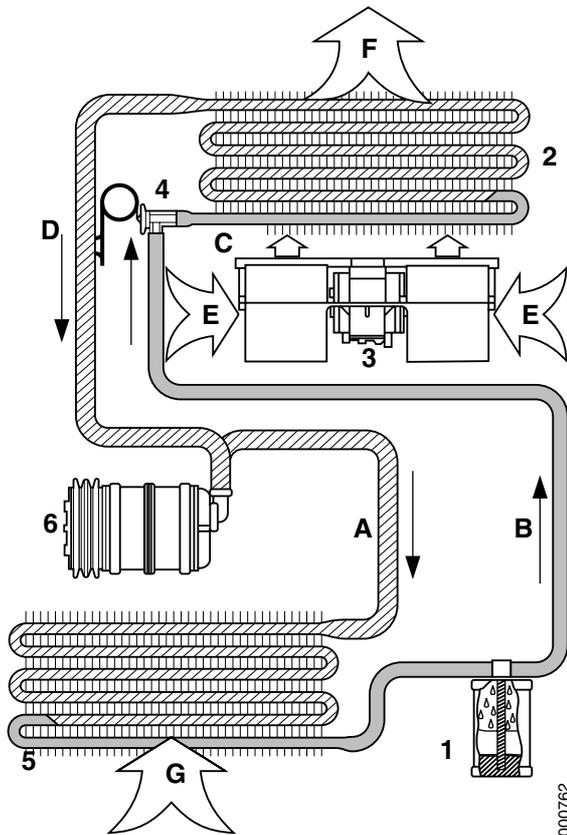


The climate control unit (ECC) handles heating ventilation, cooling, and dehumidification. Heating of the air works in the same way as for the Heater unit (EHC).

For cooling, the outside air is forced through the evaporator that cools the air. Then the air can be controlled in the same way as for the heater unit.

The climate control unit's function is to:

- warm the air when it is cold
- dry the air when it is damp
- clean the air from impurities
- cool the air when it is warm
- defrost (defroster function)



Principle illustration, cooling plant

1. Fluid reservoir/filter dryer with built-in pressure monitor
  2. Heating coil and evaporator
  3. Fan
  4. Expansion valve
  5. Condenser
  6. Compressor
- A. High pressure gas  
 B. High pressure fluid  
 C. Low pressure fluid  
 D. Low pressure gas  
 E. Outdoor air for ventilation of cab  
 F. Heated or cooled air to cab  
 G. Outdoor air for transporting (dissipating) heat



Pos	Explanation	Signal description	Reference
4	Sensor cab temperature (B775-1) sends a voltage signal proportional to temperature to Control unit cab (D790-1).	R = 10 kΩ at 25 °C	<i>Sensor cab temperature, description page 57</i> D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.4.1 <i>CLIMATE</i> , menu 1
5	Sensor temperature outlet (B775-2) fan sends a voltage signal proportional to temperature to Control unit cab (D790-1).	R = 10 kΩ at 25 °C	<i>Sensor temperature outlet fan, description page 56</i> D5: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.4.2 <i>CLIMATE</i> , menu 2
6	Sensor outdoor temperature (B774) sends a voltage signal proportional to temperature to Control unit cab (D790-1).	R = 10 kΩ at 25 °C	<i>Sensor ambient temperature, description page 58</i> D6: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.4.2 <i>CLIMATE</i> , menu 2
7	Control unit cab (D790-1) controls temperature and air distribution with signals from sensors and controls.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
8	The engine produces heat when running. It is cooled with the cooling system. The heat from the cooling system is used to heat the cab air.	-	-
9	Control unit cab (D790-1) controls Water valve (Y673) that leads warm water to heat exchanger heat. The water valve's opening (%) is sent back to Control unit cab (D790-1). This gives information for controlling the water valve's position.	U = 0.5–4.5 V	<i>Water valve, description page 43</i> D9: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.4.7 <i>CLIMATE</i> , menu 7 and 8.4.4.4 <i>CLIMATE</i> , menu 4
10	Sensor engine temperature sends voltage signal proportional to engine temperature to Control unit engine (D794).	Controlled by control and monitoring system, error shown with error code.	Tab 1 <i>Engine</i> D10: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.4.2 <i>CLIMATE</i> , menu 2
11	Heat exchanger heat adds heat to the cab air. Heat is transferred from the engine's cooling system to the cab air.	-	<i>Heat exchanger heat, description page 40</i>
12	Control unit engine (D794) sends engine temperature in cooling system on the CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.10 <i>Control unit engine</i>
13	Control unit cab (D790-1) controls Damper motor recirculation (M612) that sets fresh air or recirculation damper in desired position.	Checked by control and monitoring system, error shown with error code.	<i>Fresh air filter or recirculation damper, description page 34</i> D13: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.4.6 <i>CLIMATE</i> , menu 6

Pos	Explanation	Signal description	Reference
14	Control unit cab (D790-1) controls Fan motor (M657) which increases air flow in the cab.	Checked by control and monitoring system, error shown with error code.	<i>Cab fan, description page 37</i> D14: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.4.6 <i>CLIMATE</i> , menu 6
15	Control unit cab (D790-1) controls Damper motor (Y672) which sets the air distributor in desired position.  The air distributor's position is sent back to Control unit cab (D790-1). This gives information for controlling the air distributor's position.	U = 0.5–4.5 V	<i>Air distributor, description page 54</i> D15: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.4.8 <i>CLIMATE</i> , menu 8 and 8.4.4.4 <i>CLIMATE</i> , menu 4
16 +	Control unit frame rear (D797-R) controls cut-in of the AC compressor.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i>
17 +	Control unit frame rear (D797-R) supplies voltage to the magnet clutch (645) on the compressor.	U = 24 V	<i>Compressor air conditioning, description (engine alternative Volvo) page 44</i> D17: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.4.6 <i>CLIMATE</i> , menu 6
18 +	The compressor draws gaseous refrigerant from the evaporator, compresses it, and forces it on to the condenser.	-	<i>Compressor air conditioning, description (engine alternative Volvo) page 44</i>
19 +	The condenser cools the refrigerant. The gaseous refrigerant condenses to liquid form and is pumped on in the circuit.	-	<i>Condenser, description page 47</i>
20 +	The moisture filter absorbs any moisture from the cooling circuit. The fluid reservoir stores the refrigerant.	-	<i>Moisture filter, description page 48</i>
21 +	Pressure monitor (S246) sends signal to Control unit frame rear (D797-R) about the pressure in the system becomes abnormally high or low.	U = 24 V	<i>Pressure monitor, description page 49</i> D21: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.4.3 <i>CLIMATE</i> , menu 3
22 +	The expansion valve adjusts the amount of refrigerant that is let in to the evaporator. If the temperature in the evaporator's outlet pipe increases, the evaporator valve increases flow of refrigerant so that heat dissipation in the evaporator increases.	-	<i>Expansion valve, description page 50</i>

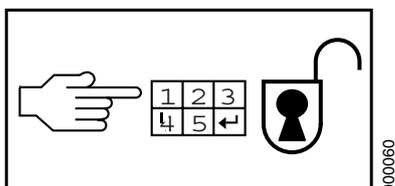
Pos	Explanation	Signal description	Reference
23 +	Sensor temperature in refrigerant circuit sends voltage signal proportional to temperature to Control unit cab (D790-1).	R = 10 kΩ at 25 °C	<i>Sensor temperature in refrigerant, description page 51</i> D23: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.4.2 <i>CLIMATE</i> , menu 2.
24 +	Heat exchanger cooling dissipates heat from the cab air. Heat is transferred from the air to the refrigerant and transforms the refrigerant to a gaseous state.	-	<i>Heat exchanger cooling, description page 53</i>
25	Switch defroster on Control unit KIT (D790-2) activates defroster program for air conditioning unit for six minutes.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.11 <i>Control unit KIT</i>
26	Control unit KID (D795) shows settings on heating and ventilation unit in the display.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>

### Heating, ventilation and air conditioning, checking

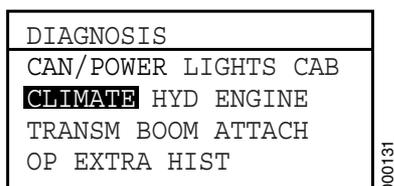
- 1 Machine in service position, see tab *B Safety*.
- 2 Navigate to the service menu and press Enter.



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000060



000131

- 3 Enter code for diagnosis. Code is obtained from Kalmar Industries Support.

#### NOTE

*The code decides which service menu is to be activated (Diagnostic test, Initiation, Calibration, or Service indication).*

- 4 Select CLIMATE.

DIAG CLIMATE	1 (8)
PRESENT INPUT SIGNAL	
REQUIRED TEMP	XXX
PRESENT TEMP	XXX
WATER VALVE FEEDB.	XXX

000132

DIAG CLIMATE	2 (8)
TEMP COIL	XXX
TEMP COOLANT	XXX
TEMP AMBIENT	XXX
TEMP DE-ICE	XXX

000133

DIAG CLIMATE	3 (X)
PRESENT INPUT SIGNAL	
PRESSURE SWITCH	X
OPT DOOR SWITCH	X

006865

### Menu 1

- 5 Check of desired temperature, inside temperature sensor and water valve.

REQUIRED TEMP: should be 160 (16.0 °C) for max. cool and 280 (28.0 °C) for max. heat. Setting is changed with Switch temperature.

PRESENT TEMP shows the temperature inside the cab. This is measured by Sensor cab temperature (located down to the right on the instrument panel, behind the rubber bushing). Blowing through the hole should increase the value.

WATER VALVE FEEDB. should show 0 (closed) when the requested temperature is 160 and 100 (open) when the requested temperature is 280. The water valve is located under the cab.

### Menu 2

- 6 Check of Sensor temperature outlet fan (B775-2), engine temperature, Sensor outdoor temperature (B774), Check of Sensor temperature refrigerant (B775-1).

TEMP COIL: temperature that the air has in the air distributor is measured by Sensor temperature outlet fan (B775-2).

TEMP COOLANT: engine temperature sent on the CAN-bus.

TEMP AMBIENT: outdoor temperature measured by Sensor outdoor temperature (B774).

TEMP DE-ICE: cooling circuit's temperature measured by Sensor temperature refrigerant (B775-1). If the compressor is activated the value will be low. However, if heat has been selected and the compressor is deactivated, the value will almost be equal to TEMP COIL.

### Menu 3

- 7  (Only machines with ECC)

Checks that refrigerant circuit is filled.

PRESSURE SWITCH: 0 = not filled 1 = filled.

The sensor is located on the dryer filter which is fitted right rear in the frame.

DIAG CLIMATE	4 (8)
PRESENT INPUT SIGNAL	
WATER VALVE	XX.XXV
DRAUGHT VALVE	XX.XXV

000135

DIAG CLIMATE	5 (8)
PRESENT INPUT SIGNAL	
REQUIRED TEMP	XX.XXV
REQ. DRAUGHT	XX.XXV
REQ. FAN SPEED	XX.XXV

000136

DIAG CLIMATE	6 (8)
PRESENT OUTPUT SIGNAL	
FAN SPEED	XXX
RECIRCULATION	XY
COMPRESSOR	XY

000137

#### Menu 4

- 8 Checks Water valve (Y673) and Air distributor (Y642).

WATER VALVE: should work between 1.0-1.24 V and 2.95-3.2 V. This is checked by turning the temperature control and changing temperature setting from min. to max.

DRAUGHT VALVE: should work in the range 1.0-4.0 V. The difference between min. and max. should be approx 1 V. This is checked by changing the air distribution from floor to front windshield. At the same time, feel with your hand so that air blows through different vents.

#### NOTE

*Air to the round panel vents is not controlled by the air conditioning unit.*

#### Menu 5

- 9 Checks switches for temperature, air distribution and fan speed.

REQUIRED TEMP: resting position U = 0 V; raise U = 2-2.5 V; lower U = 4.5-5 V.

REQ. DRAUGHT: resting position U = 0 V; against windshield U = 2-2.5 V; against floor U = 4.5-5 V.

REQ. FAN SPEED: resting position U = 0 V; raise U = 2-2.5 V; lower U = 4.5-5 V.

#### Menu 6

- 10 Checks Cab fan (M657), Fresh air and recirculation damper (M612) and Magnet clutch compressor (M645) .

FAN SPEED: increase and decrease fan speed, value should increase from 0 to 255 in steps.

RECIRCULATION: press in Switch by-passing (S1005) (on the panel for load handling functions). When checking, the display should show "11". Check that the damper really moves as it should by removing the fresh air filter at the front on the air conditioning casing and feeling with your hand.

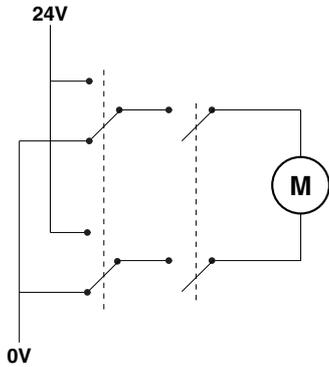
 (Only machines with ECC)

COMPRESSOR: lower temperature setting to max. cooling, after approx. 45 seconds the compressor will be activated and the display should show "11".

#### NOTE

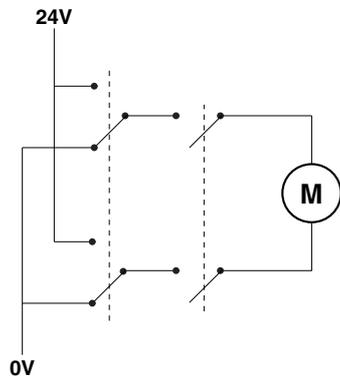
*Compressor activation can only be tested when the engine is running and the system is filled.*

<b>DIAG CLIMATE</b>	<b>7 (8)</b>
OUTPUT WATER VALVE	
CLOCKWISE	XY XY
ANTI-CLOCKWISE	XY XY



000138

<b>DIAG CLIMATE</b>	<b>8 (8)</b>
OUTPUT DRAUGHT VALVE	
CLOCKWISE	XY XY
ANTI-CLOCKWISE	XY XY



000139

**Menu 7**

11 Checks direction selector for Water valve (Y673).

CLOCKWISE: When temperature is increased and the water valve opens shows "CLOCKWISE 11 11" and "COUNTER-CLOCKWISE 00 11".

COUNTER-CLOCKWISE: When temperature is lowered and the water valve closes shows "CLOCKWISE 00 11" and "COUNTER-CLOCKWISE 11 11".

**NOTE**

*The ones are only showed for a moment when the water valve changes position, zeros are shown when the valve is not changing position. The water valve does not open if engine temperature is low, or if outdoor temperature is high.*

**Menu 8**

12 Checks direction selector for air distributor.

CLOCKWISE: when the air is directed against the windshield and the air distributor changes position shows "CLOCKWISE 00 11" and "COUNTER-CLOCKWISE 11 11".

COUNTER-CLOCKWISE: when the air is directed against the feet and the air distributor changes position shows "CLOCKWISE 11 11" and "COUNTER-CLOCKWISE 00 11".

**NOTE**

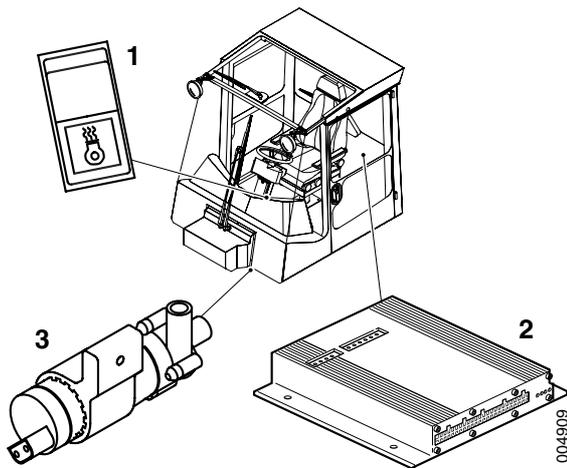
*The ones are only shown for a moment when the air distributor changes position, zeros are shown when the air distributor is not changing position.*

## Pause heater, description



Pause heater is an option for the heating system that uses the surplus heat in the engine's cooling system to keep the cab warm.

An extra electrically driven water pump pumps the coolant through the heating system when the engine is off. The cab fan pumps air into the cab. The pause heater is turned off automatically when the temperature in the cab is six degrees below the set value on the air conditioning system. The pause heater is activated with Switch pause heater when the ignition is on.

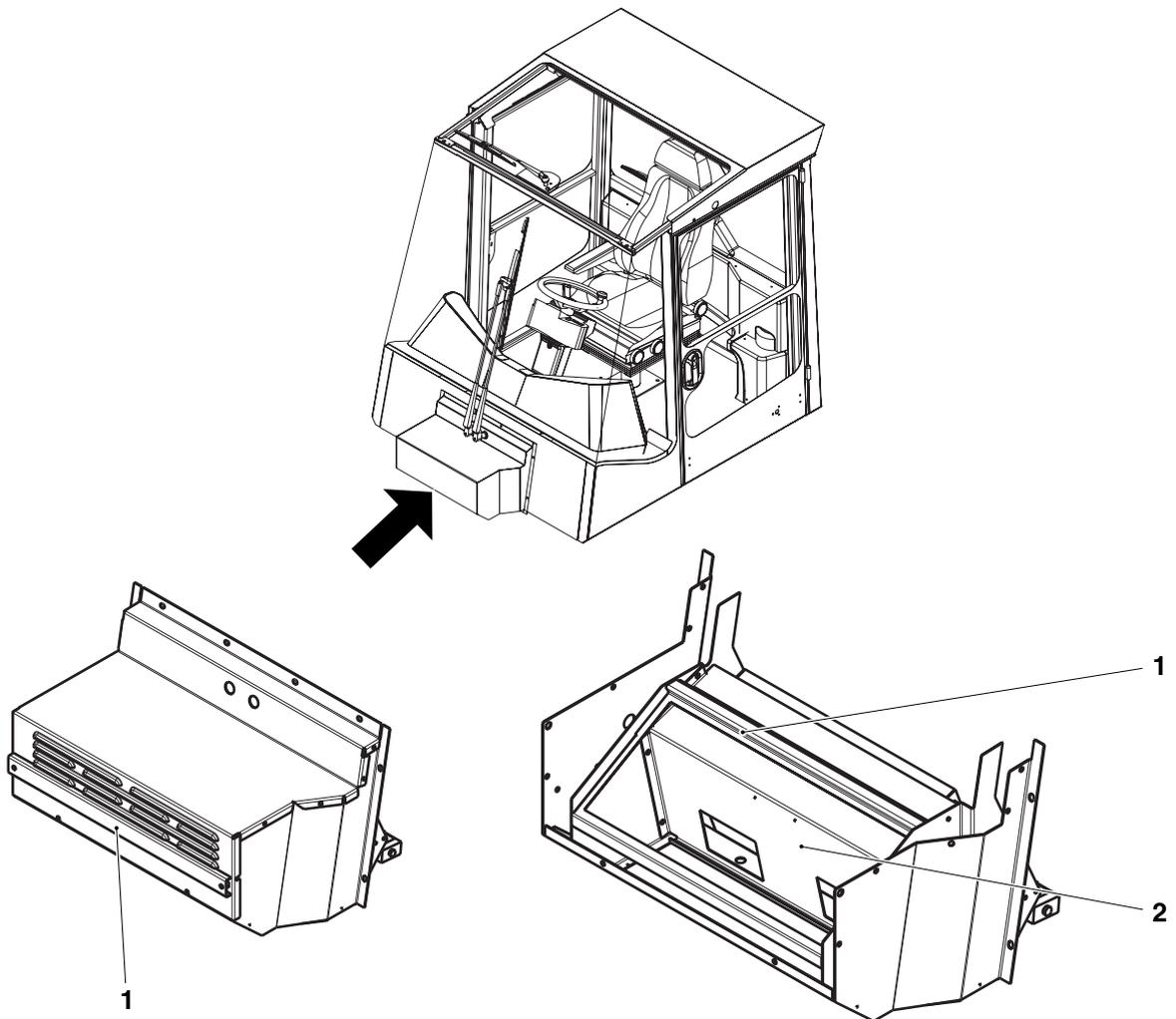


1. Switch pause heater (S0\_OPT-1)
2. Control unit cab (D790-1)
3. Circulation pump pause heater (M667)

## 9.4.1 Fresh air filter

### Fresh air filter, description

The fresh air filter is located under the cover in the external unit for fresh air inlet to the cab, in front of the cab fan. A finer filter can be selected (⊕) but then the maximal air flow can be affected.



*Fresh air inlet cab*

1. Fresh air filter
2. Fresh air filter and recirculation damper

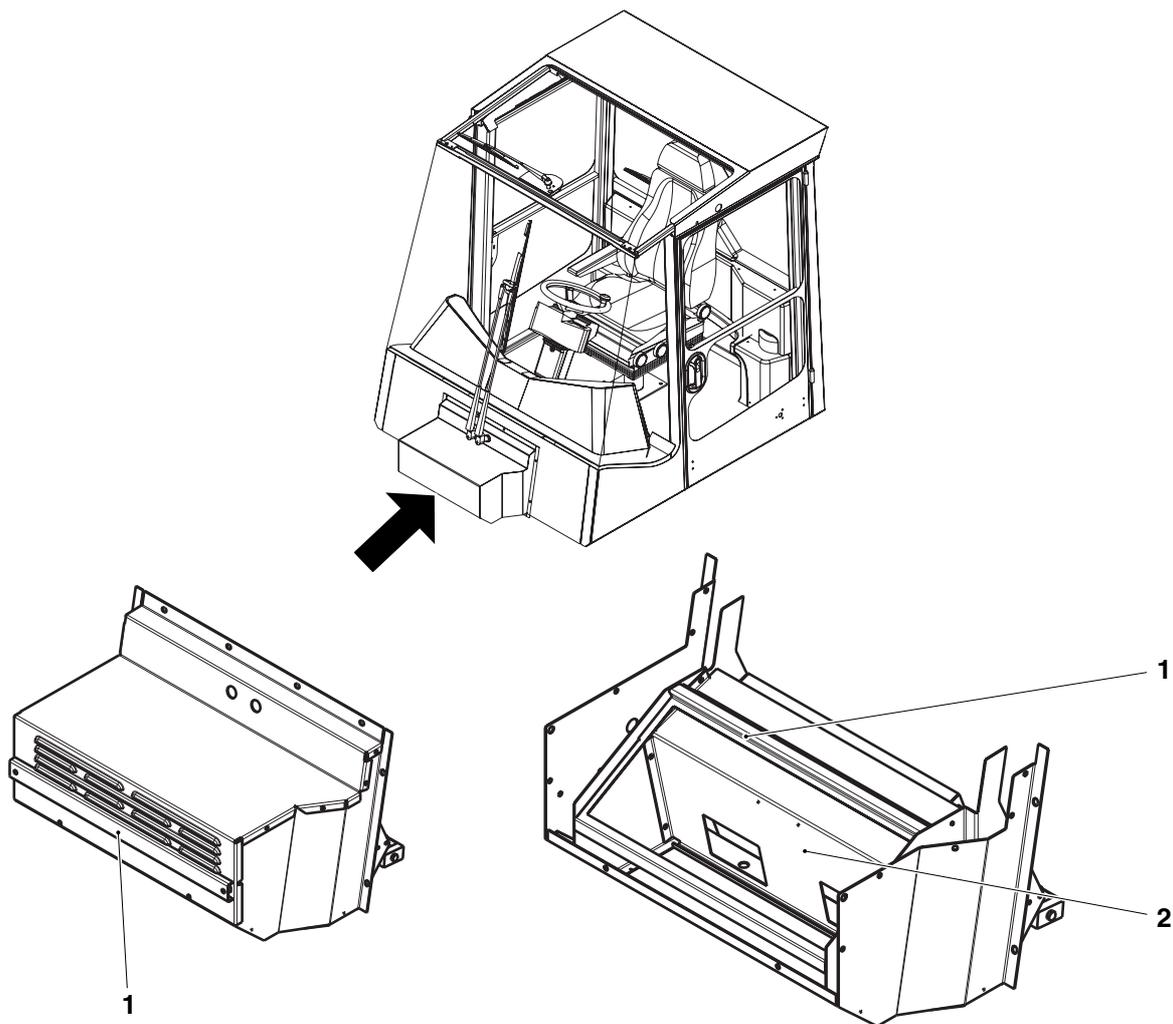
003208

## 9.4.2 Fresh air damper or recirculation damper

### Fresh air filter or recirculation damper, description

The damper is controlled electrically and controls the air between fully open for fresh air to recirculation of air. The damper is located in the external unit for fresh air inlet to the cab.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.4.6 *CLIMATE*, menu 6.



*Fresh air inlet cab*

1. Fresh air filter
2. Fresh air filter and recirculation damper

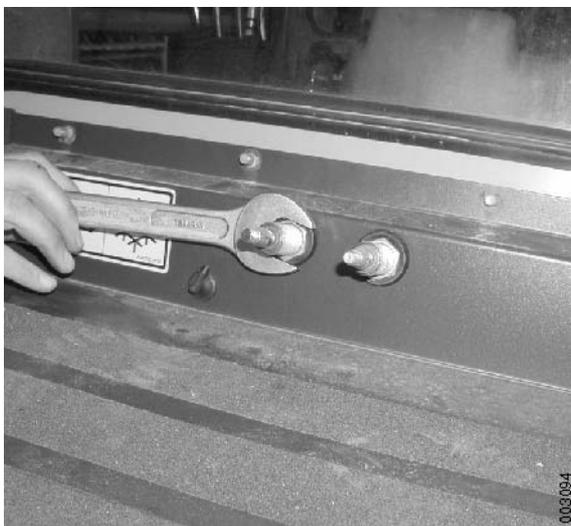
003208

### Motor, fresh air filter or recirculation damper, replacement

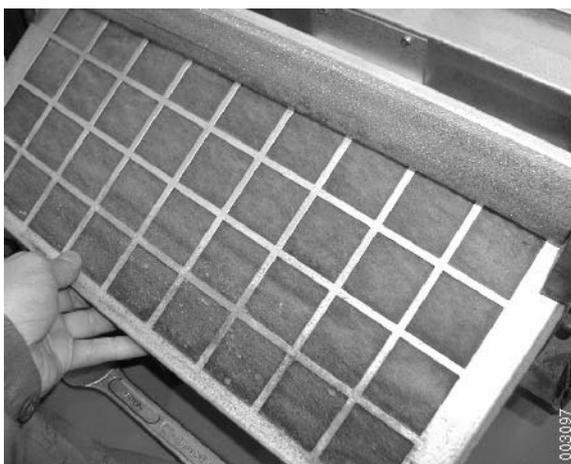
- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the wiper arms.

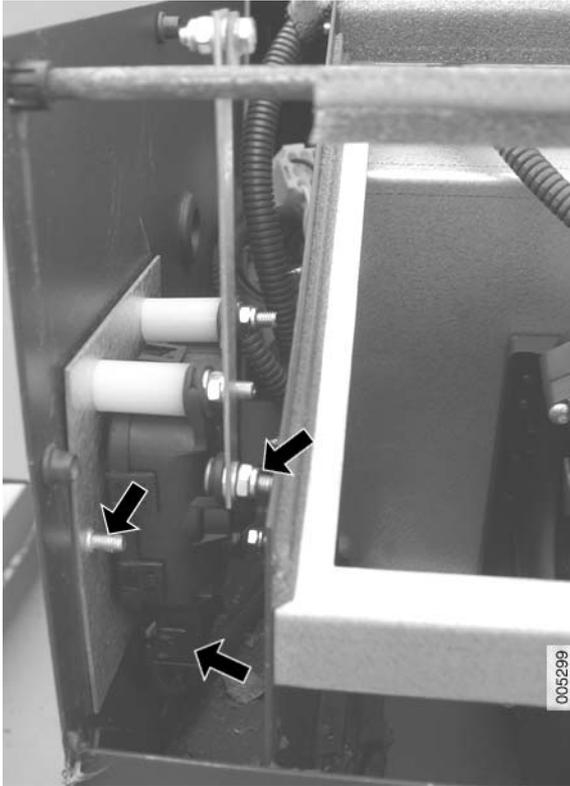


- 3 Remove the nuts which hold the wiper motor in the protective plate.
- 4 Remove the protective plate.



- 5 Remove the fresh air filter.





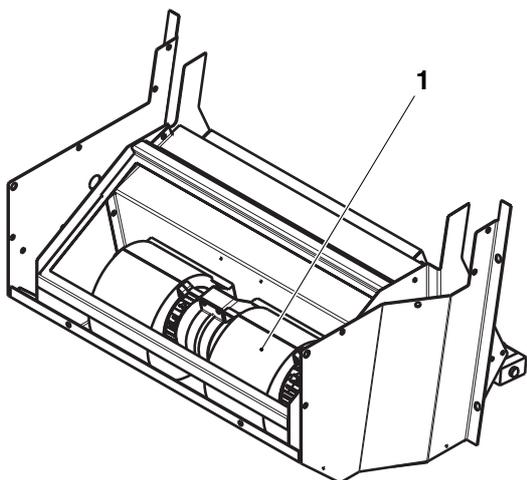
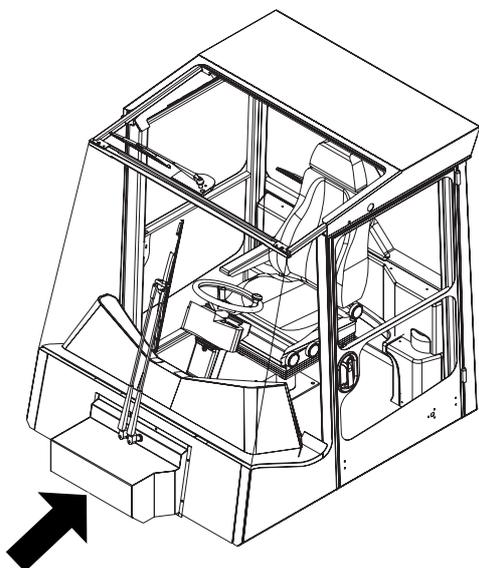
- 6 Remove the bolts which secure the arm and motor in the plate.
- 7 Detach the connector from the motor.
- 8 Replace the motor.
- 9 Fit in the reverse order. Tighten the wiper arm with 16-20 Nm.

### 9.4.3 Cab fan

#### Cab fan, description

The cab fan is located in the external unit for fresh air inlet to the cab. The fan consists of two single fans driven by one motor.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.4.6 *CLIMATE*, menu 6.



003209

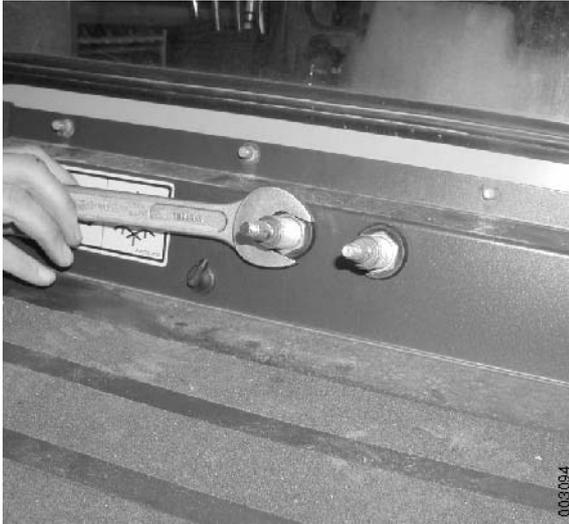
Fresh air inlet cab  
1. Cab fan

#### Cab fan, replacement

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the wiper arms.



003079

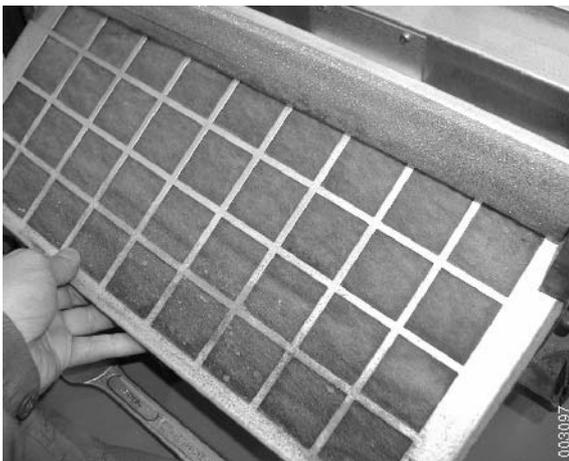


3 Remove the bolts which secure the wiper motor in the protective plate.

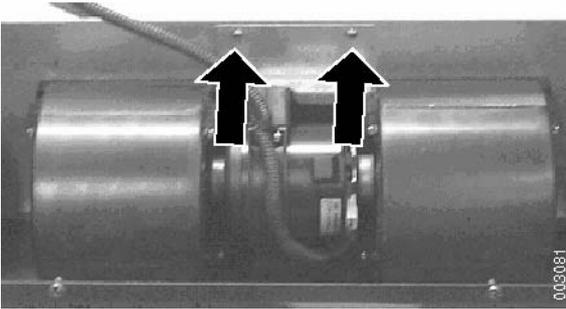
4 Remove the protective plate.



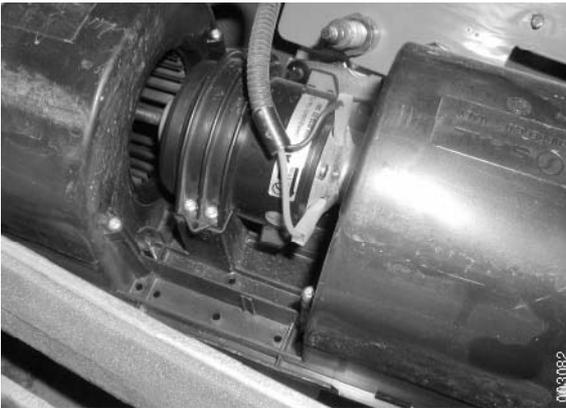
5 Detach the washer hose from the protective plate.



6 Remove the fresh air filter.



7 Remove the bolts which secure the plate and cab fan.



8 Detach the connector from the cab fan.

9 Remove the cab fan.

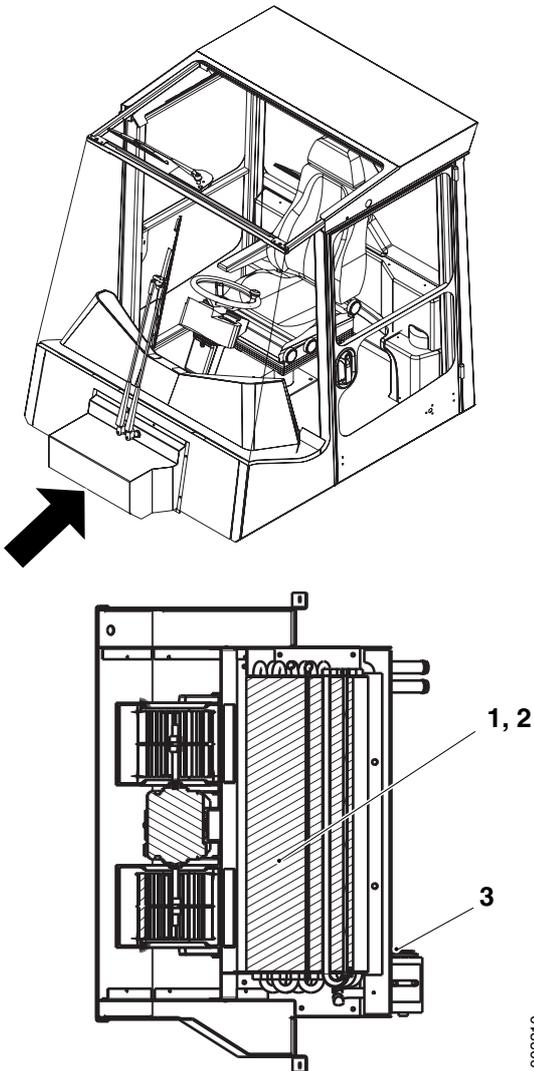
10 Replace the cab fan.

11 Fit in the reverse order. Tighten the wiper arm with 16-20 Nm.

## 9.4.4 Heat exchanger heat

### Heat exchanger heat, description

The heat from the engine's coolant is transmitted to the cab via the heat exchanger. The heat exchanger is located behind the fan in the external unit for fresh air inlet to the cab.



Fresh air inlet cab

- 1. Heat exchanger, heating
- 2. Heat exchanger, cooling
- 3. Expansion tank valve and sensor for refrigerant temperature

003210

## Heat exchanger, cooling/heating, replacement

### **WARNING**

**Personal injury, environmental damage**

**Read the safety instructions for refrigerant, see section *B Safety*.**

- 1 Machine in service position, see tab *B Safety*.
- 2 Drain the AC system of R134a refrigerant.

### **IMPORTANT**

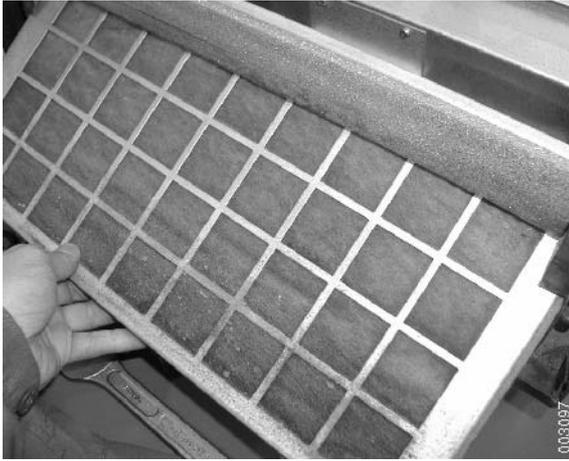
**Working on the air conditioning requires special authorization.**

- 3 Detach the AC system hoses and the coolant hoses.
- 4 Remove the wiper arms.
- 5 Remove the nuts which hold the wiper motor in the protective plate.
- 6 Remove the protective plate.

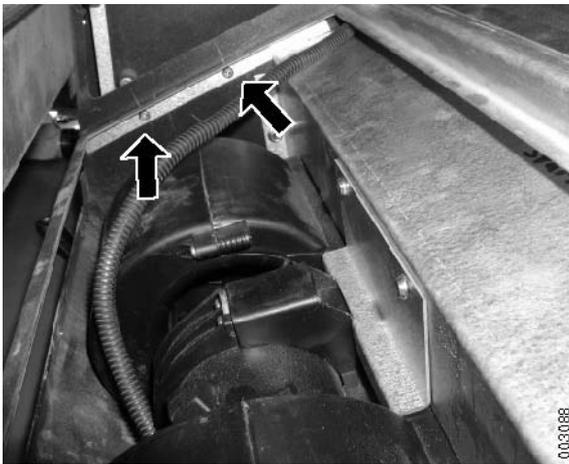


- 7 Detach the washer hose from the protective plate.

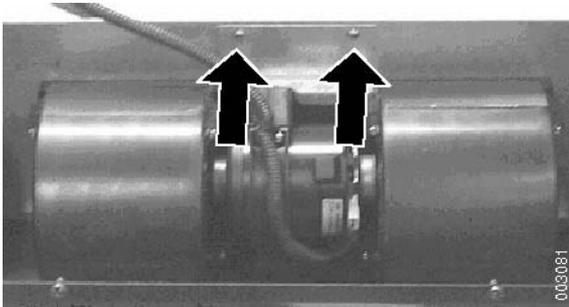




8 Remove the fresh air filter.



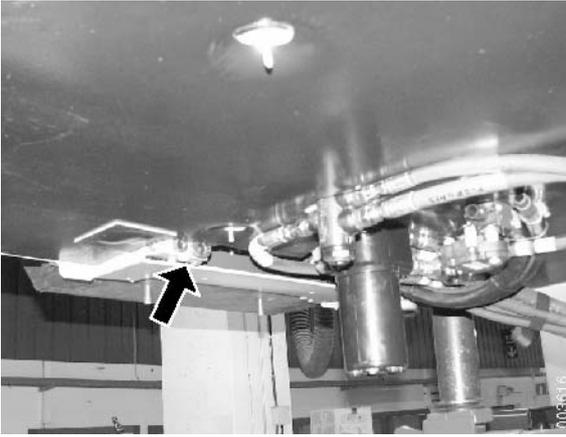
9 Remove the plate frame.



10 Remove the cab fan.



11 Remove the heat exchanger cover plate.



- 12 Detach all fluid inlets and outlets from the heat exchanger.
- 13 Lift out the heat exchanger carefully.
- 14 Change the heat exchanger.
- 15 Fit in the reverse order. Tighten the wiper arm to 16-20 Nm.
- 16 Check for leaks and refill the AC-system with refrigerant R134a, with the intended equipment.

For volume, see tab *F Technical data*.

## IMPORTANT

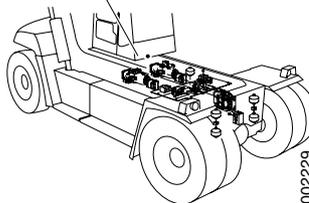
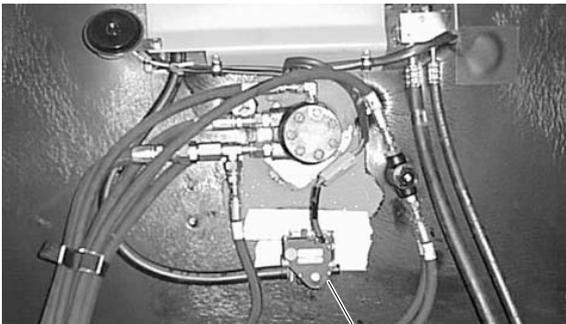
**Working on the air conditioning requires special authorization.**

### 9.4.5 Water valve

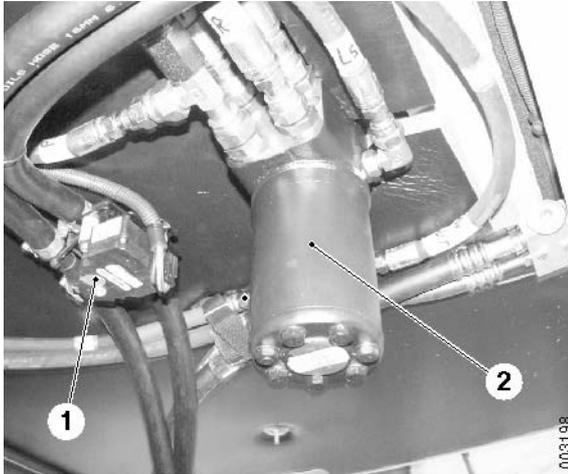
#### Water valve, description

The water valve controls the climate control unit's capacity for heating from 0 (closed valve) to 100 % (open valve). The water valve is electrically controlled.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.4.1 *CLIMATE, menu 1*, 8.4.4.4 *CLIMATE, menu 4* and 8.4.4.7 *CLIMATE, menu 7*.



Water valve position under cab floor (from below)



1. Water valve  
2. Steering valve

### Water valve, replacement

- 1 Machine in service position, see tab *B Safety*.
- 2 Detach the connector from the water valve.
- 3 Stop the flow of fluid to and from the water valve using hose pliers.
- 4 Detach the coolant hoses from the water valve.
- 5 Remove the water valve from the cab floor.
- 6 Change the water valve.
- 7 Fit in the reverse order.
- 8 Check the coolant level.

## 9.4.6 Sensor engine temperature

### Sensor, engine temperature, description

Sensor coolant temperature is located on the engine and senses the engine's coolant temperature, see supplier documentation engine.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.4.2 *CLIMATE*, menu 2.

For position, see tab 1 *Engine*

## 9.4.7 AC-compressor

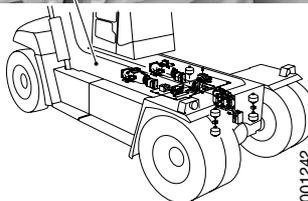
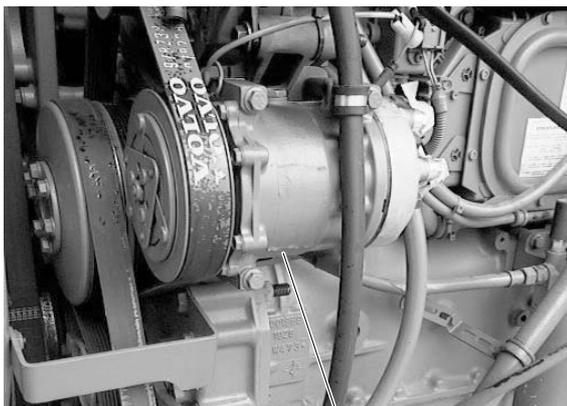
### Compressor air conditioning, description (engine alternative Volvo)

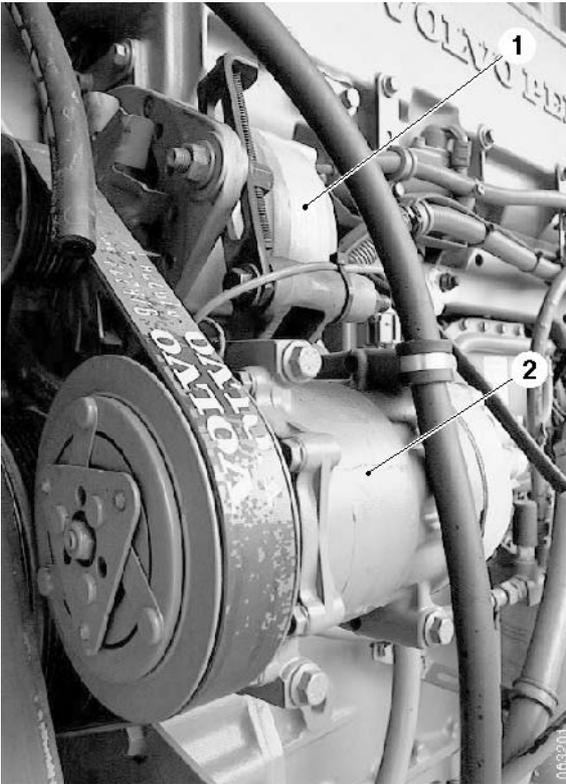


The compressor drives the climate control system by working as a pump. It draws in cold, low-pressure gas from the evaporator, compresses the gas which then becomes warm, and then forces out high-pressure gas to the condenser.

The compressor is driven by V-belts directly by the machine's engine. Activation and deactivation of the compressor is handled by a magnet clutch, controlled by a thermostat.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.4.6 *CLIMATE*, menu 6.



**Compressor, changing (engine alternative Volvo)**

1. Alternator, belt tensioner
2. Compressor

## **WARNING**

**Personal injury, environmental damage**

**Read the safety instructions for refrigerant, see section *B Safety*.**

- 1 Machine in service position, see tab *B Safety*.
- 2 Drain the AC system of R134a refrigerant.

## **IMPORTANT**

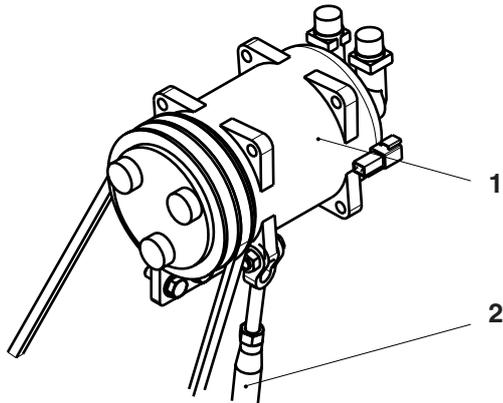
**Working on the air conditioning requires special authorization.**

- 3 Detach the coolant hoses from the compressor.
- 4 Loosen the belt tensioner so that the compressor belt is released.
- 5 Remove the bolts which secure the compressor.
- 6 Replace the compressor.
- 7 Fit in the reverse order.
- 8 Check for leaks and refill the AC-system with refrigerant R134a, with the intended equipment.

For volume, see tab *F Technical data*.

## **IMPORTANT**

**Working on the air conditioning requires special authorization.**



005000

1. Compressor air conditioning
2. Turnbuckle

### Compressor air conditioning, description (engine alternative Cummins QSM11)

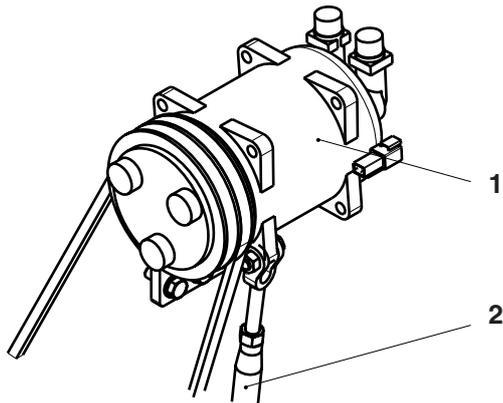


The compressor drives the climate control system by working as a pump. It draws in cold, low-pressure gas from the evaporator, compresses the gas which then becomes warm, and then forces out high-pressure gas to the condenser.

The compressor is driven by V-belts directly by the machine's engine. Activation and deactivation of the compressor is handled by a magnet clutch, controlled by a thermostat.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.4.6 *CLIMATE*, menu 6.

### Compressor, changing (engine alternative Cummins QSM11)



005000

1. Compressor air conditioning
2. Turnbuckle



## WARNING

**Personal injury, environmental damage**

**Read the safety instructions for refrigerant, see section B Safety.**

- 1 Machine in service position, see tab B Safety.
- 2 Drain the AC system of R134a refrigerant.

## IMPORTANT

**Working on the air conditioning requires special authorization.**

- 3 Detach the coolant hoses from the compressor.
- 4 Loosen the turnbuckle so that the compressor belt is released.
- 5 Remove the bolts which secure the compressor.
- 6 Replace the compressor.
- 7 Fit in the reverse order.
- 8 Check for leaks and refill the AC-system with refrigerant R134a, with the intended equipment.

For volume, see tab *F Technical data*.

## IMPORTANT

**Working on the air conditioning requires special authorization.**

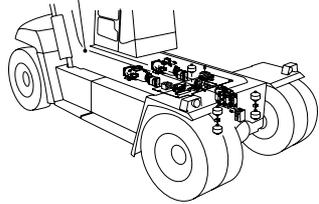
### 9.4.8 Condenser

#### Condenser, description



The condenser is located on the radiator in the engine compartment. The function of the condenser is to convert the hot, high-pressure gas from the compressor to liquid form. Pipes and cooling fins in the condenser battery absorb the heat, which is dissipated with a fan.

The refrigerant temperature in the condenser varies from approx. 50 °C to 70 °C, and the pressure between 12 and 14 bar, depending on the ambient temperature and air flow through the condenser. When the refrigerant has condensed to liquid, it is forced on to the fluid reservoir/filter dryer.



002228

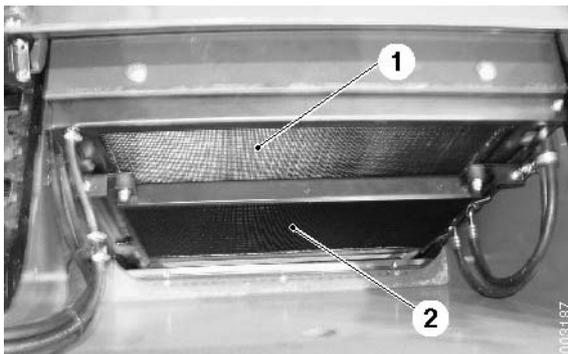
#### Condenser, replacement



## WARNING

**Personal injury, environmental damage**

**Read the safety instructions for refrigerant, see section *B Safety*.**



- 1. Radiator
- 2. Condenser

003187

- 1 Machine in service position, see tab *B Safety*.
- 2 Drain the AC system of R134a refrigerant.

## IMPORTANT

**Working on the air conditioning requires special authorization.**

- 3 Detach the inlet and outlet hoses from the condenser.
- 4 Remove the bolts which secure the condenser at the top edge and lift the condenser out in a suitable way.
- 5 Replace the condenser, fitting it in the reverse order.
- 6 Check for leaks and refill the AC-system with refrigerant R134a, with the intended equipment.

For volume, see tab *F Technical data*.

## IMPORTANT

**Working on the air conditioning requires special authorization.**

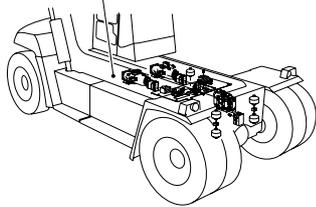
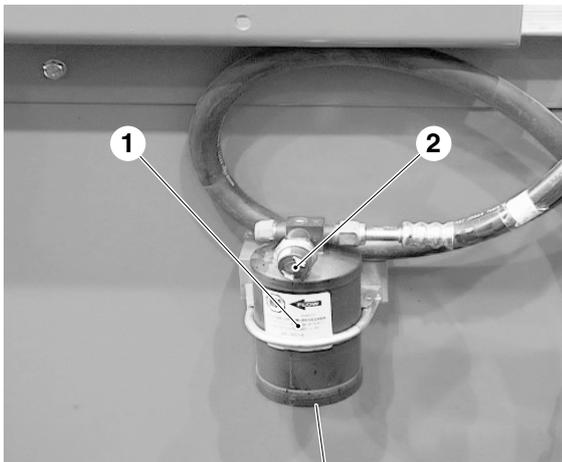
### 9.4.9 Humidity filter

#### Moisture filter, description



The moisture filter collects the liquid refrigerant, binds moisture and filters impurities. The reservoir functions as an expansion tank in the cooling circuit.

When the refrigerant has passed through the dryer in the bottom of the fluid reservoir, it rises through a standpipe. Through a sight glass, it is possible to check that flow is without bubbles and that the system is adequately filled with refrigerant.



002227

1. Fluid reservoir moisture filter
2. Pressure monitor

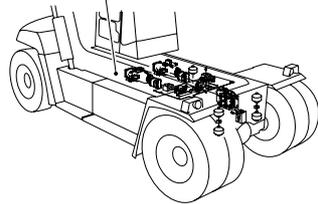
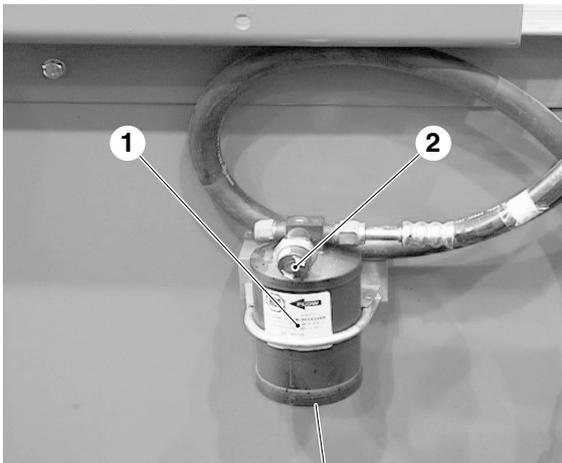
## 9.4.10 Pressure monitor

### Pressure monitor, description



The pressure monitor cuts off the current to the compressor's magnet clutch if the pressure in the cooling circuit becomes abnormally high or low.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.4.3 *CLIMATE*, menu 3.



002227

1. Fluid reservoir moisture filter
2. Pressure monitor

### Pressure switch, replacement



## WARNING

**Personal injury, environmental damage**

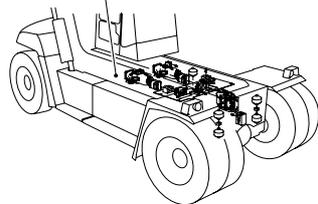
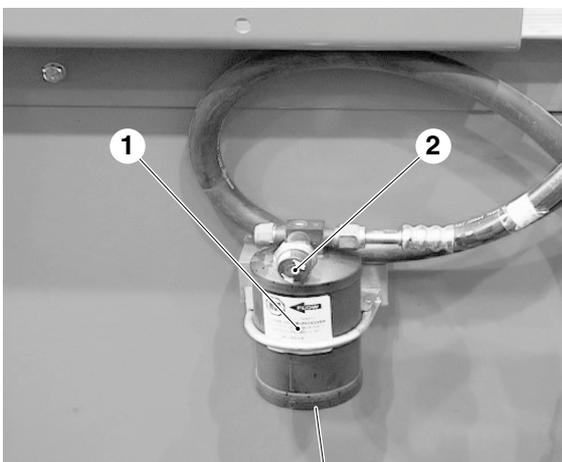
**Read the safety instructions for refrigerant, see section B Safety.**

- 1 Machine in service position, see tab B Safety.
- 2 Drain the machine of refrigerant, R134a.

## IMPORTANT

**Working on the air conditioning requires special authorization.**

- 3 Disconnect the connector from the pressure monitor.
- 4 Unscrew the pressure switch from its mounting.
- 5 Replace the pressure switch.



002227

1. Fluid reservoir moisture filter
2. Pressure switch.

- 6 Check for leaks and refill the AC-system with refrigerant R134a, with the intended equipment.

For volume, see tab *F Technical data*.

## IMPORTANT

**Working on the air conditioning requires special authorization.**

### 9.4.11 Expansion valve

#### Expansion valve, description



The expansion valve is the part in the circuit that separates the high-pressure side from the low-pressure side. The refrigerant arrives at the expansion valve under high pressure and leaves it under low pressure. After the expansion valve, the refrigerant converts to a gaseous state and is transported to the compressor once again.

The amount of refrigerant that passes the evaporator varies depending on the heat load. The valve works from fully open to fully closed and searches between these for an optimal evaporation point.

#### Expansion valve, replacement



## WARNING

**Personal injury, environmental damage**

**Read the safety instructions for refrigerant, see section *B Safety*.**

- 1 Machine in service position, see tab *B Safety*.
- 2 Drain the AC system of refrigerant.

## IMPORTANT

**Working on the air conditioning requires special authorization.**

- 3 Detach the AC system hoses.
- 4 Detach the coolant hoses.
- 5 Remove the heat exchanger for cooling/heating to access the expansion valve, see *Heat exchanger, cooling/heating, replacement page 41*.

- 6 Replace the expansion valve.
- 7 Fit in the reverse order.
- 8 Check for leaks and refill the AC-system with refrigerant R134a, with the intended equipment.

For volume, see tab *F Technical data*.

## IMPORTANT

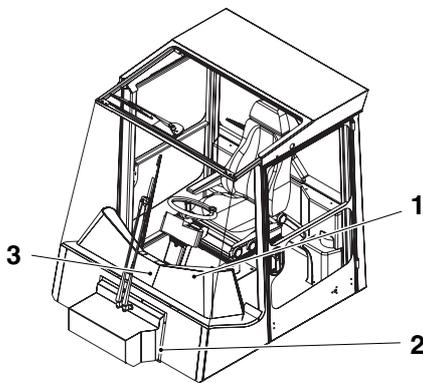
**Working on the air conditioning requires special authorization.**

### 9.4.12 Sensor coolant temperature

#### Sensor temperature in refrigerant, description

Sensor, refrigerant temperature (position 2), senses the refrigerant temperature in the heat exchanger cooling, this is used to control the air conditioning.

The signal can be checked from the diagnostic menu, section 8 *Control system*, group 8.4.4.2 *CLIMATE*, menu 2.



002226

1. Sensor, cab temperature
2. Sensor, refrigerant temperature 
3. Sensor, outlet fan temperature

## Sensor, refrigerant temperature, replacement



### WARNING

**Personal injury, environmental damage**

**Read the safety instructions for refrigerant, see section *B Safety*.**

### IMPORTANT

**Working on the air conditioning requires special authorization.**

### NOTE

*Requires special authorisation.*

- 1 Machine in service position, see tab *B Safety*.
- 2 Drain the AC system of refrigerant.

### IMPORTANT

**Working on the air conditioning requires special authorization.**

- 3 Detach the AC system hoses from the heat exchanger.
- 4 Detach the coolant hoses from the heat exchanger.
- 5 Detach the heat exchanger to access the refrigerant temperature sensor, see *Heat exchanger, cooling/heating, replacement page 41*.
- 6 Replace the temperature sensor.
- 7 Fit in the reverse order.
- 8 Check for leaks and refill the AC-system with refrigerant R134a, with the intended equipment.

For volume, see tab *F Technical data*

### IMPORTANT

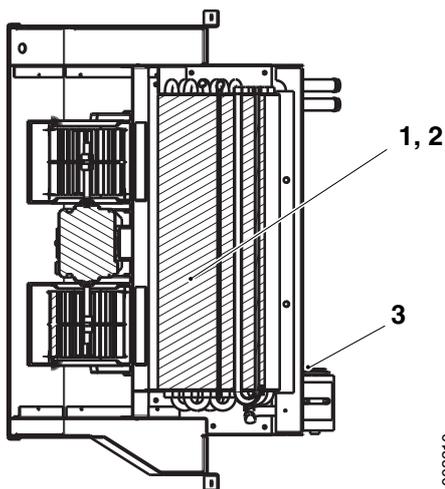
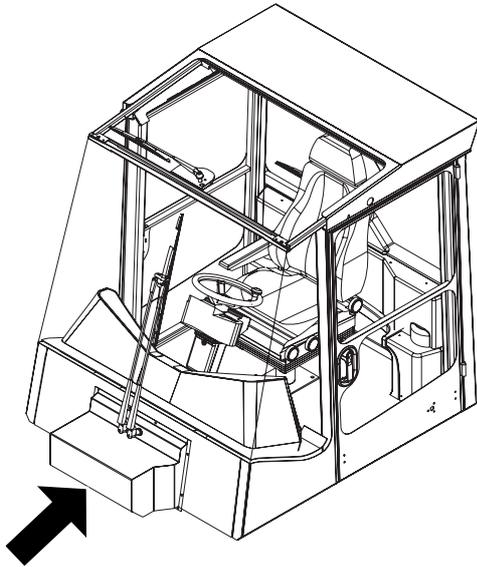
**Working on the air conditioning requires special authorization.**

### 9.4.13 Heat exchanger cooling

#### Heat exchanger cooling, description



Heat exchanger cooling consists of pipes and fins. The cab air is cooled when it passes through the cooling heat exchanger. The heat exchanger is located behind the fan in the external unit for fresh air inlet to the cab.



003210

Fresh air inlet cab

- 1. Heat exchanger, heating
- 2. Heat exchanger, cooling
- 3. Expansion tank valve and sensor for refrigerant temperature

#### Heat exchanger cooling, replacement

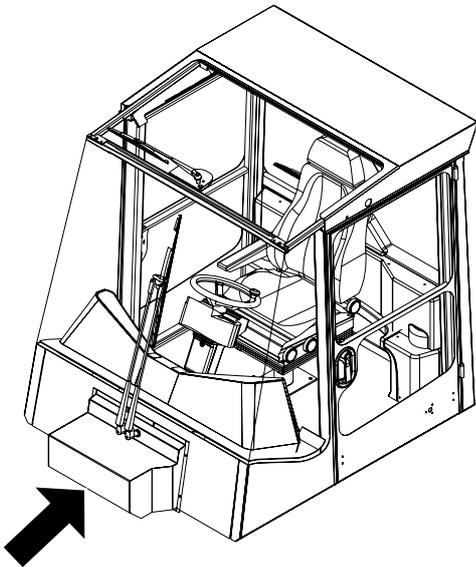
See *Heat exchanger, cooling/heating, replacement page 41.*

## 9.4.14 Air distributor

### Air distributor, description

The air distributor controls the air between defroster and floor and is located behind the panel inside the cab, the damper is controlled electrically by the Control and monitoring system.

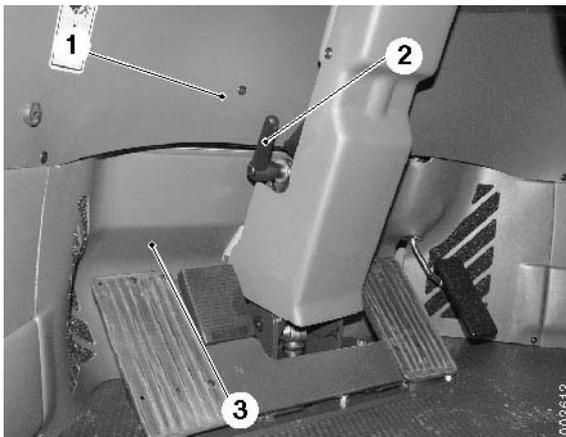
The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.4.4 *CLIMATE*, menu 4, 8.4.4.5 *CLIMATE*, menu 5 and 8.4.4.8 *CLIMATE*, menu 8.



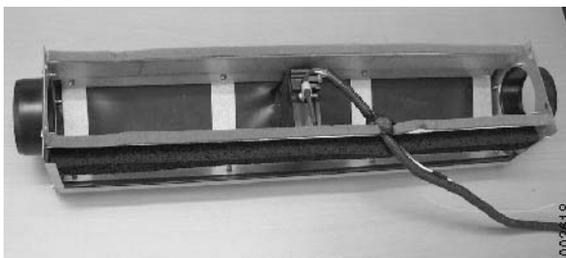
002230

### Air distributor, replacement

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the dashboard panel.
- 3 Remove the steering wheel shaft cover.
- 4 Detach the steering wheel shaft and angle it back against the driver's seat.
- 5 Remove the lower cover in front of the pedal bracket.
- 6 Detach the air hoses from the air distributor and detach the connector.
- 7 Remove the air distributor from its mounting.
- 8 Replace the air distributor, fitting it in the reverse order.



1. Dashboard panel
2. Steering wheel shaft adjustment
3. Lower protective cover



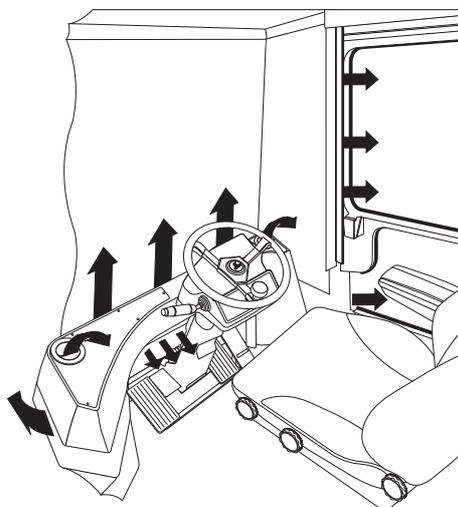
Air distributor

## 9.4.15 Air vents

### Air vents, description

There are a number of fixed air vents in the cab's interior: at the front of the doors and the defroster for the windshield. There are also two adjustable air vents (flow and direction) in the instrument panel's outside corners.

There is an air inlet towards the cab's lower part (floor).



001839

### Defroster nozzles, replacement

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the air damper manually.
- 3 Remove the bolts which hold the other section of the defroster nozzle in the dashboard.



003002



- 4 Detach the air hose from the defroster nozzle.
- 5 Replace the defroster nozzle.

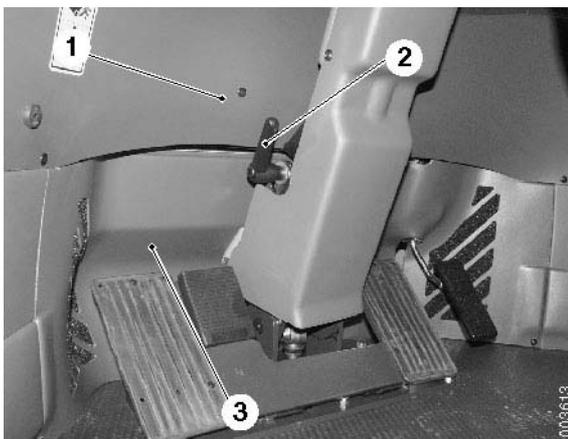
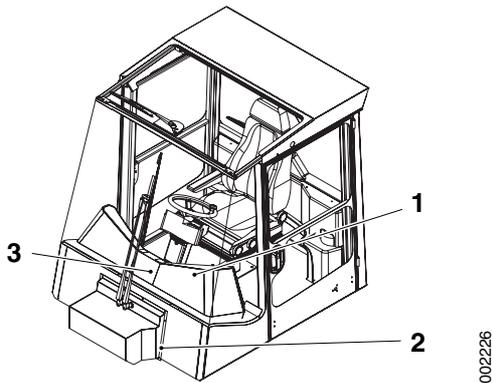
## 9.4.16 Sensor temperature fan air out

### Sensor temperature outlet fan, description

Sensor temperature outlet fan (position 3) senses the temperature of the air that blows out in the air vents. The air conditioning is controlled by signals from the following sensors:

1. Sensor cab temperature
2. Sensor, refrigerant temperature
3. Sensor, outlet fan temperature

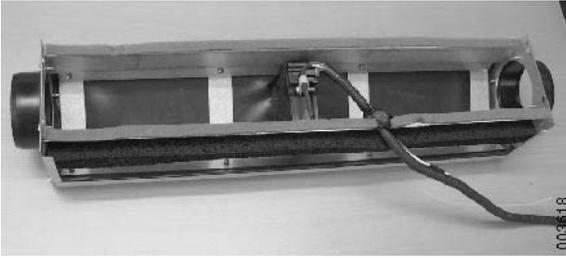
The signal can be checked from the diagnostic menu, section *8 Control system*, group *8.4.4.2 CLIMATE*, menu 2.



1. Dashboard panel
2. Steering wheel shaft adjustment
3. Lower protective cover

### Sensor, outlet fan temperature, replacement

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the dashboard panel.
- 3 Remove the lower protective cover in front of the steering wheel shaft.
- 4 Detach the steering wheel shaft and angle it back against the driver's seat.



Air distributor including temperature sensor.

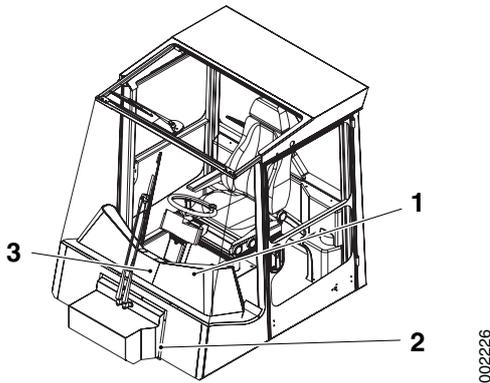
- 5 Detach the temperature sensor from the air distributor.
- 6 Fit in the reverse order.

## 9.4.17 Sensor cab temperature

### Sensor cab temperature, description

Sensor cab temperature (position 1) senses the temperature of the air in the cab.

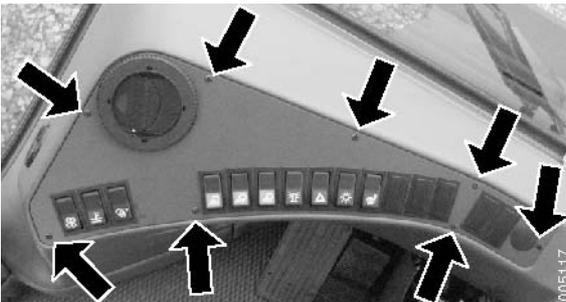
The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.4.1 *CLIMATE*, menu 1

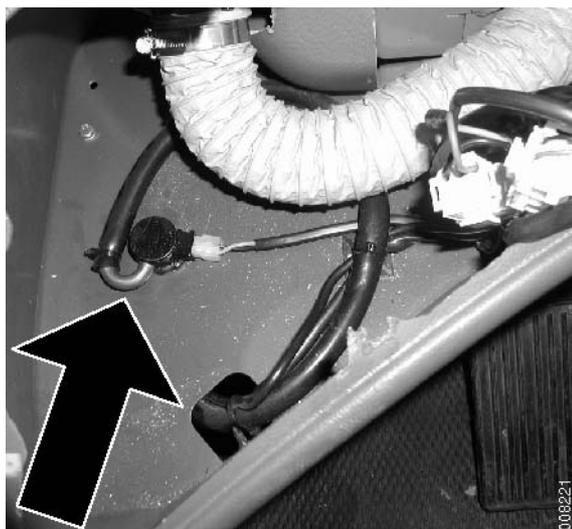


1. Sensor, cab temperature
2. Sensor, refrigerant temperature
3. Sensor, outlet fan temperature

### Sensor, cab temperature, replacement

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the dashboard panel.





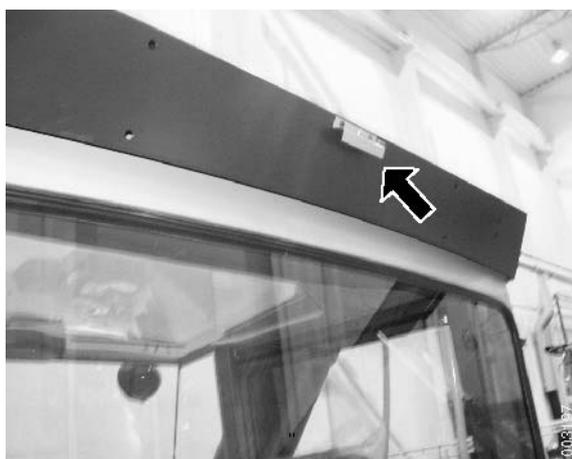
- 3 Detach the hose from the temperature sensor.
- 4 Detach the connector from the temperature sensor.
- 5 Remove the temperature sensor.
- 6 Replace the temperature sensor.
- 7 Fit in the reverse order.

### 9.4.18 Sensor outer temperature

#### Sensor ambient temperature, description

Sensor ambient temperature senses the temperature of the air outside the cab.

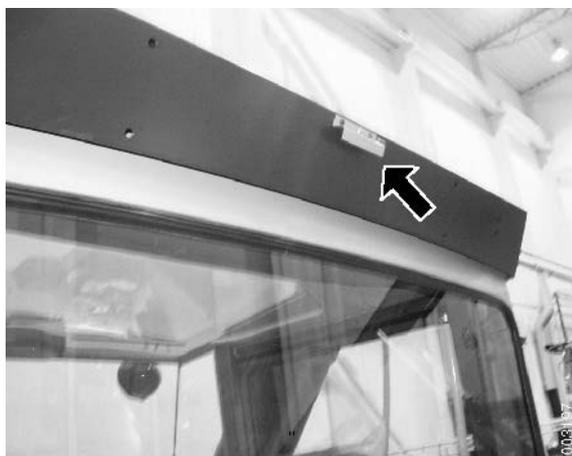
The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.4.2 *CLIMATE*, menu 2



Sensor ambient temperature

#### Sensor, ambient temperature, replacement

- 1 Machine in service position, see tab *B Safety*.
- 2 Detach the connector from the temperature sensor.
- 3 Remove the temperature sensor from its mounting in the cab.
- 4 Replace the temperature sensor.
- 5 Fit in the reverse order.



## 9.5 Wiper/washer system

### 9.5.1 Wiper front

#### Wiper front, description

The front wiper is the parallel wiper type, i.e. the wiper blade is moved in a constant vertical manner over the windscreen.



### 9.5.2 Wiper roof

#### Wiper roof, description

Wiper roof are of the type sector wiper. Wiping angle is approx. 180 degrees.

### 9.5.3 Wiper rear

#### Wiper rear, description

The rear wiper is a sector wiper type. The wiping angle is approx. 180 degrees.

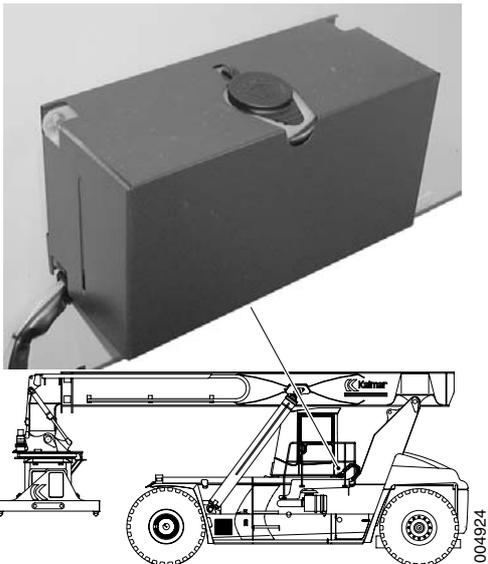
### 9.5.4 Washer motor and reservoir

#### Washer motor and reservoir, description

Washer motors are located on the washer fluid reservoir. There are non-return valves on the lines from the reservoir to the washer nozzles, preventing the washer fluid from draining back in the line between washings. This minimizes the time from activation of switch washing and washer fluid spraying on the windshield.

The washer nozzles are mounted on the wiper arms.

The signal can be checked from the diagnostic menu, see section 8 *Control system, group 8.4.3.1 CAB, menu 1.*





A B

003619

Washer fluid reservoir without protective plate.

A. Washer fluid reservoir

B. Washer motors

### Washer motor and container, replacement

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the protection over the washer fluid reservoir.
- 3 Drain the washer fluid from the container.
- 4 Remove the washer motors from the fluid reservoir.
- 5 Remove the bolts which secure the fluid container in the cab wall.
- 6 Change the washer fluid reservoir. Change the washer motor, if needed.

## 9.5.5 Wiper motor front

### Wiper motor front, description

The wiper motor drives the front windshield's wiper. The wiper arm is mounted on the motor. The motor produces the movement of the wiper.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.3.2 *CAB*, menu 2.

### Wiper motor (front), replacement

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the wiper arms.
- 3 Remove the nuts which secure the motor in the protective plate.
- 4 Remove the protective plate.
- 5 Detach the washer hose from the protective plate.



003079



- 6 Remove the nuts which secure the motor in the cab.
- 7 Detach the connector from the wiper motor.
- 8 Replace the motor.
- 9 Fit in the reverse order. Tighten the wiper arms with 16-20 Nm.

## 9.5.6 Wiper motor roof

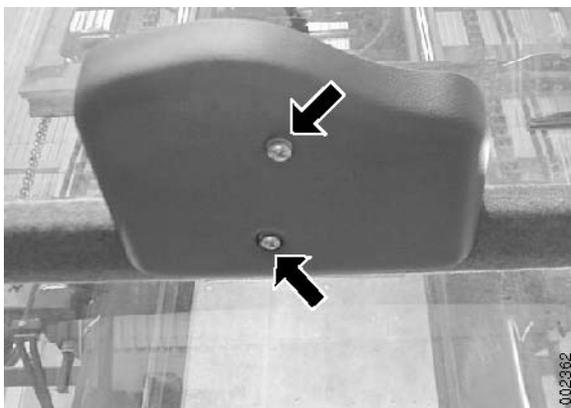
### Wiper motor roof, description

The wiper motor drives the roof window's wiper. The wiper arm is mounted on the motor. The motor produces the movement of the wiper.

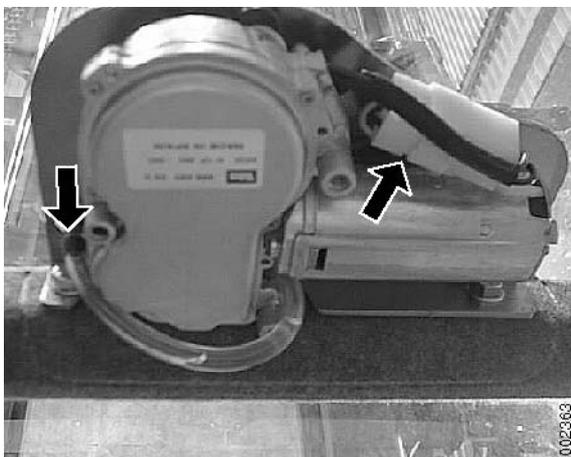
The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.3.4 *CAB*, menu 4.

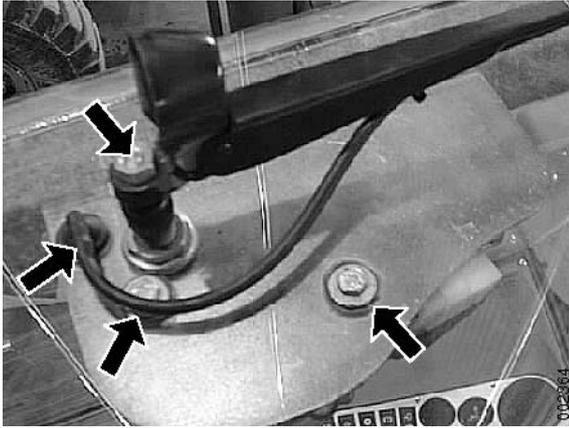
### Wiper motor (roof), replacement

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the plastic cover.



- 3 Detach the washer hose and the connector to the wiper motor.





- 4 Undo the lock nut securing the wiper arm and disconnect the washer fluid hose.
- 5 Remove and replace the wiper motor.
- 6 Fit in the reverse order. Tighten the wiper arm with 16-20 Nm.

## 9.5.7 Wiper motor rear

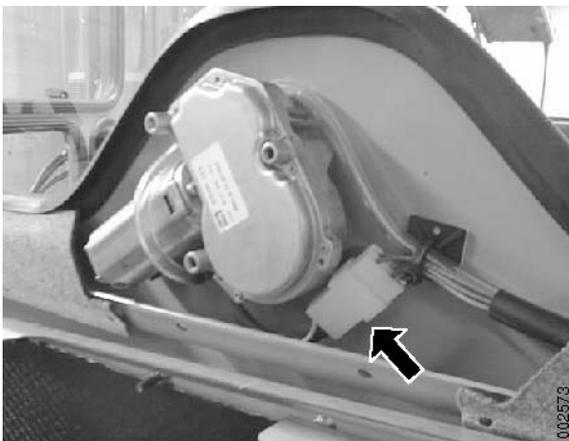
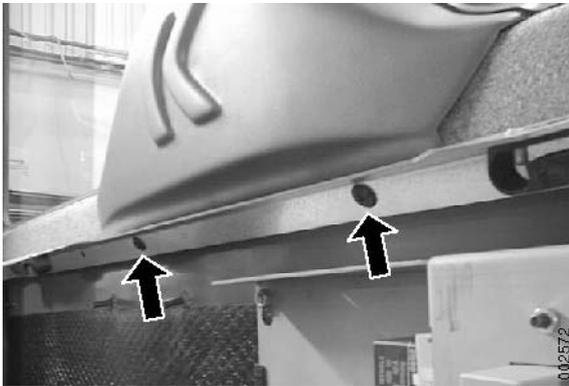
### Wiper motor rear, description

The wiper motor drives the rear window's wiper. The wiper arm is mounted on the motor. The motor produces the movement of the wiper.

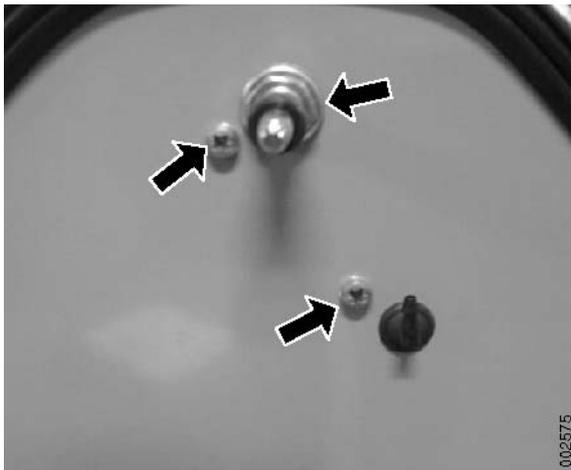
The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.3.3 *CAB*, menu 3.

### Wiper motor (rear), replacement

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the panels behind the operator's seat.
- 3 Remove the bolts which secure the plastic cover over the wiper motor.



- 4 Unplug the connector from the motor.
- 5 Raise the plastic cover and remove the nut securing the wiper arm. Disconnect the washer hose.



- 6 Remove the bolts which secure the motor and the lock nut on the motor.
- 7 Change the wiper motor.
- 8 Fit in the reverse order. Tighten the wiper arms with 16-20 Nm.

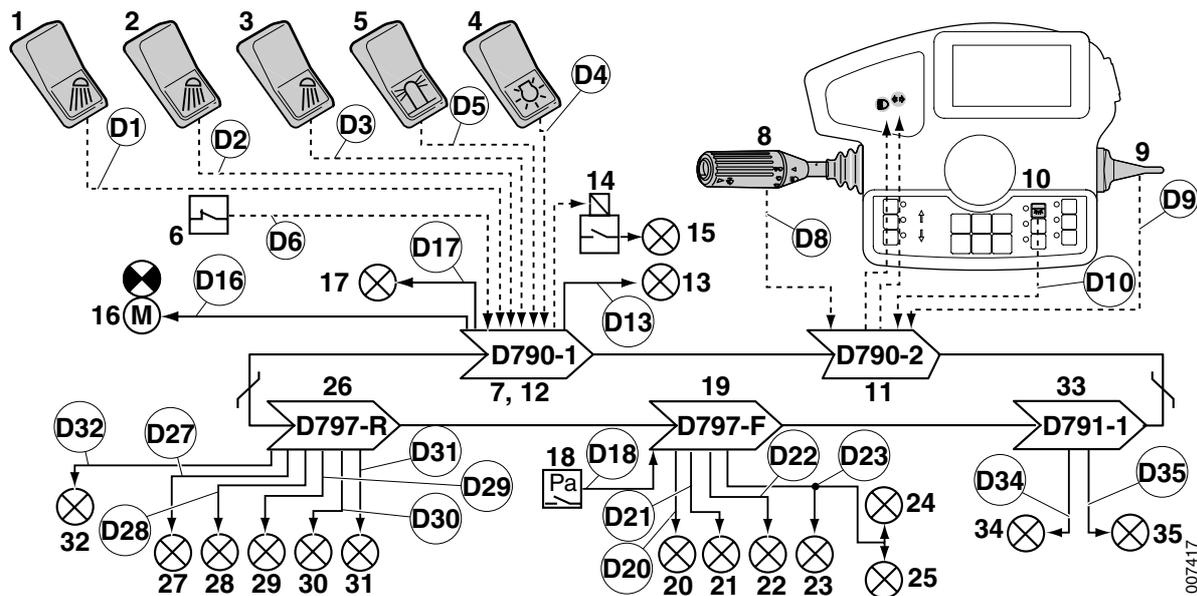
## 9.6 Lighting system

### Lighting system, function description

Lighting is shut off automatically after 5 minute's idling in order to not discharge the batteries. Extra work lights are shut off after 2 minutes. Lighting is activated automatically again when the operator sits in the seat, selects a gear or if the gas pedal is pressed.

### NOTE

It is important that the right bulb is used for respective area. See tab F Technical data.



Pos	Explanation	Signal description	Reference
1	Switch work lights cab (S105-1) sends voltage signal to Control unit cab (D790-1).	Switch in position on: U = 24 V	D1: Diagnostic menu, see section 8 Control system group 8.4.2.1 LIGHTS, menu 1
2	Switch work lights attachment (S105-2) sends voltage signal to Control unit cab (D790-1).	Switch in position on: U = 24 V	D2: Diagnostic menu, see section 8 Control system group 8.4.2.2 LIGHTS, menu 2
3	Switch work lights boom (S105-3) sends voltage signal to Control unit cab (D790-1).	Switch in position on: U = 24 V	D3: Diagnostic menu, see section 8 Control system group 8.4.2.3 LIGHTS, menu 3
4	Switch headlights (S100) sends voltage signal to Control unit cab (D790-1).	Switch in position on: U = 24 V	D4: Diagnostic menu, see section 8 Control system group 8.4.2.4 LIGHTS, menu 4
5	Switch rotating beacon (S110) sends voltage signal to Control unit cab (D790-1).	Switch in position on: U = 24 V	D5: Diagnostic menu, see section 8 Control system group 8.4.2.9 LIGHTS, menu 9
6	Break-contact door (S226-LE & S226-RI) sends voltage signal to Control unit cab (D790-1).	Door open: U = 24 V	Interior lighting cab, description page 72 D6: Diagnostic menu, see section 8 Control system group 8.4.2.12 LIGHTS, menu 12

7	Control unit cab (D790-1) sends messages to activate lights on the CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
8	Multi-function lever (S162) sends voltage signal to Control unit KIT (D790-2).	Lever in high beam position: $U_{S162/56a} = 24\text{ V}$	<i>Gear and multi-function lever, description page 12</i> D8: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.6 <i>LIGHTS</i> , menu 6
9	Lever direction indicators (S161) sends voltage signal to Control unit KIT (D790-2).	Left: $U_{S161/6} = 24\text{ V}$ Right: $U_{S161/1} = 24\text{ V}$	D9: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.7 <i>LIGHTS</i> , menu 7
10	Switch interior lighting on Control unit KIT (D790-2) sends voltage signal to Control unit KIT (D790-2).	Controlled by control and monitoring system, error shown with error code.	D10: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.12 <i>LIGHTS</i> , menu 12
11	Control unit KIT (D790-2) sends message to activate lights on the CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.11 <i>Control unit KIT</i>
12	Control unit cab (D790-1) supplies voltage to lights in and around the cab.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
13	Work lights cab (E404-1L & E404-1R) are lit when work lights cab are activated.	Light on: $U = 24\text{ V}$	<i>Working lights cab, description page 71</i> D13: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.1 <i>LIGHTS</i> , menu 1
14	 Relay extra work lights boom (K304) is activated when work lights boom are activated and supplies voltage to Extra work lights boom (E404-5L & E404-5R).	$U_{K304/30} = 24\text{ V}$ $U_{K304/85} = 0\text{ V}$ Work lights boom lit: $U_{K304/86} = 24\text{ V}$ $U_{K304/87} = 24\text{ V}$ Work lights boom off: $U_{K304/86} = 0\text{ V}$ $U_{K304/87} = 0\text{ V}$	<i>Work lights boom, lighting page 71</i>
15	 Extra work lights boom (E404-5L & E404-5R) are lit when work lights boom are activated.	Light on: $U = 24\text{ V}$	<i>Work lights boom, lighting page 71</i>
16	Rotating beacon (H428) is lit when rotating work light is activated.	Light on: $U = 24\text{ V}$	<i>Revolving beacon, description page 70</i> D16: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.9 <i>LIGHTS</i> , menu 9

17	Interior lighting is lit when any door is opened or if interior lighting is activated with the switch on Control unit KIT (D790-2).	Light on: U = 24 V	<i>Interior lighting cab, description page 72</i> D17: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.12 <i>LIGHTS</i> , menu 12
18	Make-contact brake lights (S216) sends voltage signal to Control unit frame front (D797-F).	Brake pressure over 0.2 MPa: U = 24 V	Tab 4 <i>Brakes</i> , group 4.3.8 <i>Making contact brake light</i> D18: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.10 <i>LIGHTS</i> , menu 10
19	Control unit frame front (D797-F) supplies voltage to lights on front of machine.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i>
20	Direction indicators front (H422 & H423) are lit when direction indicators or hazard lights are activated.	Light on: U = 24 V	<i>Direction indicators, description page 70</i> D20: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.8 <i>LIGHTS</i> , menu 8
21	Running lights front (H416-1 & H417-1) are lit together with headlights.	Light on: U = 24 V	<i>Running lights, description page 69</i> D21: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.5 <i>LIGHTS</i> , menu 5
22	Headlights low beams (E400L & E400R) are lit when headlights are activated.	Light on: U = 24 V	<i>Headlights, description page 69</i> D22: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.6 <i>LIGHTS</i> , menu 6
23	Headlights high beams (E402L & E402R) are lit when high beams are activated.	Light on: U = 24 V	<i>Headlights, description page 69</i> D23: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.6 <i>LIGHTS</i> , menu 6
24	Extra work lights front (E404-7L & E404-7R) are lit at the same time as the high beams.	Light on: U = 24 V	
25	Extra work lights front (E404-8L & E404-8R) are lit at the same time as the high beams.	Light on: U = 24 V	
26	Control unit frame rear (D797-R) supplies voltage to lights on rear of machine.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i>
27	Tail lights (H412L & H412R) red are lit when headlights are activated.	Light on: U = 24 V	<i>Rear lights, description page 69</i> D27: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.5 <i>LIGHTS</i> , menu 5
28	Brake lights (H411L & H411R) are lit when the brake is activated.	Light on: U = 24 V	<i>Brake lights, description page 69</i> D28: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.11 <i>LIGHTS</i> , menu 11
29	Direction indicators rear (H426 & H427) are lit when direction indicators or hazard lights are activated.	Light on: U = 24 V	<i>Direction indicators, description page 70</i> D29: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.8 <i>LIGHTS</i> , menu 8

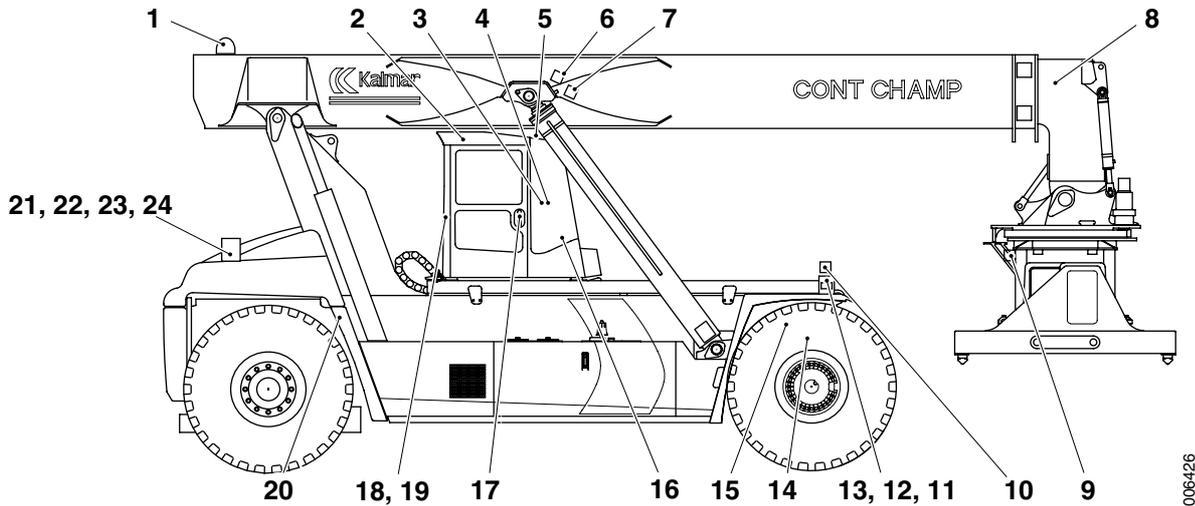
30	Running lights rear (H416-2 & H417-2) are lit when headlights are activated.	Light on: U = 24 V	<i>Running lights, description page 69</i> D30: Diagnostic menu, see section 8 Control system group 8.4.2.5 LIGHTS, menu 5
31	Tail lights (E405L & E405R) white are lit when reverse gear is selected.	Light on: U = 24 V	<i>Reversing lights, description page 70</i> D31: Diagnostic menu, see section 8 Control system group 8.4.2.11 LIGHTS, menu 11
32	Work lights boom (E404-3L & E404-3R) are lit when work lights boom are activated.	Light on: U = 24 V	<i>Work lights boom, lighting page 71</i> D32: Diagnostic menu, see section 8 Control system group 8.4.2.3 LIGHTS, menu 3
33	Control unit attachment (D791-1) supplies voltage to lights on attachment.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.5 <i>Control unit attachment</i>
34	Work lights attachment (E406-L & E406R) are lit when work lights attachment are activated.	Light on: U = 24 V	<i>Work lights attachment, description page 72</i> D34: Diagnostic menu, see section 8 Control system group 8.4.2.2 LIGHTS, menu 2
35 	Extra work lights attachment (E404-4L & E404-4R) are lit when work lights attachment are activated.	Light on: U = 24 V	<i>Work lights attachment, description page 72</i> D35: Diagnostic menu, see section 8 Control system group 8.4.2.2 LIGHTS, menu 2

## Lighting system, component position

The function of the lighting is to increase safety during operation and load handling. The following lighting is fitted to the machine:

### NOTE

*It is important that the right bulb is used for respective area. See tab F Technical data.*



- |   |  |
|---|--|
| 1. Rotating beacon (H428)   | 13. Headlights low beams (E400L & E400R)<br>Headlights high beams (E402L & E402R)                                |
| 2. Interior lighting  | 14. Make-contact brake lights (S216)   |
| 3. Control unit KIT (D790-2)                                      | 15. Control unit frame front (D797-F)  |
| 4. Multi-function lever (S162)                                    | 16. Switch, see tab 9 <i>Frame, body, cab and accessories</i> ,<br>group 9.1 <i>Controls and instrumentation</i> |
| 5. Work lights cab (E404-1L & E404-1R)                            | 17. Break-contact door (S226-LE & S226-RI)   |
| 6. Extra work lights boom (E404-5L & E404-5R)                     | 18. Control unit cab (D790-1)  |
| 7. Work lights boom (E404-3L & E404-3R)                           | 19. Relay extra work lights boom (K304)  |
| 8. Control unit attachment (D791-1)                               | 20. Control unit frame rear (D797-R)   |
| 9. Work lights attachment (E406-L & E406R)                        | 21. Running lights rear (H416-2 & H417-2)  |
| Extra work lights attachment (E404-4L & E404-4R)                  |  |
| 10. Extra work lights front (E404-7L, E404-8L, E404-7R & E404-8R) | 22. Back-up lights (E405L & E405R), white  |
| 11. Direction indicators front (H422 & H423)                      | 23. Rear lights (H421L & H412R) red<br>Brake lights (H411L & H411R)  |
| 12. Running lights front (H416-1 & H417-1)                        | 24. Direction indicators rear (H426 & H427)  |

006426

## 9.6.1 Headlights

### Headlights, description

Headlights are located in the front of the machine to give the operator enhanced vision when operating in darkness, and to provide surrounding traffic and the environment an indication of the machine's position. Headlights have high beam and low beam (for meeting other traffic).

Switch between low and high beams with the gear and multi-function lever. The signal goes to Control unit cab (D790-1).

Signals high and low beams can be checked from the diagnostic menu, tab *8 Control system*, group *8.4.2.6 LIGHTS*, menu *6*.

## 9.6.2 Position lights

### Running lights, description

Running lights are located on the right and left-hand sides of the machine to provide surrounding traffic and the environment an indication of the machine's position and direction of travel.

The running lights are controlled by selecting with the switch for headlights. The signal travels to the Control unit cab (D790-1).

The lights and their signal can be checked from the diagnostic menu, see section *8 Control system*, group *8.4.2.5 LIGHTS*, menu *5*.

## 9.6.3 Rear lights

### Rear lights, description

Rear lights are located in the rear of the machine to provide surrounding traffic and the environment an indication of the machine's position, and a limited enhancement of the view for the operator in darkness.

The rear lights are controlled by selecting with the switch for headlights. The signal travels to the Control unit cab (D790-1).

The lights and their signal can be checked from the diagnostic menu, see section *8 Control system*, group *8.4.2.11 LIGHTS*, menu *11*.

## 9.6.4 Brake lights

### Brake lights, description

Brake lights are located in the rear of the machine to provide surrounding traffic and the environment an indication that the machine is braking and consequently slowing down.

The brake lights are controlled by the position of the brake pedal (via acting on break contact). The signal travels to the Control unit frame front (D797-F) which in turn supplies power feed to the brake light bulbs.

The lights and their signal can be checked from the diagnostic menu, see section *8 Control system*, group *8.4.2.11 LIGHTS*, menu *11*.

## 9.6.5 Back-up lights

### Reversing lights, description

Reversing lights are located in the rear of the machine to provide surrounding traffic and the environment an indication that the machine is travelling backwards. In addition, this provides the operator enhanced view when operating in darkness.

The reversing lights are controlled by the direction of travel. The signal travels via the CAN bus.

The lights and their signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.2.11 *LIGHTS*, menu 11.

## 9.6.6 Travel direction indicators

### Direction indicators, description

Direction indicators are located both front and rear on the machine to provide surrounding traffic and the environment an indication that the machine is changing direction, i.e. turning.

The direction indicator is controlled by selecting with the switch (lever) for direction indicators. The signal travels to the Control unit frame front (D797-F).

The lights and their signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.2.8 *LIGHTS*, menu 8.

## 9.6.7 Warning light Hazard

### Hazard lights, description

Hazard lights (hazard) are used to warn the surroundings, hazard lights activate all direction indicators at the same time.

The hazard lights are controlled with the switch for hazard lights. The signal is sent to control unit (D790-2).

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.2.8 *LIGHTS*, menu 8.



Machines for the North American market are equipped with flashing brake lights front and rear during operation.

## 9.6.8 Rotating beacon

### Revolving beacon, description

A revolving beacon is located high on the machine's boom (rear section). This is used to provide surrounding traffic and the environment an indication that a working vehicle is moving and at work. Indication to bystanders to exercise caution.

The revolving beacon is controlled by selecting with the switch for revolving beacon. The signal travels to the Control unit cab (D790-1).

The light and its signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.2.9 *LIGHTS*, menu 9.

## 9.6.9 Work light cab

### Working lights cab, description

Work lights on the cab provide enhanced view when load handling in darkness.

The work lights are controlled by selecting with the switch for cab roof work lights. The signal travels to the Control unit cab (D790-1) which in turn supplies power feed to the work lights bulbs.

The lights and their signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.2.1 *LIGHTS*, menu 1.

### Work lights, changing (product alternative Xenon lights)



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## DANGER

**Xenon lights are activated with high voltage. Always turn off the main electric power before working on xenon lights.**

**Handle the headlights with care since the light is under gas pressure and may explode.**

### NOTE

*The xenon light is filled with different gases and metals. Replaced xenon headlights should be considered as hazardous waste and should be deposited for recycling.*

## 9.6.10 Work light boom

### Work lights boom, lighting

The work lights on the boom provide enhanced view when load handling in darkness.

The work lights are controlled by selecting with the switch for boom work lights. The signal travels to the Control unit cab (D790-1).

The lights and their signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.2.3 *LIGHTS*, menu 3.

The lift boom can be equipped with two extra work lights (.

### Work lights, changing (product alternative Xenon lights)



See *Work lights, changing (product alternative Xenon lights)* page 71.

## 9.6.11 Work light attachment

### Work lights attachment, description

Work lights on the attachment provide enhanced view when load handling in darkness.

The work lights are controlled by selecting with the switch for attachment lights. The signal travels to the Control unit cab (D790-1).

The lights and their signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.2.2 *LIGHTS*, menu 2.

The attachment can be equipped with two extra work lights ().

### Work lights, changing (product alternative Xenon lights)



See *Work lights, changing (product alternative Xenon lights)* page 71.

## 9.6.12 Interior lighting

### Interior lighting cab, description

Interior lighting provides light when doors are opened or by selecting with the switch for interior lighting.

Background lighting is available in all switches, function keys and knob controls. This is so that the operator can interpret functions and settings in darkness. The intensity of the lighting is controlled by the function keys for plus and minus.

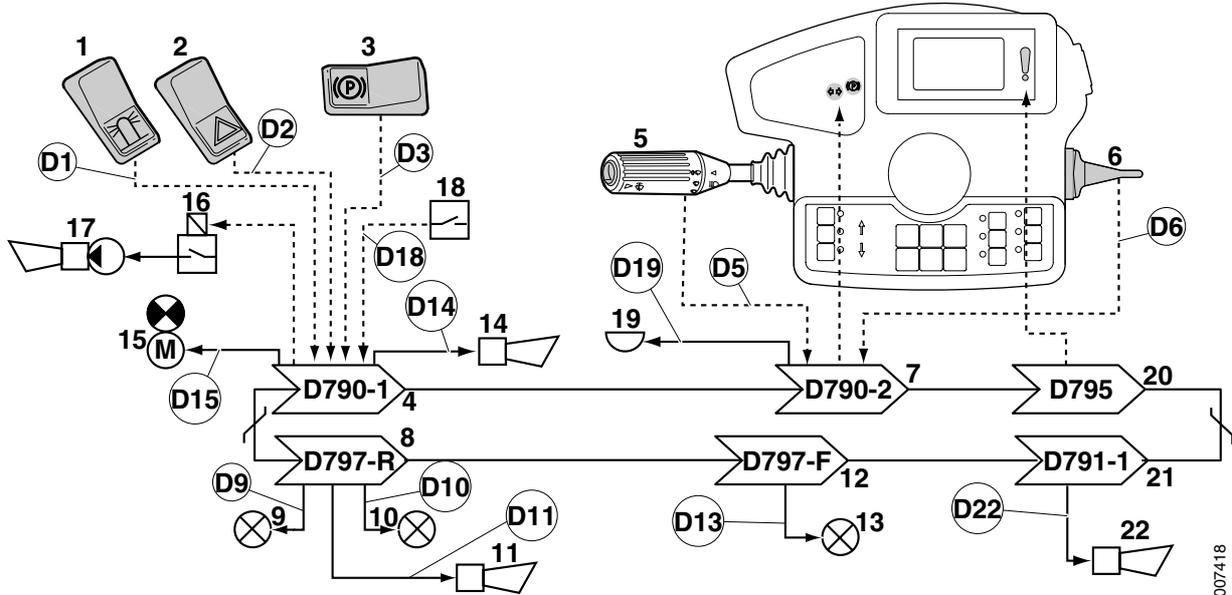
The lighting and its signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.2.12 *LIGHTS*, menu 12.

## 9.7 Communication system

### Signal system, function description

#### NOTE

It is important that the right type of lamp is used for each respective area. See tab F Technical data.

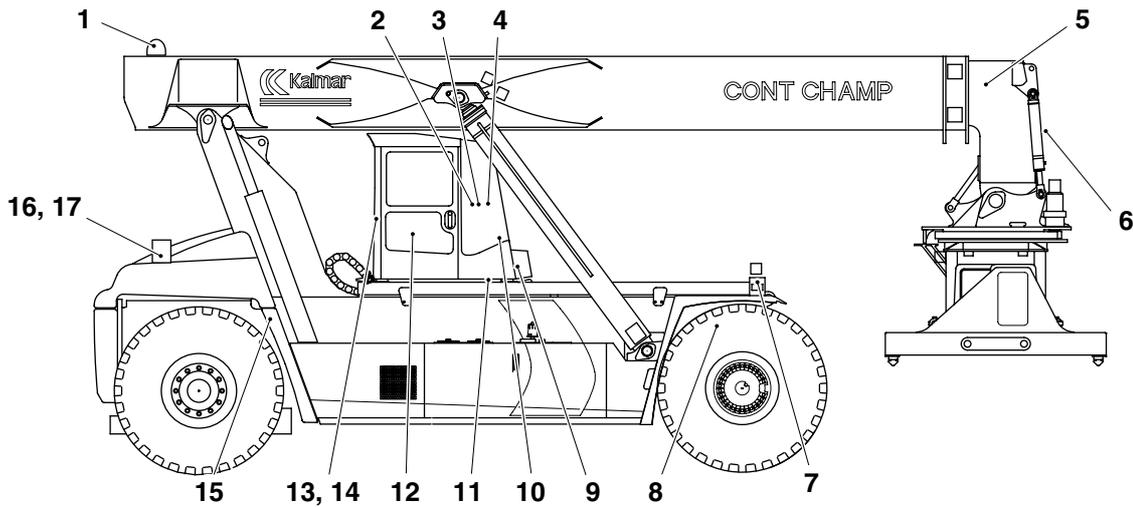


Pos	Description	Signal description	Reference
1	Switch rotating beacon (S110) sends voltage signal to Control unit cab (D790-1).	Switch in position on: U = 24 V	D1: Diagnostic menu, see section 8 Control system group 8.4.2.9 LIGHTS, menu 9
2	Switch hazard lights (S109) sends voltage signal to Control unit cab (D790-1).	Switch in position on: U = 24 V	D2: Diagnostic menu, see section 8 Control system group 8.4.2.8 LIGHTS, menu 8
3	Switch parking brake (S107) sends voltage signal to Control unit cab (D790-1).	Switch in position on: U = 24 V	D3: Diagnostic menu, see section 8 Control system group 8.4.5.4 HYD, menu 4
4	Control unit cab (D790-1) sends messages about activation on the CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 Common electric, group 11.5.3.1 Control unit cab
5	Multi-function lever (S162) sends voltage signal to Control unit KIT (D790-2).	Signal button pressed in: $U_{S162/H} = 24\text{ V}$	Gear and multi-function lever, description page 12 D5: Diagnostic menu, see section 8 Control system group 8.4.3.5 CAB, menu 5
6	Lever direction indicators (S161) sends voltage signal to Control unit KIT (D790-2).	Left: $U_{S161/6} = 24\text{ V}$ Right: $U_{S161/1} = 24\text{ V}$	D6: Diagnostic menu, see section 8 Control system group 8.4.2.7 LIGHTS, menu 7

Pos	Description	Signal description	Reference
7	Control unit KIT (D790-2) sends messages about activation on the CAN-bus.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.11 <i>Control unit KIT</i>
8	Control unit frame rear (D797-R) supplies voltage to lights and buzzer rear on machine.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i>
9	Direction indicators rear (H426 & H427) are lit when hazard lights are activated.	Light on: U = 24 V	<i>Direction indicators</i> , description page 70 D9: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.8 <i>LIGHTS</i> , menu 8
10	Back-up lights (E405L & E405R) are lit when reverse gear is selected.	Light on: U = 24 V	<i>Reversing lights</i> , description page 70 D10: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.11 <i>LIGHTS</i> , menu 11
11	Back-up alarm (H965) is activated when reverse gear is selected.	Reverse gear selected: U = 24 V	<i>Back-up alarm</i> , description page 76 D11: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.11 <i>LIGHTS</i> , menu 11
12	Control unit frame front (D797-F) supplies voltage to lights on front of machine.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.2 <i>Control unit frame front</i>
13	Direction indicators front (H422 & H423) are lit when direction indicators are activated.	Light on: U = 24 V	<i>Direction indicators</i> , description page 70 D13: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.8 <i>LIGHTS</i> , menu 8
14	Horn (H850) sounds when the horn is activated.	Horn active: U = 24 V	<i>Horn</i> , description page 76 D14: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.3.5 <i>CAB</i> , menu 5
15	Rotating beacon (H428) is lit when hazard lights are activated.	Light on: U = 24 V	<i>Rotating beacon</i> , description page 76 S15: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.9 <i>LIGHTS</i> , menu 9
16 +	Relay loud horn (K3016) is activated when horn is activated.	$U_{K3016/30} = 24\text{ V}$ $U_{K3016/85} = 0\text{ V}$ Horn activated: $U_{K3016/86} = 24\text{ V}$ $U_{K3016/87} = 24\text{ V}$	<i>Horn</i> , description page 76
17 +	Loud horn (H850-1) sounds when the horn is activated.	Horn active: U = 24 V	<i>Horn</i> , description page 76
18	Make-contact operator in seat (S230) sends voltage signal to Control unit cab (D790-1) when operator's seat is loaded.	Operator in seat: U = 24 V	<i>Sensor operator in seat</i> , description page 23 D18: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.3.6 <i>CAB</i> , menu 6

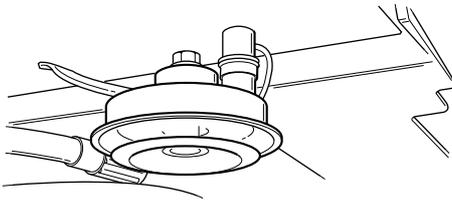
Pos	Description	Signal description	Reference
19	Buzzer cab (H853) is supplied with voltage by Control unit KIT (D790-2) in case of warnings to draw the operator's attention to the warning message.	Controlled by control and monitoring system, error shown with error code.	D19: Diagnostic menu, see section 8 Control system group 8.4.3.6 CAB, menu 6
20	Control unit KID (D795) activates warning light in case of warnings to draw the operator's attention to the warning message.	A click sound can be heard when the termination resistance is connected.	Tab 11 Common electric, group 11.5.3.12 Control unit KID
21	Control unit attachment (D791-1) supplies voltage buzzer automatic spreading in case of automatic spreading.	Controlled by control and monitoring system, error shown with error code.	Tab 11 Common electric, group 11.5.3.5 Control unit attachment
22 ⊕	Buzzer automatic spreading (H9003) is activated when automatic spreading 20'-40' is activated.	Buzzer active: U = 24 V	Tab 7 Load handling, group 7.5.13 Summer automatic positioning 20'-40' D22: Diagnostic menu, see section 8 Control system group 8.4.9.15 ATTACH, menu 15

**Communication system, component position**



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- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>1. Rotating beacon (H428)</li> <li>2. Control unit KIT (D790-2)</li> <li>3. Buzzer cab (H853)</li> <li>4. Control unit KID (D795)</li> <li>5. Control unit attachment (D791-1)</li> <li>6. Buzzer automatic spreading (H9003) ⊕</li> <li>7. Direction indicators front (H422 &amp; H423)</li> <li>8. Control unit frame front (D797-F)</li> <li>9. Loud horn (H850-1) ⊕</li> </ul> | <ul style="list-style-type: none"> <li>10. Switch, see tab 9 Frame, body, cab and accessories, group 9.1 Controls and instrumentation</li> <li>11. Horn (H850)</li> <li>12. Make-contact operator in seat (S230)</li> <li>13. Control unit cab (D790-1)</li> <li>14. Relay loud horn (K3016) ⊕</li> <li>15. Control unit frame rear (D797-R)</li> <li>16. Direction indicators rear (H426 &amp; H427)</li> <li>17. Back-up alarm (H965)</li> </ul> |
|---|--|



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## 9.7.1 Horn

### Horn, description

The horn is electromagnetic. Air horn can be selected (⊕).

The horn is activated from the gear and multi-function lever. The horn can also be activated with switch open twistlocks on the control lever, when the attachment is not aligned with a container.

The horn is located under the cab (the compressed air horn is located in the rear edge of the cab roof).

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.3.5 *CAB*, menu 5.

## 9.7.2 Warning light Hazard

### Hazard lights, description

See *Hazard lights*, description page 70.

## 9.7.3 Rotating beacon

### Rotating beacon, description

See *Revolving beacon*, description page 70.

## 9.7.4 Warning parking brake

### Warning parking brake, description

If the operator leaves the machine without applying the parking brake a buzzer sounds to alert the operator, i.e. to ensure the operator applies the parking brake.

A sensor in the operator's seat (see *Sensor operator in seat*, description page 23) indicates for the control and monitoring system if the operator leaves the seat.

The buzzer is located in the steering wheel panel.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.3.6 *CAB*, menu 6.

## 9.7.5 Back-up alarm

### Back-up alarm, description

When reverse is selected, a warning sound and the back-up lights are activated. This is to give others in traffic an indication that the machine is reversing. Indication to bystanders to take caution.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.2.11 *LIGHTS*, menu 11.

## 9.8 Entertainment and communication

### Entertainment and communication, general

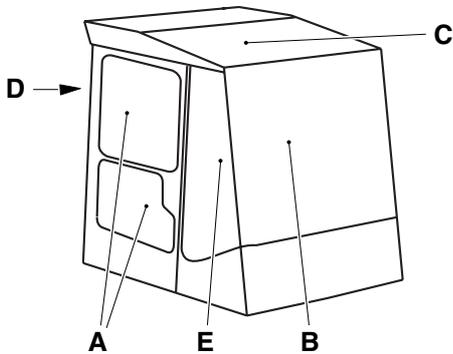


The machine is pre-wired with a connector for customer accessories, see tab *11 Common electric*, group *11.5.2.1 Electrical distribution box cab*.

### Maintenance and communication, repair



Repairs should be left to authorised personnel.



- A. Side windows
- B. Windshield (front window)
- C. Roof window
- D. Rear window
- E. Windshield (Side window front)

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## 9.9 Glass/windows/mirrors

### Glass/windows/mirrors, description

The windows are designed to both enclose the cab and provide the operator with a good view.

The windows on the Spirit Delta cab are made of tinted hardened glass, except the roof window which is made of polycarbonate plastic.

**+** As an option, the cab can be equipped with windows of laminated glass.

The rearview mirrors are of the convex mirror type. There is an interior rearview mirror on all machines.

### Silicone adhesive, handling advice

The window panes are secured with key adhesive and silicone adhesive.

### NOTE

*The purpose of this instruction is to describe how Silicone adhesive 923854.0100 should be handled in connection with replacement of windshield and roof window on the Spirit Delta cab.*

- *Silicone adhesive 923854.0100 is a fast-hardening, two-component silicone adhesive that withstands temperatures between -50 °C and +200 °C. The adhesive's hardening properties are very much dependent on the ambient temperature, an increase by 10 °C reduces the hardening time by half.*

*Silicone adhesive 923854.0100 is mixed in a relation of 1:10 in a static mixer. Change mixer after every interruption that lasts more than 5 minutes. The short fixing time means that work has to be planned carefully, to avoid undesired hardening.*

#### Fixing time:

10-20 minutes at 20 °C  
approx. 5 minutes at 60 °C

#### Hardening time:

approx. 24 hours at 20 °C  
approx. 1 hour at 60 °C  
Full strength is obtained after 7 days.

- In warm climates, it is advantageous to cool the container to increase hardening time. The silicone adhesive should not be used at temperatures above +75 °C.
- In cold climates, the hardening time can be shortened by covering the joints so that cooling is prevented. The window pane can be warmed with defroster or cab heater.
- Recommended storage temperature is between -30 °C and +20 °C. Preferably in a refrigerator or colder.

## 9.9.1 Windscreen

### Windshield, description

The windshield consists of the front window and side windows. The windshield is attached to the cab with a key strip and is glued to the roof window with silicone adhesive. Front and side windows are joined with silicone adhesive to give good allround visibility from the operator's station.

For position, see *Glass/windows/mirrors, description page 78*.

### Windscreen, replacement

#### NOTE

*Read handling advice for silicone adhesive before work, see Silicone adhesive, handling advice page 78.*

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the key strip.
- 3 Remove the broken window pane and check that no glass or other particles remain in the window pane's groove on the strip. Cut apart silicone joints with a sharp tool.

#### NOTE

*Make sure that no silicone adhesive remains between the window pane and the strip by the window pane's lower front edge.*

*If the roof window is to be changed, then all bolts must be removed before the silicone adhesive is cut away.*



Figure 1: Removing key strip



## CAUTION

**Acetone may not come into contact with a roof window made of polycarbonate plastic. Acetone has a chemical effect on the polycarbonate plastic which reduces the roof window's strength.**

- 4 Clean all surfaces thoroughly. Remove old remains of silicone with a razor blade or similar.

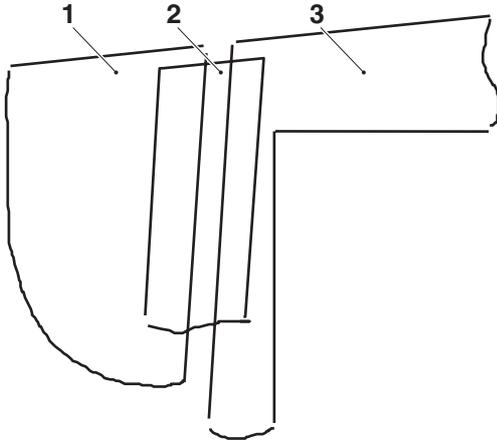


Figure 2: Adjusting side window - cab window

1. Side window
2. Rubber strip
3. Cab frame / door opening

- 5 Fit masking tape on the inside and outside of the window panes by the surfaces that are to be glued.
- 6 When the windshield or a side window is to be changed, then the window panes must be adjusted so that the upper edge on the side window has the same height as the top edge of the roof (see figure 2) and so that the distance between windshield and side window is as shown in figure 3.

Use spacers against the roof member to ensure that the distances are obtained.

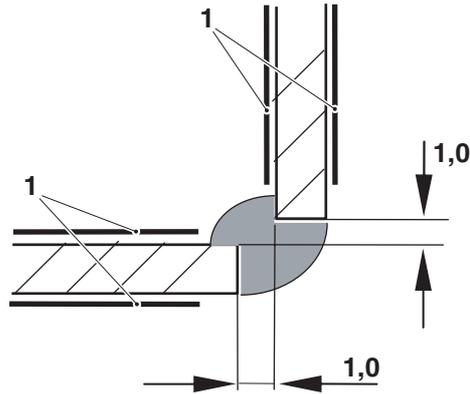


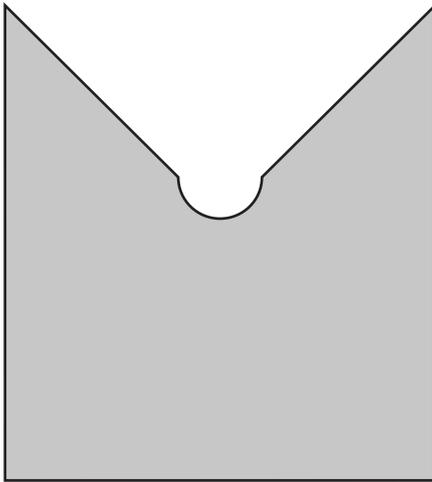
Figure 3: Adjusting side window - windshield

1. Masking tape

- 7 Install the key strip around the whole window pane.
- 8 Apply Silicone adhesive 923854.0100 around the window panes. Make the new joint wider than the old one to give a good joint.  
The silicone should be applied from the outside of the joints, to give a full and smooth joint.

## NOTE

*There must be silicone between the window panes, to avoid contact between the window panes.*



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Figure 4: Tool template for silicone joint, scale 1:1

- 9 Remove excess silicone adhesive from the outer vertical corners with a tool made of cardboard as shown in figure 4. Smooth out the joints on the inside with a finger, wet with water or soapy water.
- 10 Apply Silicone adhesive 923854.0100 between the strip and window pane at the bottom edge of the front corners, so-called top sealing.
- 11 If the roof window is to be changed, apply Silicone adhesive 923854.0100 by the cab frame (where it was glued earlier).
- 12 Lay the roof window into place and check that there is a uniform distance of one or several millimetres along the window pane's edges and by the protection over the frame's sides. Then tighten the corner bolts for the window pane.
- 13 Apply Silicone adhesive 923854.0100 by the edges and smooth out the joints with a finger, wet with water or soapy water.

## IMPORTANT

**Mark the window panes with "New adhesive. Do not touch."**

- 14 Remove the masking tape immediately after applying adhesive to avoid edge formation. Hardening time is dependent on ambient temperature, plan the change so that downtime is minimized.

### 9.9.2 Side window

#### Side window, description

The side windows are secured in the cab and doors with key strips.

For further details, see *Glass/windows/mirrors, description page 78*.

## Side window, replacement

### NOTE

*The method describes a general procedure.*

- 1 Machine in service position, see tab *B Safety*.
- 2 Use special tools to detach the wedge strip.



- 3 Remove the wedge strip which runs around the whole window.
- 4 Carefully remove any glass remains from the rubber strip.



- 5 Fit the new window, secure at the bottom edge.

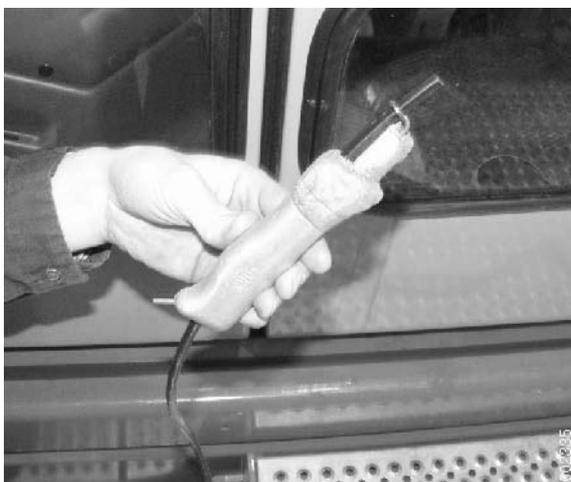




- 6 Spray soap solution on the window and rubber strip to facilitate fitting.



- 7 Thread the rubber strip around the whole window, use special tools.



- 8 Secure the wedge strip with a special tool.
- 9 Pull the wedge strip around the whole window.



- 10 Cut off the wedge strip approx. 2 cm too long.
- 11 Fit the other end of the wedge strip edge to edge.
- 12 Adjust the wedge strip so that the correct fit is obtained.

### 9.9.3 Roof window

#### Roof window, description

The roof window is made of polycarbonate plastic, which is a safety feature for the operator, intended to protect the operator from falling objects. The polycarbonate plastic is elastic.

Safety is maintained within a temperature range from 120 °C to -45 °C (becomes brittle first at -110 °C, glass conversion temperature 145 °C). The roof window has a patented surface layer which increases its wear resistance as well as resistance to UV-light and chemicals.

The roof window is joined with the windshield. Joints between the window panes and between roof window and cab are sealed with silicone adhesive. Lay a new seal of silicone adhesive when replacing.

For position, see *Glass/windows/mirrors, description page 78*.



#### WARNING

**The strength of the roof window may be significantly reduced in case of exposure to substances containing: aromatic hydrocarbons, ketones, esters and chlorinated hydrocarbons.**

**Check the roof window's surface at regular intervals, and only clean with washer fluid or mild cleaning agents. Rinse with lukewarm water. Replace the roof window if it is damaged, cracked, or scratched!**

#### Roof window, replacement

See *Windscreen, replacement page 79*, for the general procedure.

The roof window is combined with the windscreen. The join is sealed with silicone. Add a new silicone seal when replacing.

## 9.9.4 Back window

### Rear window, description

The rear window is attached to the cab with a key strip.

**+** On machines with hydraulic sliding cab or hydraulic cab lift and lower, the rear window can be opened to provide an emergency exit. For further details, see *Glass/windows/mirrors, description page 78*.

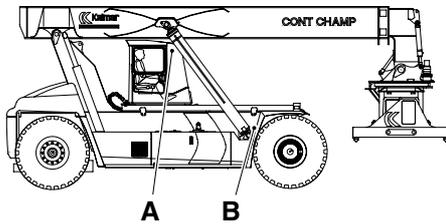
### Rear window, replacement

See *Side window, replacement page 82* for the general procedure.

## 9.9.5 Rear-view mirror

### Rear-view mirror, description

The cab has a rearview mirror (position A) located in the cab as well as rearview mirrors (position B) on the left and right front fender. The function of the rearview mirrors is to give the operator visibility around the machine.



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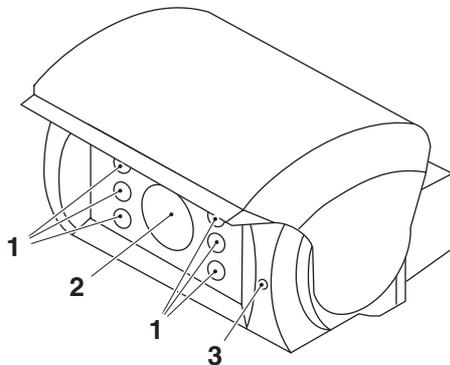
- A. Rear-view mirror
- B. External mirror

## 9.9.6 Back-up camera

### Back-up camera, description

**+** The back-up camera is located at the trailing edge of the horizontal counterweight at the back of the machine for better visibility when reversing. The back-up camera is waterproof and has a microphone and infrared lighting for visibility in the dark. The camera is also equipped with automatic heating which is activated at an outdoor temperature below +10 °C.

The back-up camera sends a colour picture and sound to the monitor in the cab, see *Monitor back-up camera, description page 86*.



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- 1. IR-diodes
- 2. Camera
- 3. Microphone

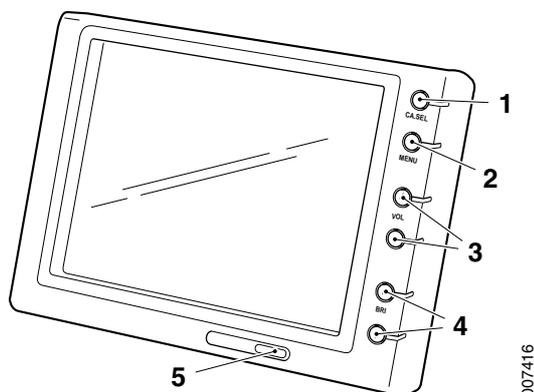
## 9.9.7 Monitor back-up camera

### Monitor back-up camera, description



The monitor shows picture and sound from the back-up camera. The picture is shown in colour and light intensity is automatically adjusted according to light conditions in the cab. The monitor can handle signals from two different cameras.

The monitor is mounted on a hinged bracket to the left in front of the door in the cab.

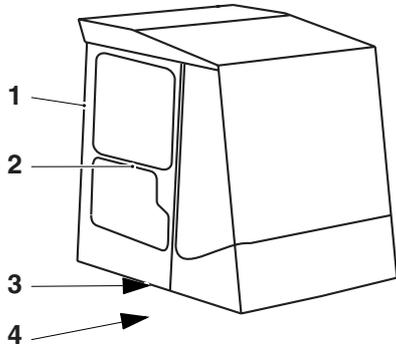


1. Choice of camera
2. Menu
3. Light intensity
4. Volume setting
5. On and off

## 9.10 Cab structure and suspension

### Construction and mounting, description

The cab is mounted in a cab undercarriage via strong rubber insulators located on the underside of the cab. This is to minimise vibrations from the frame to the cab. There is an insulator at four points, one at each corner. Each insulator mounting has one rubber bushing and one bolt.



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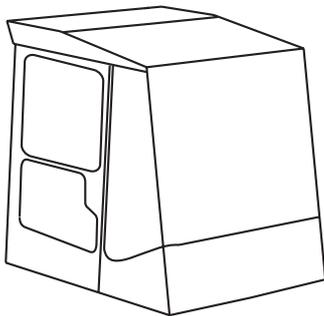
Cab, Spirit Delta

1. Cab frame
2. Door
3. Cab mounting
4. Cab undercarriage

### 9.10.1 Framework cab

#### Cab frame, description

The cab frame is made of sheet metal profiles made of high-tensile steel. The cab is dimensioned to withstand blows and to some degree dropped loads. Do not modify the frame!



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Cab Spirit Delta

### 9.10.2 Doors

#### Doors, description

The cab has two doors, the left is the operator's door and the right is the emergency exit. The door has:

- rail
- handle
- key lock
- openable window (passenger door )

There are switches in the doors' locks which sense if the door is open. The switch is used to light the interior lighting and warn of an open door.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.2.12 *LIGHTS*, menu 12 or 8.4.11.2 *SLIDING-CAB*, menu 1.

### 9.10.3 Cab mounting

#### Cab undercarriage, description

The cab is mounted on a cab undercarriage via strong rubber insulators located on the underside of the cab. This is to minimise vibrations from the frame to the cab.

The cab undercarriage is fitted on the machine's chassis (frame) via a mounting. The chassis mounting depends on whether the machine is equipped with:

1. manual sliding cab
2. hydraulic sliding cab
3. hydraulic cab lift and lowering
4. hydraulic cab tilt.

#### 9.10.3.1 Cab mounting longitudinal displacement of cab

##### Cab undercarriage, sliding cab, description

The cab undercarriage is fitted on the machine's chassis (frame) via a mounting. The mounting to the chassis consists of four ball bearing metal rollers which run in rails above the machine's frame.

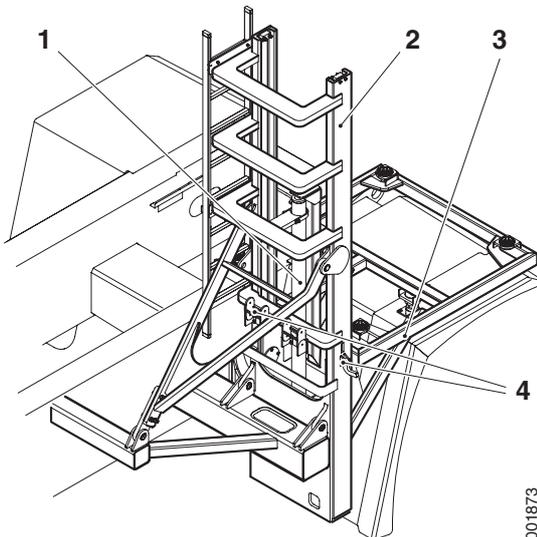
#### 9.10.3.2 Cab mounting vertically adjustable cab

##### Cab undercarriage cab lift and lowering, description



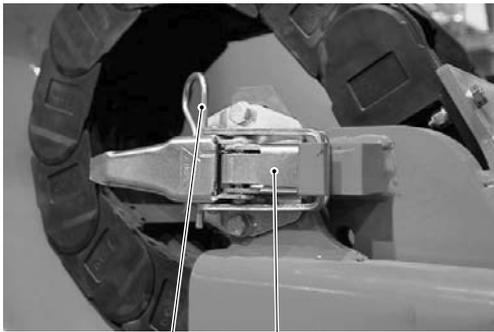
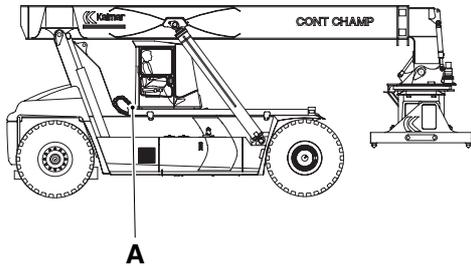
The cab undercarriage is fitted on the machine's chassis (frame) via a mounting. The mounting runs in a lift mast which is secured in the machine's chassis behind the right-hand front wing which means that the cab is positioned above the right-hand drive wheel.

The lift mast consists of outer mast, inner mast lift cylinder and chains. The inner mast runs in the outer mast on ball bearing rollers.



001873

1. Hydraulic cylinder, cab lift and lowering
2. Mast, cab lift and lowering
3. Cab undercarriage, cab lift and lowering
4. Safety lock



**B**      **C**

- A Position lock handle  
 B. Lock pin  
 C. Lock catch for securing cab

000270

## 9.10.4 Longitudinal displacement of cab

### Manual movement of cab, description

Manual cab movement means that the cab can be moved forward to facilitate access for service and maintenance in the engine compartment.

The cab is pushed for and aft by hand. Two cable chains on each side ensure that hoses and electric cabling to and from the cab are not damaged when the cab is moved. The cab is secured in the rear position during operation with two lock catches at the trailing edge of the cab.



### DANGER

The cab may start to move.

**Fatal danger!**

**The cab is heavy. The machine must under no circumstances be moved with the cab unsecured. Secure the cab with the lock catches before operating the machine.**



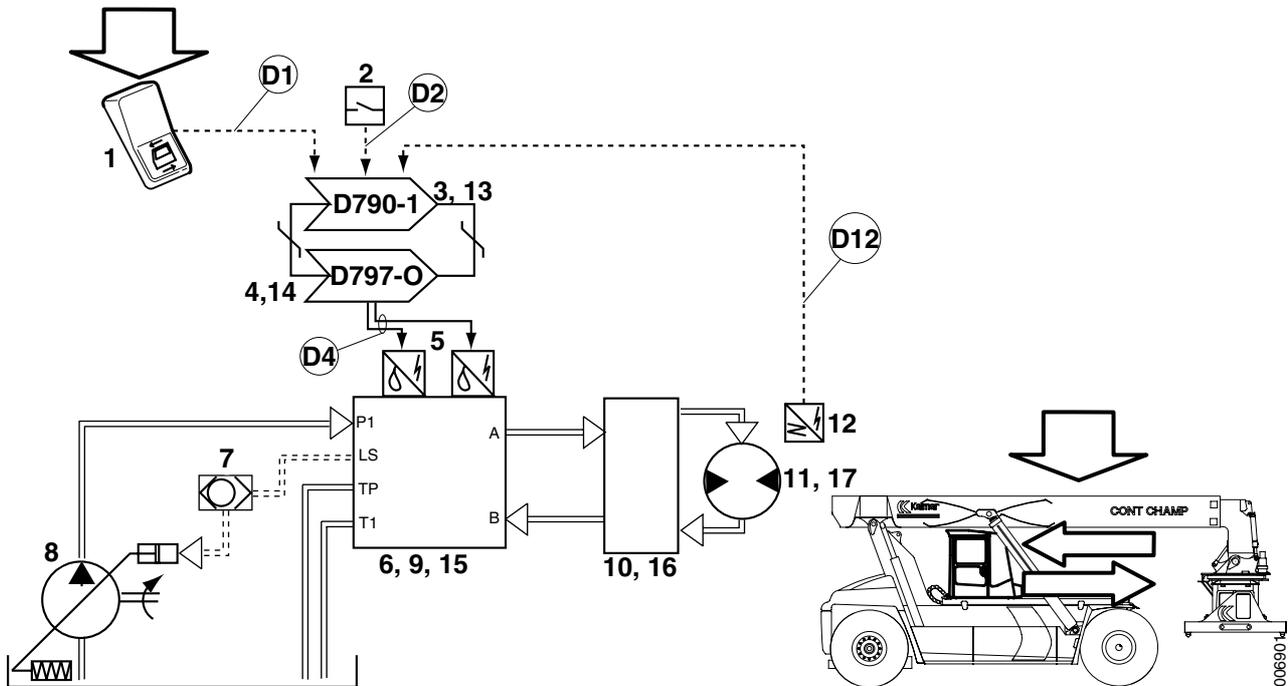
### WARNING

**It is important that the lock catches are intact! They should be checked regularly. However, it is not included as part of the service schedule in preventive maintenance!**

## Hydraulic sliding cab, function description



Condition	Reference value	Reference
Doors	Closed	<i>Doors, description page 87.</i>



Pos	Explanation	Signal description	Reference
1	Switch (S177) sliding cab sends voltage signal to control unit cab (D790-1).	$U = 24\text{ V}$	<i>Controls and instruments, overview page 5</i> D1: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 1
2	Contact closed door, sends signal to control unit cab when door is closed	$U = 24\text{ V}$	<i>Doors, description page 87</i> D2: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 1
3	Control unit cab (D790-1) sends Cab forward or Cab backward on the CAN-bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
4	Control unit frame option (D797-O) supplies voltage to servo valve sliding forward or servo valve sliding cab backward on control valve option frame.	$I = 435\text{--}650\text{ mA}$	Tab 11 <i>Common electric</i> , group 11.5.3.4 <i>Control unit frame option</i> D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 3 and 4
5	Servo valve sliding cab forward or servo valve sliding cab backward pressurizes the sliding cab spool in control valve option frame.	-	<i>Control valve option frame, description page 92</i> D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 3 and 4

Pos	Explanation	Signal description	Reference
6	Control valve option frame sends control signal to shuttle valve option.	-	<i>Control valve option frame, description page 92</i>
7	The shuttle valve sends the strongest control signal to main pumps if several functions are activated at the same time.	-	<i>Shuttle valve option frame, description page 95</i>
8	The main pumps pump oil from the tank.	Pressure plate "Max. pressure hydraulic oil pumps" on left frame member.	<i>Tab 10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement</i>
9	Control valve option frame pressurizes valve block cab movement.	-	<i>Control valve option frame, description page 92</i>
10	Valve block sliding cab pressurizes hydraulic motor for sliding cab.	-	<i>Valve block, sliding cab, description page 95</i>
11	Hydraulic motor sliding cab pulls cab forward or backward.	-	<i>Hydraulic motor sliding cab, description page 95</i>
12	Sensor end-position (B769-2) sends voltage signal to Control unit cab (D790-1) when cab is close to end-position.	U = 24 V	<i>Sensor damping end-position, description page 97</i> D12: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 2
13	Control unit cab (D790-1) sends "dampen cab movement" on the CAN bus.	Checked by control and monitoring system, error shown with error code.	<i>Tab 11 Common electric, group 11.5.3.1 Control unit cab</i>
14	Control unit frame option (D797-O) reduces the control current to servo valve sliding cab forward or servo valve sliding cab backward in control valve option frame.	-	<i>Tab 11 Common electric, group 11.5.3.4 Control unit frame option</i> D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 3 and 4
15	Control valve option frame reduces hydraulic pressure to valve block cab movement.	-	<i>Control valve option frame, description page 92</i> D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 3 and 4
16	Valve block sliding cab lets pressure through to hydraulic motor sliding cab.	-	<i>Valve block, sliding cab, description page 95</i>
17	Hydraulic motor sliding cab reduces speed of cab.	-	<i>Hydraulic motor sliding cab, description page 95</i>

Hydraulic diagram sliding cab

Hydraulic diagram sliding cab + support jacks

### 9.10.4.1 Cab sleigh

#### Cab sleigh, description

The cab is secured on a cradle which runs on wheels in rails on the frame. See *Cab undercarriage, description page 88*.

### 9.10.4.2 Hydraulic oil pump

#### Hydraulic oil pump, description



The hydraulic cab movement (sliding cab) is supplied with pressure from hydraulic oil pump 1 and 2, see section *10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement*.

### 9.10.4.3 Manoeuvre valve option frame

#### Control valve option frame, description

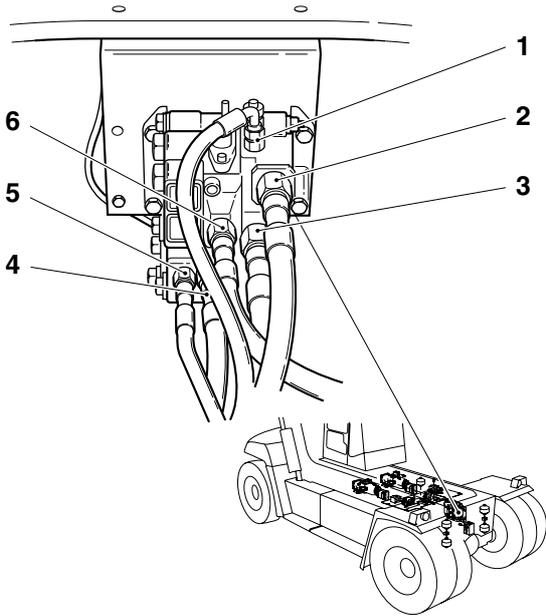


The hydraulic sliding cab is controlled by a separate section in the control valve for option frame.

The control valve is an electro-hydraulically controlled, proportional and pressure compensated direction valve. Electrically controlled pressure reducing valves convert electrical current to servo pressure. The servo pressure controls the spring centred valve slides which control pressure and flow for the function in question. The valve slide has a flow limit in order that several functions can be activated simultaneously.

The control valve is located at the front of the engine compartment and is controlled by control unit frame option (D797-O). Control valve option frame is built up of several sections, each section controls one function. The following functions are controlled by control valve option frame:

- Support jacks
- Sliding cab / Cab lift and lowering
- Cab tilt



1. Load signal (LS)
2. Pressure supply (P)
3. Tank return (T1)
4. Connection hydraulic motor (B)
5. Tank return (TP)
6. Connection hydraulic motor (A)

### Valve slide, sliding cab

The valve slide controls direction and speed of sliding cab by controlling hydraulic motor pressure, sliding cab.

The valve slide is controlled by servo valve forward and servo valve backward.

### Servo valve sliding cab forward

Servo valve sliding cab forward controls servo pressure to valve slide sliding cab so that this controls oil pressure to hydraulic motor sliding cab forward.

Servo valve sliding cab forward is controlled electrically with solenoid valve sliding cab forward (Y6016) which is activated by Control unit frame option (D797-O).

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.11.2 *SLIDING-CAB*, menu 3.

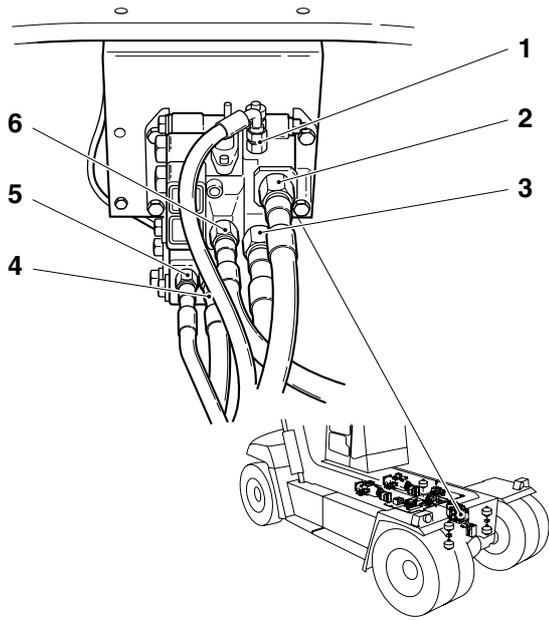
### Servo valve sliding cab backward

Servo valve sliding cab backward controls servo pressure to valve slide steering so that this controls oil pressure to hydraulic motor sliding cab forward.

Servo valve sliding cab backward is controlled electrically with solenoid valve sliding cab backward (Y6017) which is activated by Control unit frame option (D797-O).

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.11.2 *SLIDING-CAB*, menu 4.

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1. Load signal (LS)
2. Pressure supply (P)
3. Tank return (T1)
4. Connection hydraulic motor (B)
5. Tank return (TP)
6. Connection hydraulic motor (A)

## Control valve option frame, changing



### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the brake and hydraulic systems, see tab B Safety.
- 3 Mark up and disconnect hydraulic hoses from the control valve.

### NOTE

*Plug all connections immediately to protect the hydraulic system from impurities.*

- 4 Mark up and disconnect the cable harness from the control valve.
- 5 Remove the control valve.  
Remove the attaching bolts and lift away the valve. Place the valve on a clean surface.
- 6 Transfer parts to the new control valve.

### NOTE

*Check that the O-rings on the hydraulic connections are intact and in place.*

### NOTE

*Transfer one part at a time so that the marking is not mixed up.*

- 7 Mark up the servo valves on the new control valve.
- 8 Install the valve.
- 9 Connect the cable harness according to marking.
- 10 Connect the hydraulic hoses according to marking.

### NOTE

*Check that the O-rings are intact and in place.*

- 11 Start the engine and check for leaks.
- 12 Check the function.



## CAUTION

**Air in the hydraulic system may cavitate and result in product damage.**

**Activate the steering carefully and drive a couple of times with lowest possible speed to avoid cavitation.**



- 13 Check the oil level in the hydraulic oil tank with the lift cylinders completely down and the extension cylinder completely in. The oil level should be in the top of the level glass. Top up as needed.

## CAUTION

**Overfilling of oil, leakage, and environmental damage.**

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

### 9.10.4.4 Shuttle valve option frame

#### Shuttle valve option frame, description



See section *10 Common hydraulics*, group *10.5.3 Shuttle valve*.

### 9.10.4.5 Valve block longitudinal displacement of cab

#### Valve block, sliding cab, description



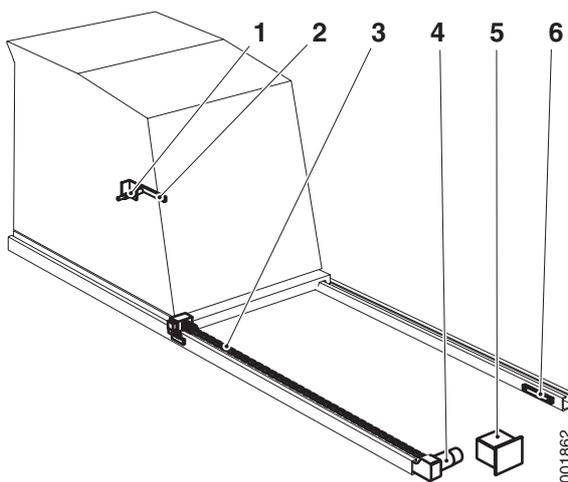
Valve block sliding cab is located on hydraulic motor, sliding cab, and prevents the motor being turned when sliding cab is not activated.

### 9.10.4.6 Hydraulic motor longitudinal displacement of cab

#### Hydraulic motor sliding cab, description



The hydraulic motor is located furthest forward on the right-hand side of the cab chain. The hydraulic motor pulls the chain which in turn pulls the cab forward and backward.



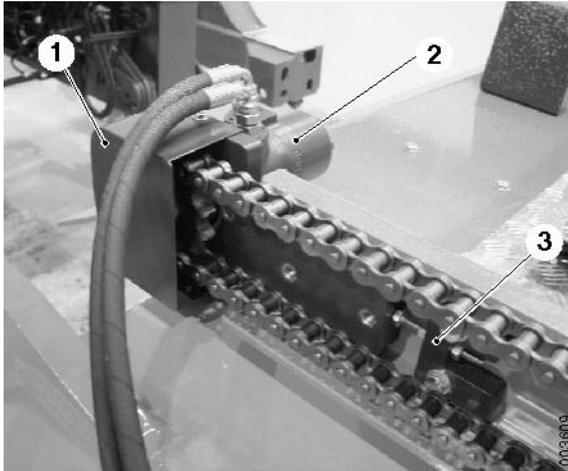
1. Sensor, damping (rear edge of cab on left-hand side)
2. Indicator plate, damping
3. Chain, sliding cab
4. Hydraulic motor, sliding cab
5. Control valve, sliding cab
6. Indicator plate, damping

### Hydraulic motor, sliding cab, replacement

#### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the hydraulic system, see tab B Safety.
- 3 Remove the protective cover.
- 4 Slacken the chain, loosen the chain tensioner and the adjusting screw.
- 5 Detach the chain from its mounting.
- 6 Detach the hydraulic hoses from the motor.
- 7 Remove the ring gear.
- 8 Remove the hydraulic motor from its mounting.
- 9 Replace the hydraulic motor.
- 10 Fit in the reverse order.



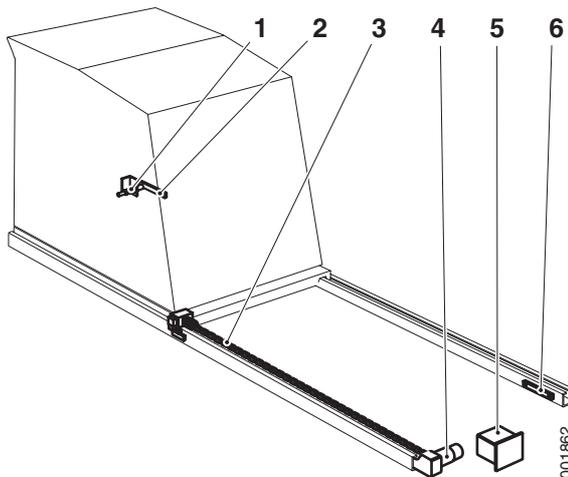
1. Protective cover
2. Hydraulic motor
3. Chain tensioner

### 9.10.4.7 Chain longitudinal displacement of cab

#### Chain sliding cab, description



The chain pulls the cab forward and backward and is secured in the front and rear edges on the cab undercarriage. The chain tension is adjusted by moving the hydraulic motor for sliding cab.



1. Sensor, damping (rear edge of cab on left-hand side)
2. Indicator plate, damping
3. Chain, sliding cab
4. Hydraulic motor, sliding cab
5. Control valve, sliding cab
6. Indicator plate, damping

### **Chain and chain wheel, sliding cab, replacement**

- 1 Machine in service position, see tab *B Safety*.
- 2 Slacken the chain, loosen the chain tensioner and the adjusting screw.
- 3 Detach the chain at the front edge.
- 4 Detach the chain at the rear edge.
- 5 Replace the chain.
- 6 Fit in the reverse order.
- 7 Adjust the chain with the adjusting screw.
- 8 Tighten the chain tensioner.

### **9.10.4.8 Sensor damping, end position**

#### **Sensor damping end-position, description**



Sensor damping end -position indicates when the cab is close to end-position and is used to activate end-position damping.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.11.2 *SLIDING-CAB, menu 2*.

#### **Position sensor, checking and adjustment**

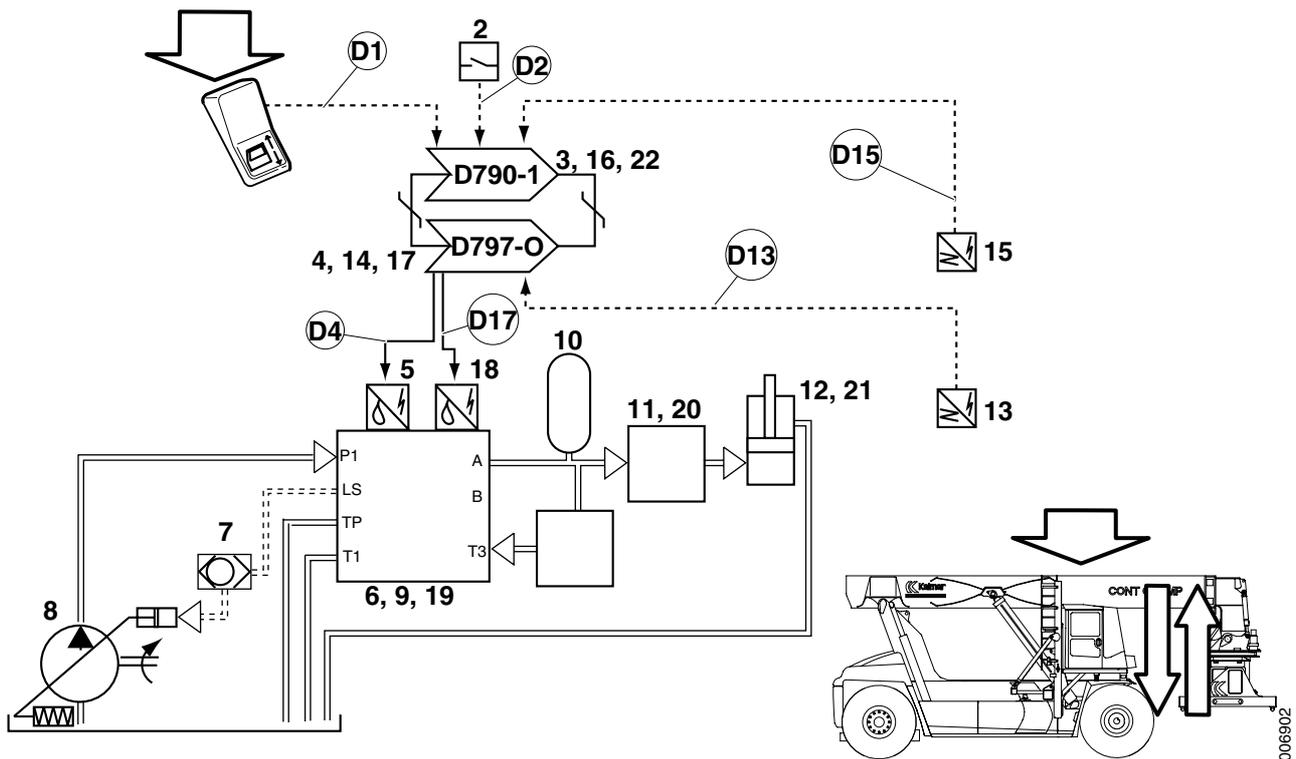
See tab 7 *Load handling*.

### 9.10.5 Vertically adjustable cab

#### Cab lift and lowering, function description



Condition	Reference value	Reference
Doors	Closed If the door is open with lifted cab, the lift and lower functions for the boom are limited.	<i>Doors, description page 87.</i>



Pos	Explanation	Signal description	Reference
1	Switch cab lift and lower (S177) sends voltage signal to Control unit cab (D790-1).	U = 24 V	<i>Controls and instruments, overview page 5</i> D1: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 1
2	Contact closed door, sends signal to Control unit cab (D790-1) when door is closed.	U = 24 V	<i>Doors, description page 87</i> D2: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 1
3	Control unit cab (D790-1) sends "cab up" or "cab down" on the CAN-bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>

Pos	Explanation	Signal description	Reference
4	Control unit frame option (D797-O) supplied voltage to Servo valve cab up (Y6016) or servo valve cab lower (Y6017) on control valve option frame.	I = 435–650 mA	Tab 11 <i>Common electric</i> , group 11.5.3.4 <i>Control unit frame option</i> D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 3 and 4
5	Servo valve cab lift (Y6016) or Servo valve cab lower (Y6017) pressurizes the sliding cab spool in control valve option frame.	-	<i>Control valve option frame</i> , description page 101 D4: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 3 and 4
6	Control valve option frame sends control signal to Shuttle valve option.	-	<i>Control valve option frame</i> , description page 101
7	The shuttle valve sends the strongest control signal to main pumps if several functions are activated at the same time.	-	<i>Shuttle valve option frame</i> , description page 95
8	The main pumps pump oil from the tank.	See pressure plate on left frame beam.	Tab 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
9	Control valve option frame pressurizes the accumulator and the load control valve.	-	<i>Control valve option frame</i> , description page 101
10	The accumulator stores pressure.	-	<i>Accumulator cab lift and lowering</i> , description page 103
11	The load control valve lets the pressure through to hydraulic cylinder for cab lower.  When lowering, the load control valve changes position and restricts flow from hydraulic cylinder cab lift and lower.	-	<i>Load control valve</i> , description page 103
12	The hydraulic cylinder for lifting and lowering cab lifts or lowers the cab.	-	<i>Hydraulic cylinder cab lift and lowering</i> , description page 104
13	Sensor lowered cab (B777-2) stops sending voltage signal to Control unit frame option (D797-O) when the cab leaves its lowest position.	U = 24 V	<i>Sensor lowered cab</i> , description page 107 D13: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 2
14	Control unit frame option (D797-O) sends “cab raised” on the CAN-bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.4 <i>Control unit frame option</i>

Pos	Explanation	Signal description	Reference
15	Sensor damping end-position (B769-2) sends voltage signal to Control unit cab (D790-1) when cab is close to end-position.	U = 24 V	<i>Sensor damping end-position, description page 108</i> D15: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 2
16	Control unit cab (D790-1) sends "dampen cab lift" on the CAN-bus.	Checked by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>
17	Control unit frame option (D797-O) reduces the control current to Servo valve cab lift (Y6016) or Servo valve cab lower (Y6017) in control valve option frame.	-	Tab 11 <i>Common electric</i> , group 11.5.3.4 <i>Control unit frame option</i> D17: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 3 and 4
18	Servo valve cab lift (Y6016) or Servo valve cab lower (Y6017) controls the pressure to the sliding cab spool in control valve option frame.	-	<i>Control valve option frame, description page 101</i> D17: Diagnostic menu, see section 8 <i>Control and monitoring system</i> , group 8.4.11.2 <i>SLIDING CAB</i> , menu 3 and 4
19	Control valve option frame reduces hydraulic pressure to valve block lift cylinder cab lift and lower.	-	<i>Control valve option frame, description page 101</i>
20	Valve block lift cylinder cab lift and lower lets pressure through to hydraulic cylinder cab lift and lower.	-	<i>Load control valve, description page 103</i>
21	Hydraulic cylinder cab lift and lower reduces speed of lifting or lowering the cab.	-	<i>Hydraulic cylinder cab lift and lowering, description page 104</i>
22	When the cab is raised, Control unit cab (D790-1) activates speed limitation	Max. speed: 5 km/h	Tab 11 <i>Common electric</i> , group 11.5.3.1 <i>Control unit cab</i>

Hydraulic diagram cab lift and support jacks

### 9.10.5.1 Hydraulic oil pump

#### Hydraulic oil pump, description

The hydraulic cab movement (sliding cab) is supplied with pressure from hydraulic oil pump 1 and 2, see section 10 *Common hydraulics*, group 10.4.2 *Axial piston pump with variable displacement*.

### 9.10.5.2 Manoeuvre valve option frame

#### Control valve option frame, description



The cab lift and lower function is controlled by a separate section of control valve option frame, for details see *Control valve option frame, description page 92*.

#### Valve slide, raise/lower cab

The valve slide controls direction and speed of cab lift and lower by directing hydraulic pressure hydraulic cylinder cab lift and lower.

The valve slide is controlled by servo valve raise cab and servo valve lower cab.

#### Servo valve lift cab

Servo valve raise cab controls servo pressure to valve slide raise/lower cab so that this controls oil pressure to hydraulic cylinder cab lift and lowering to raise the cab.

Servo valve cab lift is controlled electrically with solenoid valve (Y6016) which is activated by Control unit frame option (D797-O).

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.11.2 *SLIDING-CAB*, menu 3.

#### Servo valve lower cab

Servo valve cab lower controls servo pressure to valve slide lift/lower cab so that this drains hydraulic cylinder cab lift and lower to lower the cab.

Servo valve cab lower is controlled electrically with solenoid valve (Y6017) which is activated by Control unit frame option (D797-O).

Servo valve lower cab can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.11.2 *SLIDING-CAB*, menu 4.

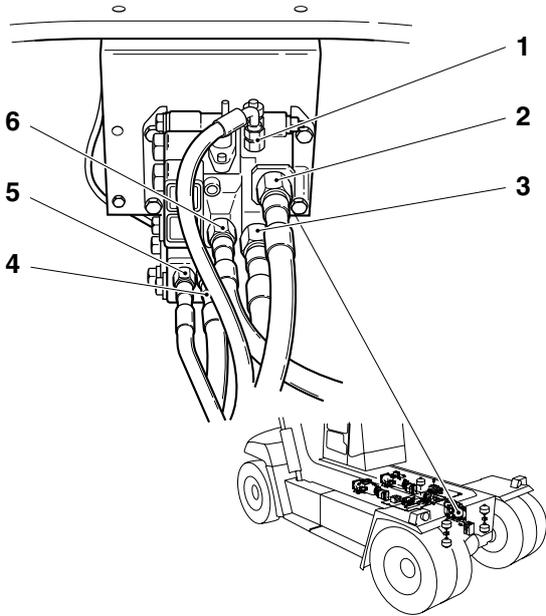
#### Control valve option frame, changing



### NOTE

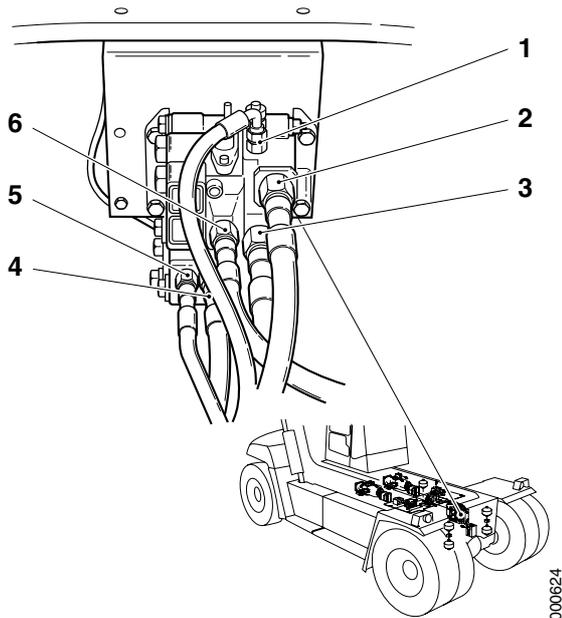
*Read the safety instructions for oil before working, see tab B Safety.*

- 1 Machine in service position, see tab *B Safety*.
- 2 Depressurize the brake and hydraulic systems, see tab *B Safety*.



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1. Load signal (LS)
2. Pressure supply (P)
3. Tank return (T1)
4. Connection hydraulic cylinder (B)
5. Tank return (TP)
6. Connection hydraulic cylinder (A)



1. Load signal (LS)
2. Pressure supply (P)
3. Tank return (T1)
4. Connection, steering cylinder (B)
5. Tank return (TP)
6. Connection, steering cylinder (A)

- 3 Mark up and detach the hydraulic hoses from the control valve.

### NOTE

*Plug all connections immediately to protect the hydraulic system from impurities.*

- 4 Mark up and detach the wiring from the control valve.
- 5 Remove the control valve.

Remove the attaching bolts and lift away the valve. Place the valve on a clean, protected surface.

- 6 Transfer parts to the new control valve.

### NOTE

*Check that the O-rings on the hydraulic connections are intact and in place.*

### NOTE

*Transfer one part at a time so that the marking is not mixed up.*

- 7 Mark up the servo valves on the new control valve.
- 8 Fit the valve.
- 9 Connect the wiring to the control valve in accordance with the marking.
- 10 Connect the hydraulic hoses to the control valve in accordance with the marking.

### NOTE

*Check that the O-rings are intact and correctly fitted.*

- 11 Start the engine and check for leaks.
- 12 Check the function.

## CAUTION

**Air in the hydraulic system may cavitate and can result in product damage.**

**Activate the steering carefully and operate at the lowest possible speed a couple of times to avoid cavitation.**



- 13 Check the oil level in the hydraulic oil tank with the lift cylinders completely down and the extension cylinder completely in. The oil level should be at the top of the level glass. Top up as needed.

## CAUTION

**Overfilling of oil, leakage, and environmental damage.**

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

### 9.10.5.3 Shuttle valve option frame

#### Shuttle valve option frame, description



See section *10 Common hydraulics*, group *10.5.3 Shuttle valve*.

### 9.10.5.4 Accumulator vertically adjustable cab

#### Accumulator cab lift and lowering, description



The accumulator stores pressure so that the cab does not lower if the engine stops and the machine becomes depressurised.

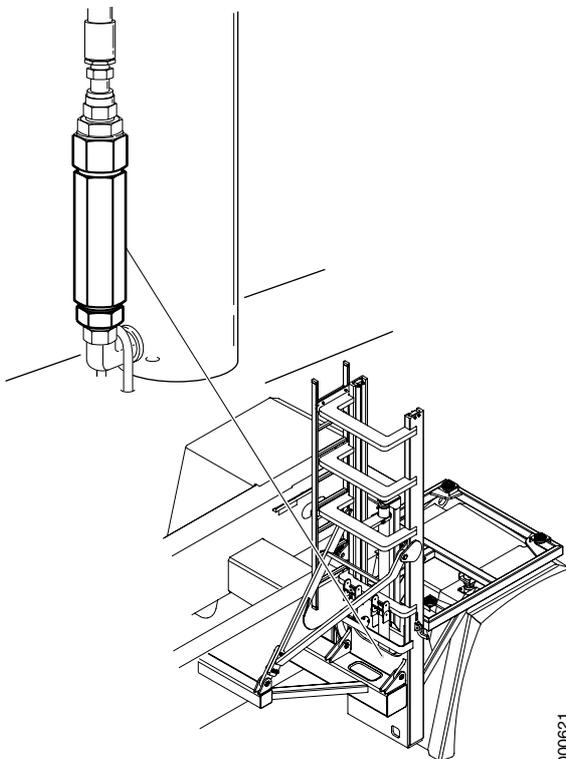
### 9.10.5.5 Load control valve

#### Load control valve, description



The load control valve reduces the speed when lowering the cab.

When the pressure is released behind the cab, the valve slide changes position and restricts the channel through the valve.

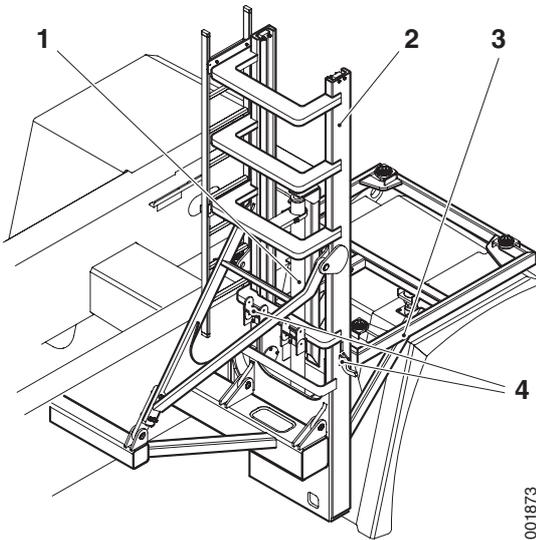


### 9.10.5.6 Hydraulic cylinder vertically adjustable cab

#### Hydraulic cylinder cab lift and lowering, description



The hydraulic cylinder lifts the inner mast and thus the cab.



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1. Hydraulic cylinder, cab lift and lowering
2. Mast, cab lift and lowering
3. Cab undercarriage, cab lift and lowering
4. Safety lock

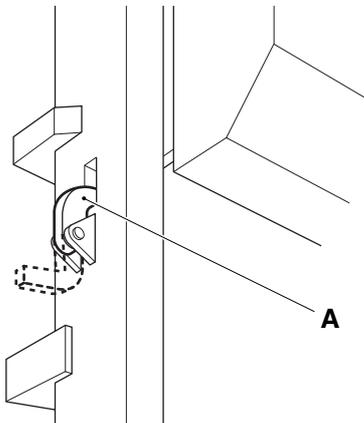
#### Hydraulic cylinder cab lift and lower, changing

### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Run up the cab so high secure its position with both lock lugs (Position A).

Lower the cab so that it rests on the safety braces.



A. Lock lug

001977

### CAUTION

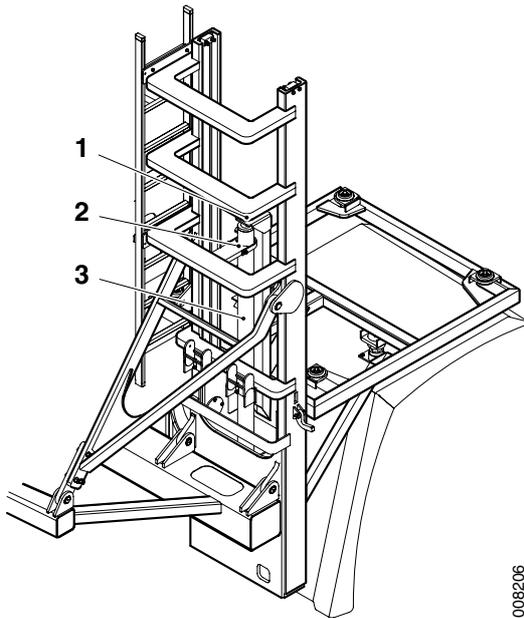
**Entering under raised cab may result in fatal accident.**

**Secure the cab with lock lugs (position A) on the cab frame's both sides.**

- 2 Machine in service position, see tab B Safety.
- 3 Depressurize the hydraulic system, see tab B Safety.
- 4 Mark up and disconnect hydraulic hoses from the extension cylinder.

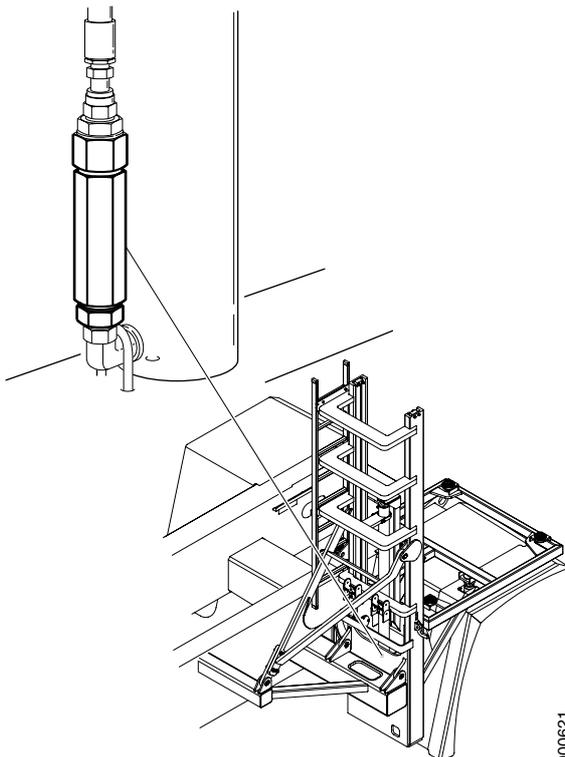
### NOTE

*Plug all hydraulic connections immediately.*



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1. Upper mounting hydraulic cylinder
2. Mounting brace hydraulic cylinder
3. Hydraulic cylinder cab lift and lower



Load control valve

000621

- 5 Disconnect the upper cylinder mounting (position 1) from the movable part of the cab frame.

- 6 Remove the load control valve and compress the hydraulic cylinder.

## NOTE

*Plug all hydraulic connections immediately.*

- 7 Connect lifting equipment to the hydraulic cylinder.
- 8 Remove the hydraulic cylinder's attaching braces from the fixed part of the cab frame.
- 9 Angle and lift out the hydraulic cylinder upward.
- 10 Transfer parts to the new hydraulic cylinder.
- 11 Install the hydraulic cylinder in reverse order.
- 12 Start the engine and check for leaks.
- 13 Check the oil level in the hydraulic oil tank, see tab 10 *Common hydraulics*, group 10.6.8 *Hydraulic oil*.

## Hydraulic cylinders, repairing

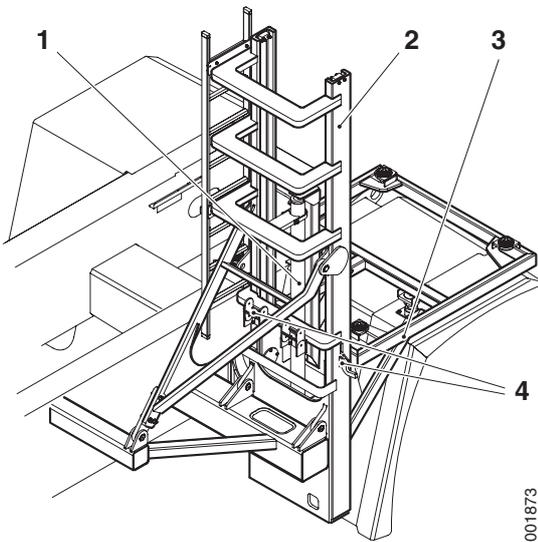
See tab 10 *Common hydraulics*, group 10.7.1 *Hydraulic cylinders*.

### 9.10.5.7 Mast vertically adjustable cab

#### Frame cab lift and lowering, description



The mast holds the cab secure and enables raising and lowering.



001873

1. Hydraulic cylinder, cab lift and lowering
2. Mast, cab lift and lowering
3. Cab undercarriage, cab lift and lowering
4. Safety lock

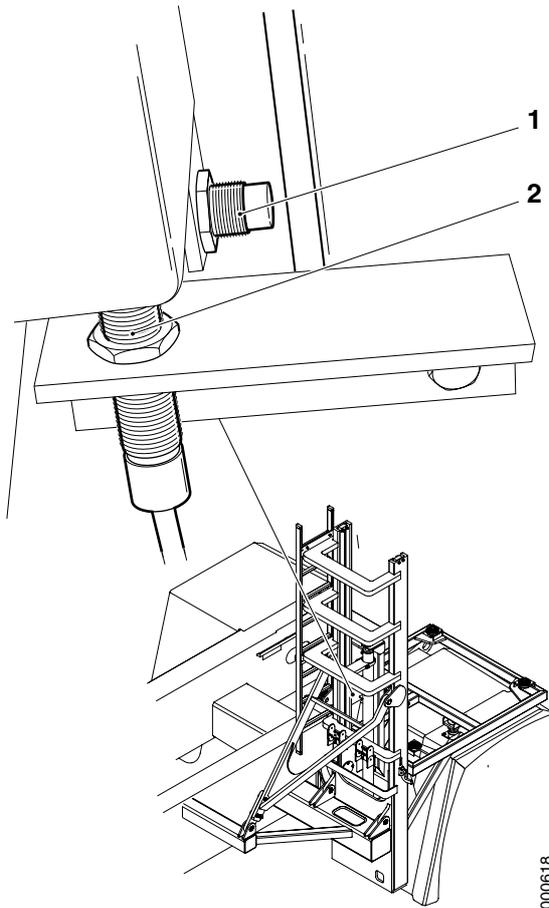
### 9.10.5.8 Sensor lowered cab

#### Sensor lowered cab, description



The sensor indicates when the cab is completely lowered. When the cab is lifted, the machine's speed is reduced and the transmission is locked in second gear.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.11.2 *SLIDING-CAB*, menu 2.



000618

1. Sensor, end-position damping
2. Sensor, end-position lowered cab

#### Position sensor, checking and adjustment

See tab 7 *Load handling*.

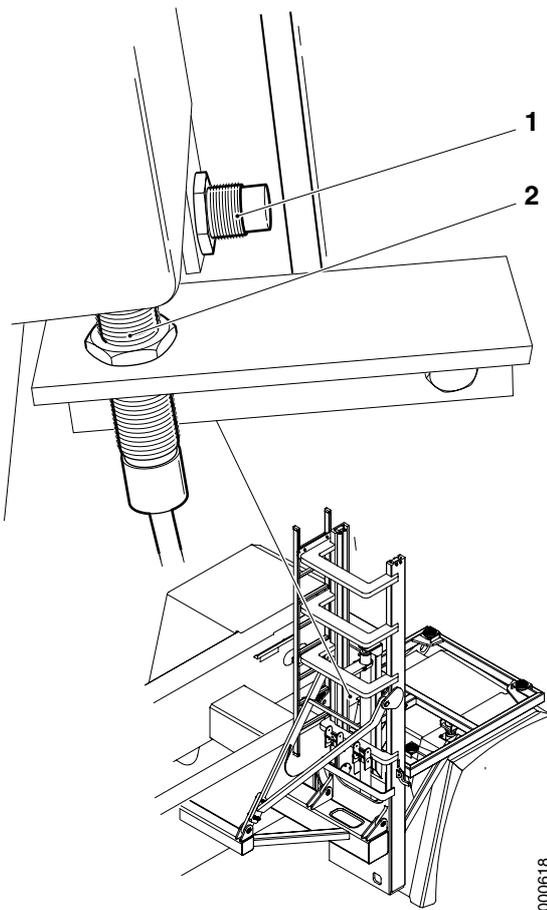
### 9.10.5.9 Sensor damping, end position

#### Sensor damping end-position, description



Sensor damping indicates when the cab is close to end-position. This is used to activate end-position damping. When the cab is raised, the machine's speed is reduced and locked to second gear.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.11.2 *SLIDING-CAB*, menu 2.



000618

- 1. Sensor, end-position damping
- 2. Sensor, end-position lowered cab

#### Position sensor, checking and adjustment

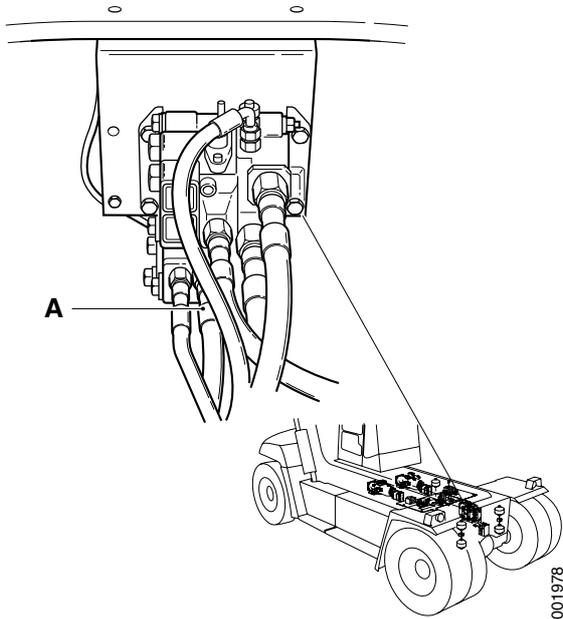
See tab 7 *Load handling*.

### 9.10.5.10 Emergency control valve

#### Emergency lowering valve, description



The emergency lowering valve (position A) opens a connection between the hydraulic cylinder's piston side and tank, and makes it possible to lower the cab if the machine loses all pressure or electric power.



A. Position emergency lowering valve

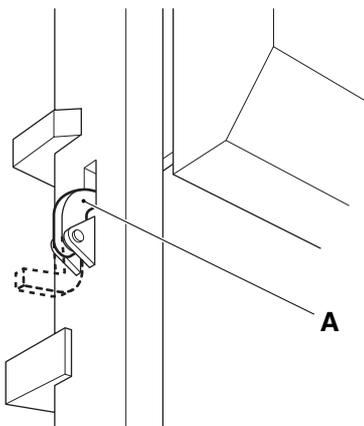
001978

### 9.10.5.11 Safety lock vertically adjustable cab

#### Safety lock cab lift and lowering, description



On the frame there are two lock lugs that are used to secure the cab in lifted position for maintenance work with raised cab.



A. Lock lug

001977

## 9.11 Cab interior

### 9.11.1 Instrument and control panels

#### Dashboard panel, description

The dashboard panel is secured to the steering column and contains warning and indicator lamps, display (KID), function keys (KIT) and switches.

#### Left-hand dashboard panel, description

Left instrument panel is located in the left corner of the cab. It contains rotary controls, switches, and ventilation.

#### Panel for load handling functions, description

The panel is mounted on the operator's seat. The panel has switches for the load handling functions and operation breakers to stop the current load handling functions. The control lever is located by the panel.

#### Dashboard panel, replacement

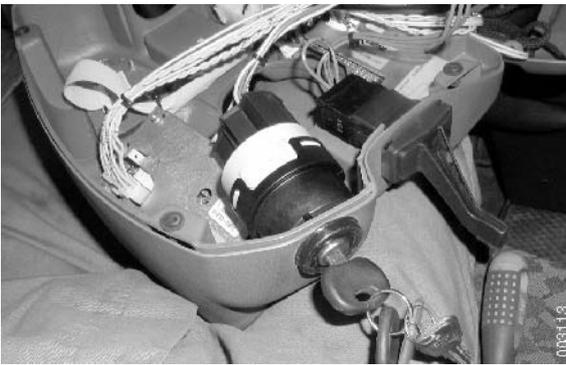
- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the steering wheel centre cover.
- 3 Remove the nut and the steering wheel.



- 4 Remove the bolts on the underside of the dashboard panel.



- 5 Remove the bolts on the top of the dashboard panel.



- 6 Disconnect the connector from the multi-function levers, ignition, Control unit KIT (D790-2) and Control unit KID (D795).
- 7 Transfer the components to the new steering wheel cover.
- 8 Fit in the reverse order.

## 9.11.2 Interior details plastic

### Interior plastic parts, description

The interior of the cab consists of recyclable material.

## 9.11.3 Interior details textile

### Interior textile/fabric parts, description

The interior of the cab consists of recyclable material.

## 9.11.4 Flooring material

### Floor covering, description

The floor covering is a wear-resistant and recyclable material.

## 9.11.5 Insulation

### Insulation, description

The cab insulation consists of recyclable material.

## 9.11.6 Sunshield curtains

### Sun shades, description



Sun blinds can be specified for the front window (windscreen) and the roof window.

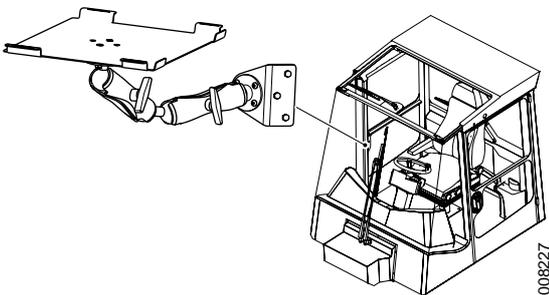
1. Sun visor, front window: Can be raised and lowered using a cord on the right-hand side. Stops in selected position.
2. Sun visor, roof window: Extendable forward to fasten in two hooks in the front edge of the window.

## 9.11.7 Terminal table

### Terminal table, description



The function of terminal desk is to provide a work surface for a computer/terminal. It is located to the right of the steering wheel, easily accessible for the operator.

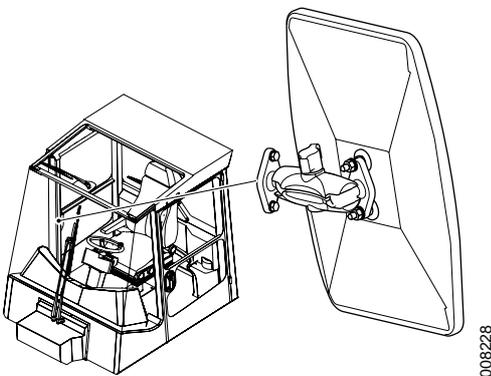


## 9.11.8 Writing-desk

### Writing table, description



The writing table with reading light is located on a flexible attachment to the right in front of the door in the cab. That is where work orders, etc. can be fastened.



## 9.12 Frame

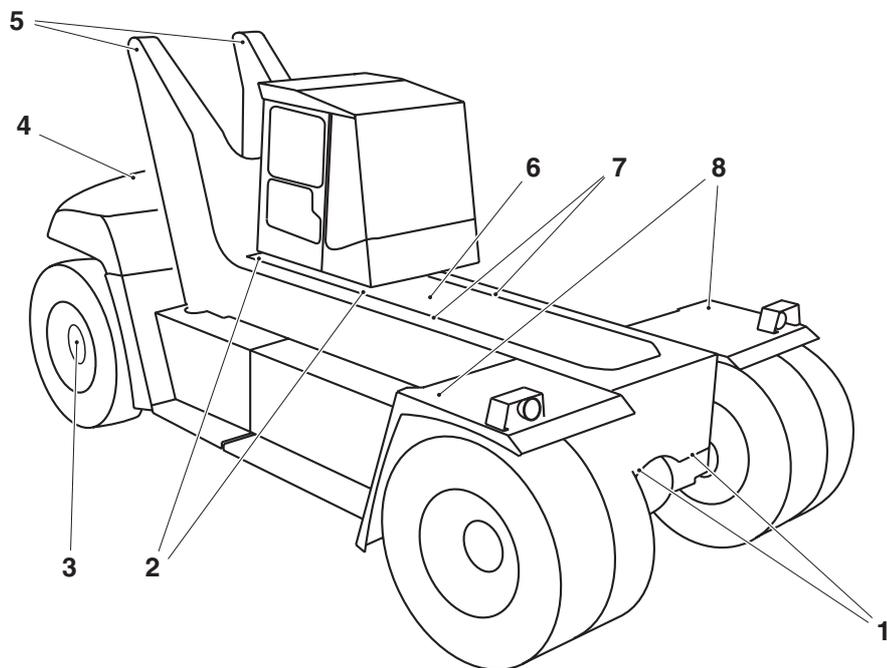
### Chassis, description

The frame is a modular construction and consists of front section, rear section and a beam pair. This construction results in advantages in terms of rigidity and strength.

There are mounting points in the frame for engine, gearbox, drive axle, steering axle, fuel and hydraulic tanks, cab, boom and body parts.

The space in the rear section of the frame is used for counterweights, the amount of which is adapted to the machine in question. The counterweights are designed to allow as good a view backwards as possible.

The front wings are bolted into the frame (which has advantages when delivering the machine).



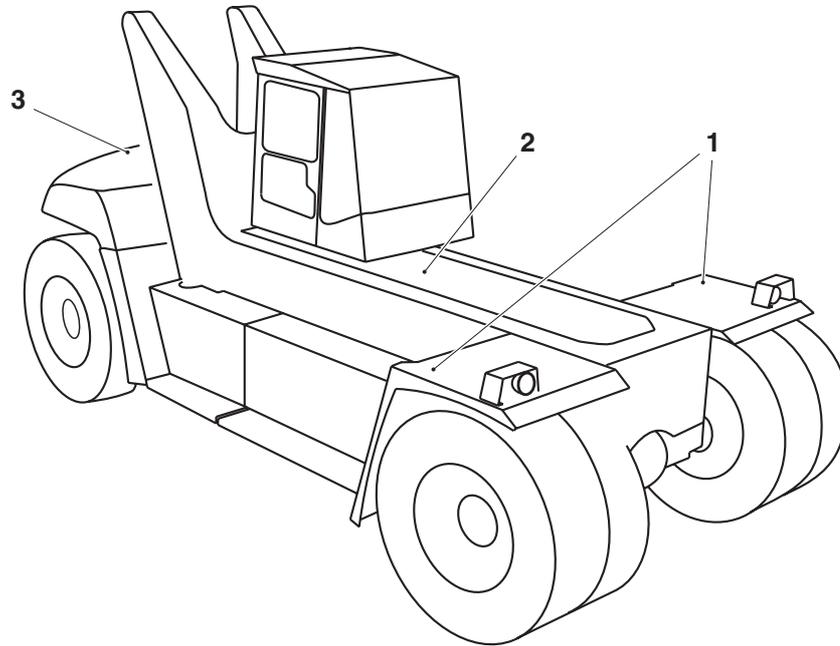
1. Frame's front part with drive axle mounting
2. Cab mounts (4 points)
3. Steering axle mounting
4. Frame's rear part with counterweights
5. Boom mounting
6. Engine compartment with mounts for engine and transmission
7. Member pair
8. Mounts front wings

001511

## 9.13 Body structure

### Body, description

The body's components comprise:



1. Wings
2. Hood engine compartment
3. Counterweight

002213

### 9.13.1 Fenders

#### Fenders, description

Fenders are provided over the wheels to prevent dirt being thrown up during driving. The counterweight acts as a mudguard over the rear wheels (see *Counterweights, description page 115*).

The fenders can be equipped with extra mudguards if required by its duties (⊕).

### 9.13.2 Hood engine compartment

#### Hood engine compartment, description

The machine's engine compartment is protected by plates that act as engine hood. The plate is divided into several sections and these are secured with attaching bolts. The plate is designed for walking on and are knurled for good footing.

### 9.13.3 Footstep and rail

#### Steps and rails, description

The cab has steps and a rail for easy access.

The rail is also available with front wings (⊕).

### 9.13.4 Counterweights

#### Counterweights, description

The machine has counterweights to balance the machine's lift capacity and may therefore vary in quantity and weight.

The counterweights are located at the very back on the frame for maximal leverage.

The machine has counterweights in the following places:

- Under the steering axle
- Furthest back on the machine there are vertical counterweights secured in the rear edge of the machine, the outer has a towing eye.

Between the outer one and the frame are smaller counterweights whose dimensions and quantity are adapted to balance the machine's lifting capacity.

- Upper horizontal counterweight.

Under the horizontal counterweight are smaller counterweights whose dimensions and quantity are adapted to balance the machine's lifting capacity.



## DANGER

**The counterweights are factory fitted and are adapted according to the machine's properties.**

**The machine's operating characteristics are changed!**

**Never change the quantity of counterweights.**

## 9.14 Central lubrication

### Central lubrication, checking



- 1 Check that no grease has been forced out through the safety valve (position 2).

If grease has been forced out through the safety valve it means that there is a stop in the system. Determine which line is clogged by feeling the connections at the distribution blocks. A clogged hose remains pressurized and the connection becomes hard.

#### NOTE

*If several distribution blocks are connected in series, a clogged line will be pressurized all the way to the first distribution block.*

- 2 Turn the start key to position I.
- 3 Operate the pump manually and check that the indicator pin moves in and out on the distribution blocks.

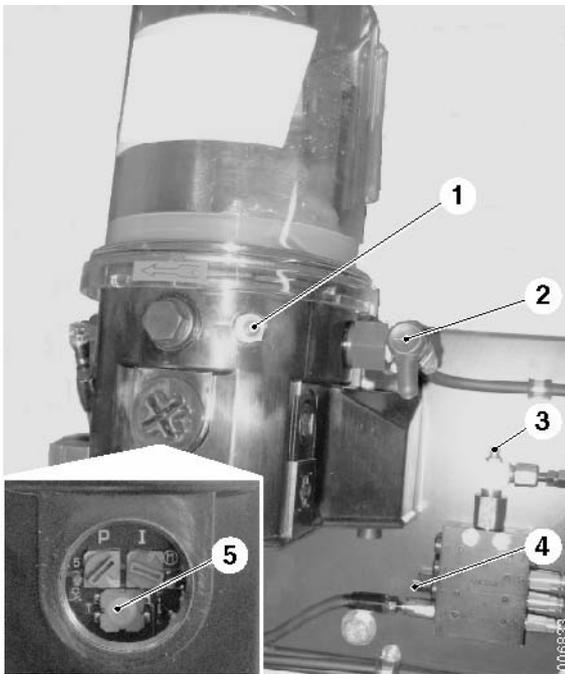
To operate the pump, loosen the cover and press in switch manual operation (position 5).

If the indicator pins do not move even when the pump is running, troubleshoot the pump unit.

#### NOTE

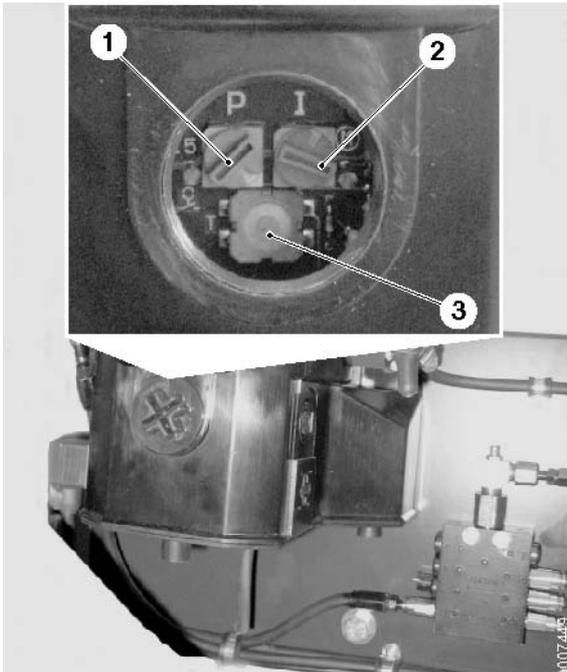
*The system can be lubricated manually through the grease nipple on the distribution block (position 3).*

- 4 Fill grease in the pump unit through the filler nipple, see tab *F* *Technical data*.



Overview central lubrication pump and distribution block. Example illustration.

1. Grease nipple filling point grease
2. Safety valve
3. Grease nipple manual greasing of system
4. Indicator pin
5. Switch manual operation



Example figure

- 1. Setting pause-time (red)
- 2. Setting run-time (blue)
- 3. Manual operation of pump

### Central lubrication, adjusting lubrication times

The central lubrication's pause and run-time must be set after replacement, the setting is unique to each machine, depending on the machine's equipment. At replacement, the new pump unit should be set in the same way as the old.

If the machine is not greased correctly, pause and run-time can be adjusted. Primarily, run-time should be adjusted so that all grease points on the machine are greased every time. If large amounts of grease are pressed out at all grease points, pause-time can be increased.

#### NOTE

*Adjust only one step each time. Small adjustments make a big difference.*

#### Test or extra greasing

Central lubrication can be operated manually by holding in the button for manual operation (position 3) for 2 seconds. This starts an extra lubrication cycle.

#### Pause-time

Pause-time is the length of the interval between greasings. The interval is adjusted in whole hours between 1 and 15 hours. Pause-time is adjusted with the red handle (position 1)

Switch position	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Pause-time [hours]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

#### Run-time

Run-time is how long the pump is activated every time. Run-time can be adjusted between 2 and 30 minutes. Run-time is adjusted with the blue handle (position 2).

Switch position	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Run-time [minutes]	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30

## 9.14.1 Pump unit

### Pump unit, description



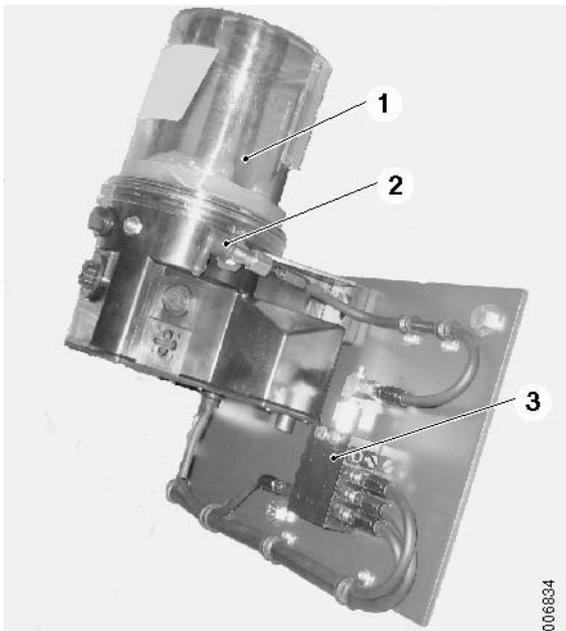
The pump unit consists of containers with stirrer, pump housing with built-in motor, timer, pump element, filler nipple, and safety valve.

The central lubrication works with lubrication cycles (pause and running time as well as read-in time). In the pump there is a circuit board with a timer with which one can set the pump motor's run and pause time.

When the central lubrication works, it greases the grease points one at a time in series. If a stop should occur in a grease point, the pressure will increase and the safety valve will release grease and also the following grease points will not be greased.

### NOTE

*The safety valve will press out grease if a grease point cannot be greased. If a grease point is not greased, none of the following grease points will be greased. Therefore, it is very important to check the safety valve.*



Example figure components central lubrication

1. Pump unit
2. Safety valve
3. Distribution block

## 9.14.2 Distribution block

### Distribution block, description

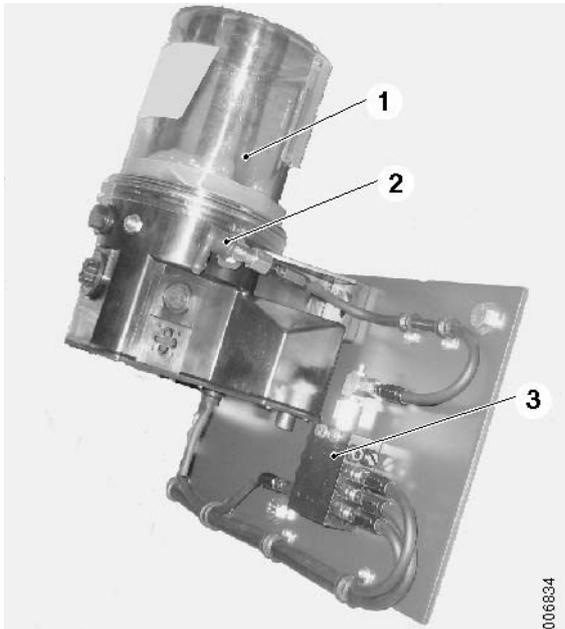


The distribution blocks distribute grease from the pump unit to grease points or on to other distribution blocks. The number of distribution blocks can vary depending on how many (and which) grease points have been selected.

The distribution blocks consist of pistons that meter out grease to each grease point. The pistons are driven by the grease and do not have springs and gaskets. It is the grease that drives the pistons inside the distributor. The shape of the pistons and channels in the distribution block enable the pistons to move in a predetermined way. Each piston must have completed its motion before the next piston can move. The pistons are dependent on each other. It is technically impossible to skip any connected grease point. If a grease point cannot be greased, the whole system is blocked and grease is pressed out through the safety valve.

The system's first distribution block (i.e. the block closest to the pump) has an indicator pin. If the pin moves forward and backward (in time with the piston movements), this indicates that grease is pumped through the system. If a distribution block is unable to supply grease to any of its lubrication points, the pin stops and accordingly the entire system.

If there is clogging in the system, that line will be pressurized, from the pump to the stop, through all the distribution blocks on the way. This makes it easy to find a block in the system. By feeling the distribution blocks' connections and feeling which connection is stiff, the blockage can be traced. Keep in mind that several distribution blocks may be connected in series.



Example figure components central lubrication

1. Pump unit
2. Safety valve
3. Distribution block

## 9.14.3 Pipes

### Lines, description



Central lubrication works under very high pressure, only use lines that meet the following specifications.

Main hose	
Diameter	8.4 mm
Explosion pressure	min. 60.0 MPa

## 9.15 Paint/coatings

### Paint and surface finish, description

The machine is painted using a single layer paint, thickness 120  $\mu\text{m}$ .

For colour code (RAL) of machine in question, see machine card.

## Table of Contents 10 Common hydraulics

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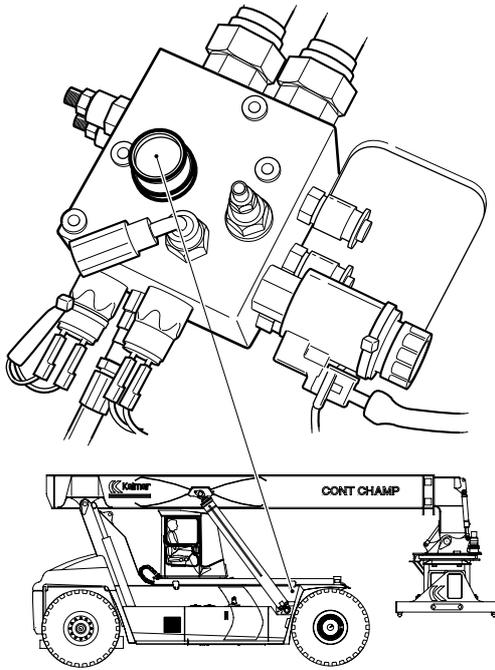
# 10 Common hydraulics

## 10.2 Security valves

### 10.2.1 Accumulator drain valve

#### Accumulator drain valve, description

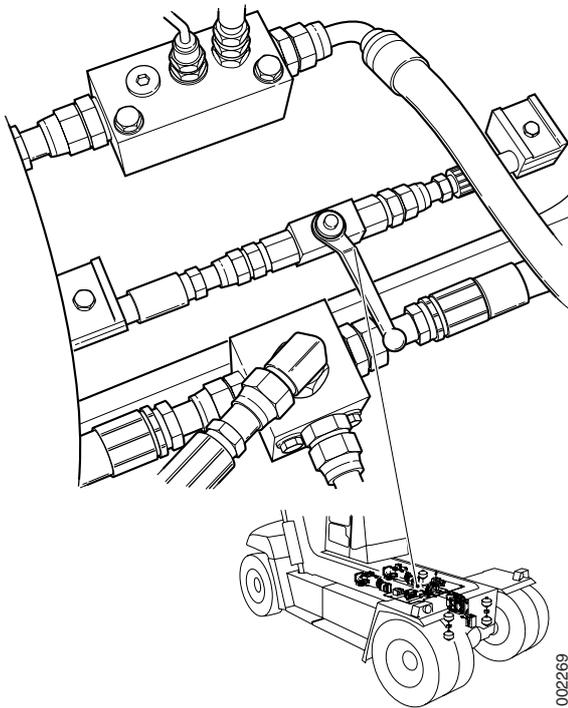
The accumulator drain valve is located on the accumulator charging valve. See section 4 *Brakes*, group 4.3.3 *Accumulator charging valve*.



## 10.2.2 Unloading valve attachment

### Relief valve attachment, description

The relief valve is located on the lift cylinder beam. See section 7 *Load handling*, group 7.4.8 *Accumulator charging valve*.



## 10.2.3 Pipes and hoses

### Pipes and hoses, general

See *Pipes and hoses, general* page 18.

## 10.3 Tanks and accumulators

### 10.3.1 Tank

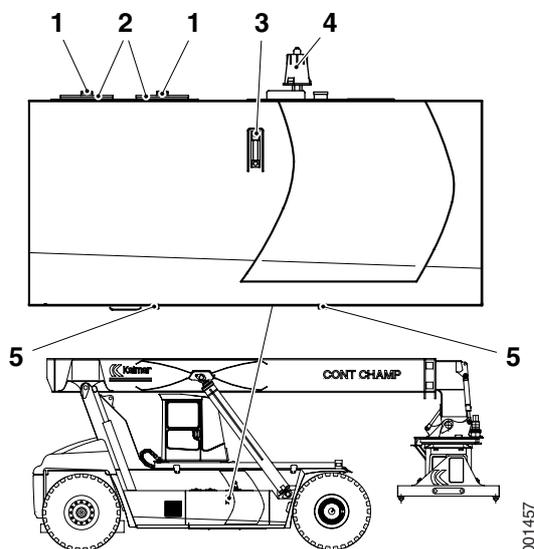
#### Tank, description

The hydraulic oil tank forms part of the side panel on the right-hand side of the machine. Inside the tank is the working hydraulic oil filter. These are accessible through hatches on top of the tank.

Hydraulic oil is filled directly into the tank through the filler caps on the filter manhole covers. For oil capacity and grade, see tab *F Technical data*. The entire filter unit can be removed to facilitate access for cleaning. There is a drain plug at the bottom of the tank.

The tank has filtered venting which allows changes in the tank volume due to usage and temperature variations.

The oil level is checked on the level glass on the tank's side when all hydraulic cylinders are in the bottom position.



001457

1. Filler plug hydraulic oil
2. Cap for hydraulic oil filter
3. Level glass, hydraulic oil
4. Breather filter, hydraulic oil tank
5. Drain plugs, hydraulic oil

### 10.3.2 Pipes and hoses

#### Pipes and hoses, general

See *Pipes and hoses, general* page 18.

## 10.4 Pumps

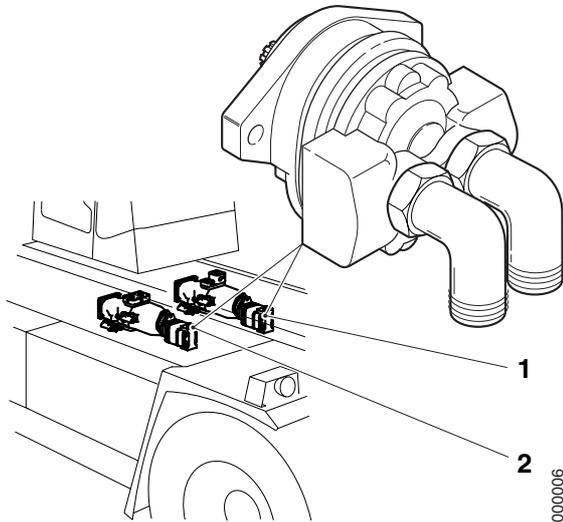
### 10.4.1 Gear pump with fixed displacement

#### Gear pump with fixed displacement, description

There are two gear pumps with fixed displacement. One of them (position 1) pressurizes the brake system, see tab 4 *Brakes*, group 4.3.1 *Brake fluid pump*. The other gear pump (position 2) circulates the hydraulic oil for the working hydraulics through a cooler and filters.

The gear pump pumps oil using two gears wheels that rotate opposite each other. One is driven by the pump's input shaft and the other rotates freely. The gear pump's flow is directly dependent on the speed of the input shaft.

The cooling pump is mounted on the right main pump and is driven by the main pump's shaft from the transmission's power take-off. The pump's speed is directly dependent on the engine speed. The pump's flow increases with the engine speed.



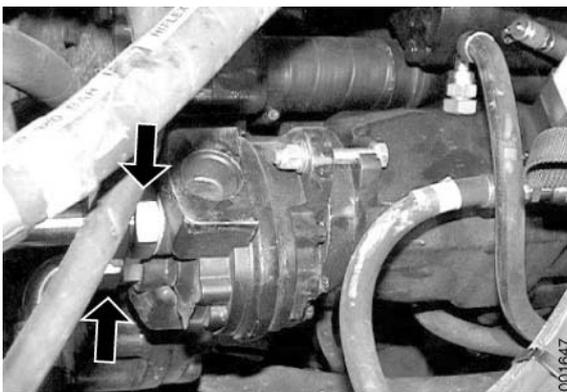
1. Brake oil pump
2. Pump cooling and filtering

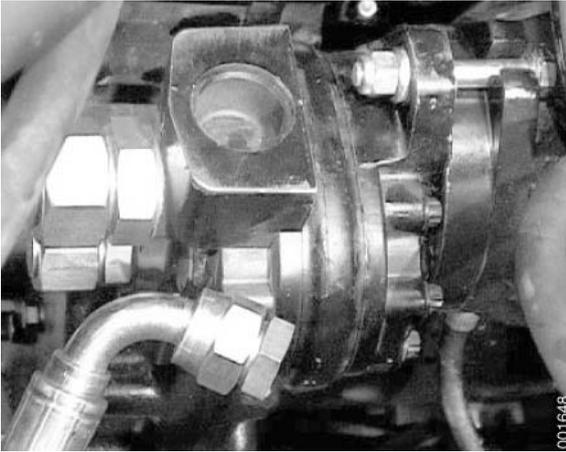
#### Gear pump, changing

#### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the brake and hydraulic systems, see tab B Safety.
- 3 Mark up and release the hydraulic hoses from the gear pump.





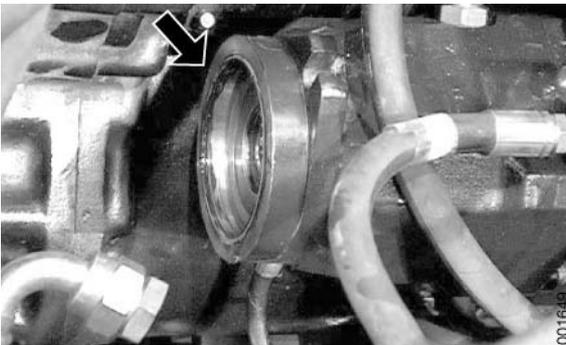
- 4 Remove the gear pump.  
Remove the retaining bolts, and pull the pump backwards and lift it away.
- 5 Transfer the connection adapters to the new gear pump.



- 6 Remove the spacer ring from the gear pump or axial piston pump.  
Clean the O rings' contact surfaces on the spacer ring.
- 7 Check the O-rings, change as needed. Install the O-rings on the spacer ring. Brush sealing silicone on the sealing face against the gear pump, see tab *F Technical data*.

## NOTE

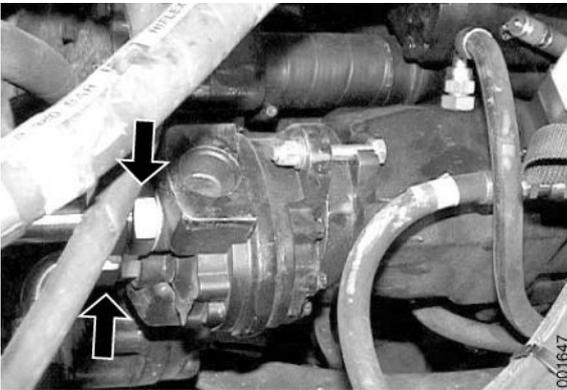
*Only use silicon on the side facing the gear pump.*



- 8 Fit the spacer ring on the axial piston pump.



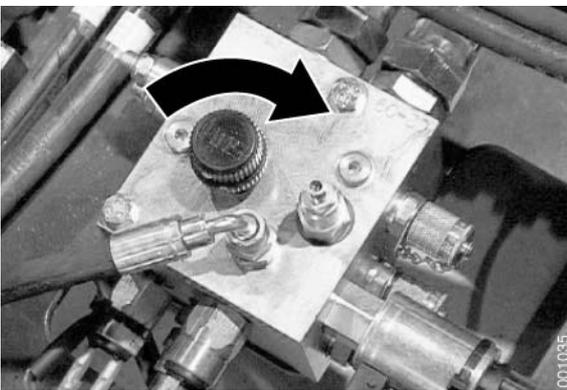
- 9 Brush sealing silicone on the gear pump's sealing face against the spacer ring, see tab *F Technical data*.
- 10 Fit the gear pump and axial piston pump.  
Fit the pump and check that the gear grips the shaft and that the spacer ring is directly against the gear pump. Fit the pump's retaining bolts.



- 11 Connect the hydraulic hoses to the gear pump.

### NOTE

*Check that the O rings are intact and are fitted correctly.*



- 12 Close the drain valve on the accumulator charging valve.
- 13 Turn on the main electric power and start the engine.
- 14 Check that the hose connections and seal between gear pump and axial piston pump are airtight.



- 15 Check the oil level in the brake or hydraulic system, depending on which pump has been changed. Top up as needed.

### NOTE

*If the pump is replaced due to malfunction, change the oil and filter as well.*

- 16 If the brake oil pump has been changed:  
Check brake pressures, see tab *4 Brakes*, group *4.3.1 Brake oil pump*.

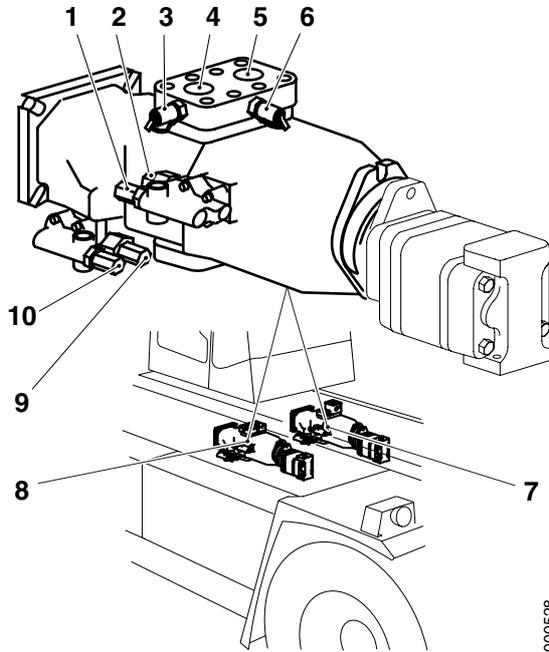
## 10.4.2 Axial piston pump with variable displacement

### Axial piston pump with variable displacement, description

The hydraulic oil pumps are of the type variable axial piston pumps and are controlled with load signals depending on the flow demand from respective function.

The hydraulic pumps are assembled two and two with a connecting block. The connecting block directs oil to and from the pumps. On the connecting block, there's a spacer block containing test outlets for checking pump pressure. On the spacer block, there are non-return valves that prevent oil from being pumped around between the pumps instead of out into the hydraulic system.

One spacer block for the left pumps also contains a branching to the attachment hydraulics with a separate non-return valve.



000528

Hydraulic oil pump unit

1. Adjusting screw, stand-by pressure of front pump
2. Adjusting screw, max. pressure of front pump
3. Test outlet, rear pump pressure
4. Connection, pressure side of rear pump
5. Connection, pressure side of front pump
6. Test outlet, front pump pressure
7. Left hydraulic oil pump unit
8. Right hydraulic oil pump unit
9. Adjusting screw, max. pressure of rear pump
10. Adjusting screw, stand-by pressure of rear pump

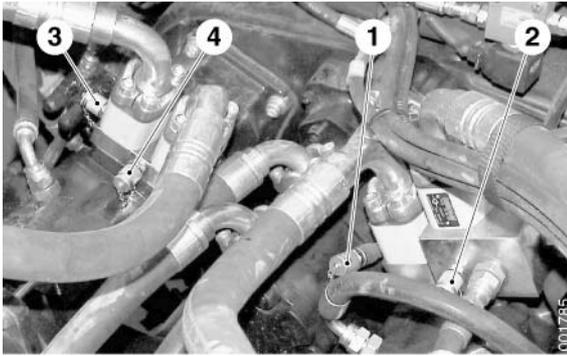


<b>Pos</b>	<b>Explanation</b>	<b>Signal description</b>	<b>Reference</b>
7	If any attachment function is activated, then control unit frame rear (D797-R) activates solenoid valve top hydraulics (Y6003).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i> Diagnostic menu, see section 8 <i>Control system</i> group 8.4.5.6 <i>HYD</i> , menu 6.
8	Solenoid valve top hydraulics (Y6003) controls an unloaded constant pressure to hydraulic oil pump no. 2, this functions as a load signal.	-	Tab 7 <i>Load handling</i> , group 7.4.2 <i>Valve block top lift hydraulics</i>
9	The shuttle valve sends load signal on to hydraulic oil pump no. 2.	-	<i>Shuttle valve</i> , description page 19
10	Hydraulic oil pump no. 2 increases the flow.	See pressure plate Max. pressure hydraulic oil pumps on left frame member.	<i>Axial piston pump with variable displacement</i> , description page 9
11	When solenoid valve top hydraulics (Y6003) is not activated, the unloaded pressure is directed to tank.	-	Tab 7 <i>Load handling</i> , group 7.4.2 <i>Valve block top lift hydraulics</i>
12	The steering valve sends load signal when the steering wheel is turned.	-	Tab 5 <i>Steering</i> , group 5.2.3 <i>Steering valve</i>
13	The shuttle valve sends load signal on to hydraulic oil pump no. 3 and no. 4.	-	<i>Shuttle valve</i> , description page 19
14	Hydraulic oil pump no. 3 and no. 4 increase the flow.	See pressure plate Steering pressure, on left frame member.	<i>Axial piston pump with variable displacement</i> , description page 9
15	Priority valve directs pressure from pumps to steering valve.	See pressure plate Steering pressure, on left frame member.	Tab 5 <i>Steering</i> , group 5.2.2 <i>Priority valve</i>
16	At boom in, Control unit frame rear (D797-R) activates Solenoid valve, pump unloading (Y6062).	U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i> Diagnostic menu, see heading 8 <i>Control and monitoring system</i> , group 8.4.8.2 <i>BOOM</i> , menu 2
17	Solenoid valve pump unloading (Y6062) leads the pressure from the control valve to tank.	-	Tab 7 <i>Load handling</i> , group 7.3.9 <i>Valve block pump unloading</i>

## Hydraulic oil pump, checking

### NOTE

Read the safety instructions for oil before work, see tab B Safety.



1. Hydraulic oil pump 1
2. Hydraulic oil pump 2
3. Hydraulic oil pump 3
4. Hydraulic oil pump 4

- 1 Operate and warm up the machine so that the hydraulic oil reaches operating temperature, approx. 50 °C.
- 2 Turn off the engine.
- 3 Connect pressure gauge to test outlet on hydraulic oil pump 1.
- 4 Start the engine and let it idle.
- 5 Check the stand-by pressure for one pump at a time in the following order:

Hydraulic oil pump 1: 1.8 MPa

Hydraulic oil pump 2: 2.1 MPa

Hydraulic oil pump 3: 2.9 MPa

Hydraulic oil pump 4: 3.1 MPa

The settings apply to standard machine, certain machines can have higher stand-by pressure. For correct stand-by pressure, see pressure plate. However, the difference in pressure between the different pumps must always be maintained.

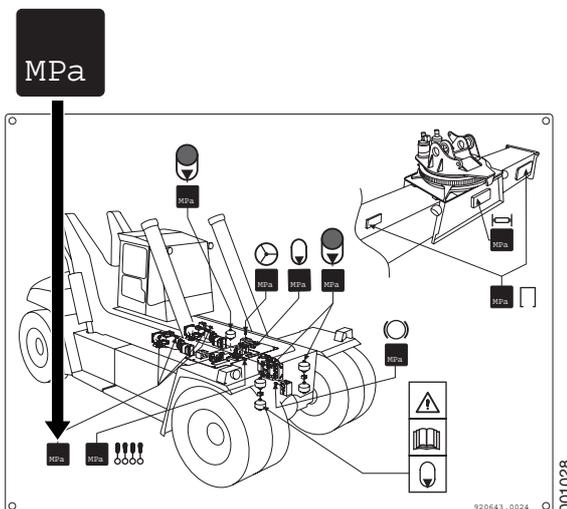
- 6 Increase engine speed to approx. 1100 r/min and run extension function against end-position (overflow).

Run out the boom to max. and continue to request max. extension with the control lever. This results in overflowing of the extension function.

- 7 Check max. pressure on hydraulic oil pump 1, the pressure should match the value on the pressure plate.

All pumps shall give the same pressure. The order between the pumps is of no importance.

- 8 Turn off the engine.
- 9 Transfer the pressure gauge to the next pump and repeat steps 3–8 on all four pumps.



## Axial piston pump with variable displacement, change

### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Park the machine with the cab in its rearmost position and the boom fully raised and extended halfway.

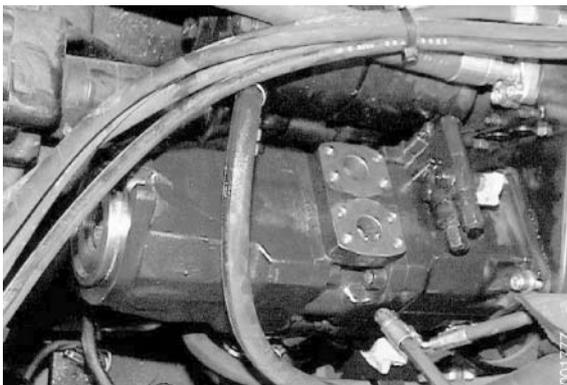
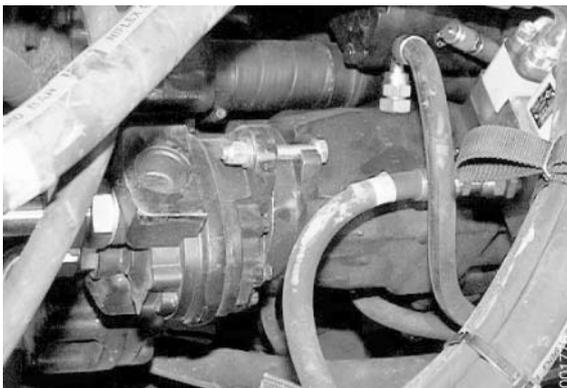


### CAUTION

**Make sure that the oil level in the hydraulic oil tank is below the mouth of the axial piston pump's suction hose.**

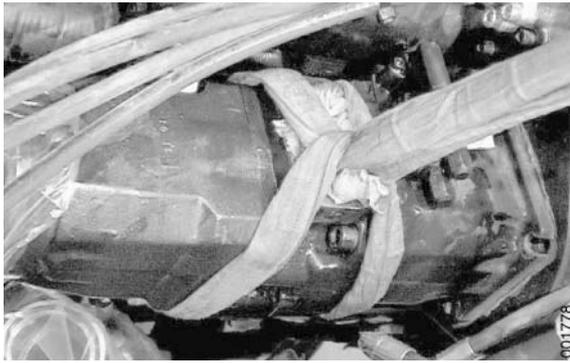
If the premises do not permit the boom to be raised, the hydraulic oil tank will have to be drained, see *Hydraulic oil, changing page 31*.

- 2 Disconnect the main power supply.
- 3 Depressurize the brake and hydraulic systems, see tab B Safety.
- 4 Disconnect the brake oil pump or cooling pump from the hydraulic oil pump, depending on which pump is to be changed.
- 5 Suspend the gear pump.
- 6 Use a plastic bag or similar to protect the connection on the gear pump.
- 7 Mark the hydraulic hoses and disconnect them from the axial piston pump.

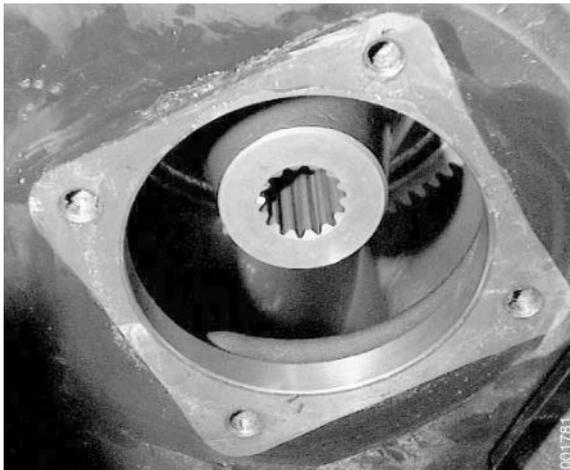


### NOTE

*Plug all connections immediately to protect the hydraulic system from impurities.*



- 8 Attach hoisting equipment to the axial piston pump.
- 9 Remove the axial piston pump.  
Remove the retaining bolts and lift the pump away.



- 10 Clean the flange on the gearbox, removing all silicone remnants.

### CAUTION

**Be careful and make sure that no gasket remains fall down into the transmission.**

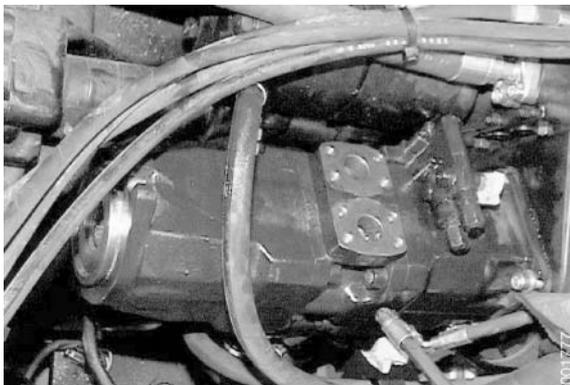
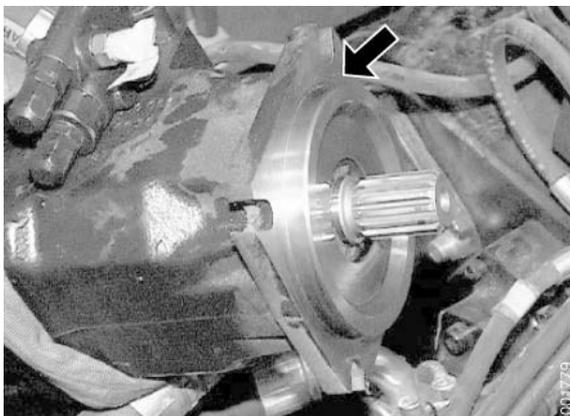
**Gasket remains may fall into the transmission and cause product damage.**

- 11 Transfer the connection adapters to the new axial piston pump.

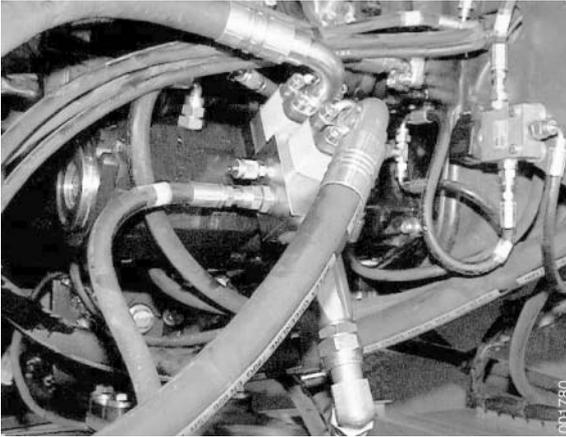
### NOTE

*Check that the O-rings are intact and fitted correctly.*

- 12 Brush sealing silicone on the axial piston pump flange that faces the transmission, see tab *F Technical data*.
- 13 Fit the axial piston pump in place.  
Place the axial piston pump so that the pump shaft engages the transmission's gears. Install the attaching bolts.
- 14 Connect the suction hose to the axial piston pump.



- 15 Fill the pump with oil through the connections at the top.



- 16 Connect the hydraulic hoses to the axial piston pump in accordance with the marking.

### NOTE

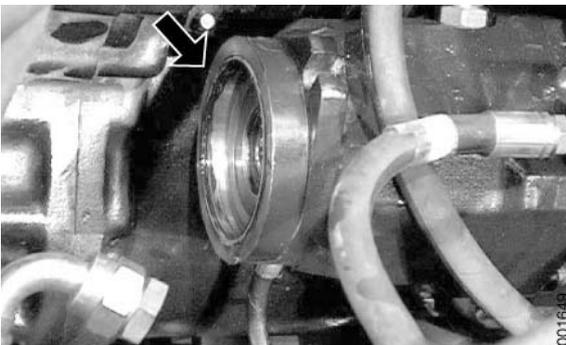
*Check that the O-rings are intact and fitted correctly.*



- 17 If the spacer ring is still on the axial piston pump. Remove the spacer ring between the gear pump and axial piston pump.  
If the spacer ring remains in place on the gear pump, go to step 20.  
Clean the O rings' contact surfaces on the spacer ring.
- 18 Check the O-rings, change as needed. Install the O-rings on the spacer ring. Brush sealing silicone on the sealing face against the gear pump, see tab *F Technical data*.

### NOTE

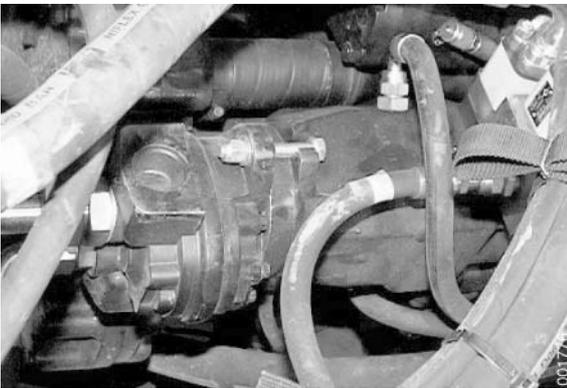
*Only use silicon on one side, the side against the brake pump.*



- 19 Fit the spacer ring on the axial piston pump.



The illustration shows a separate pump.



- 20 Brush sealing silicone on the gear pump's sealing face against the spacer ring, see tab *F Technical data*.

- 21 Fit the gear pump in place.

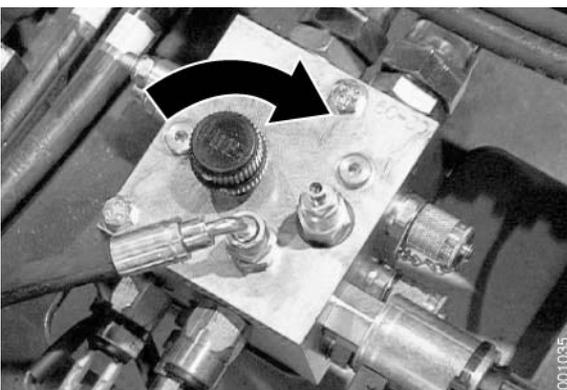
Place the gear pump on the axial piston pump and install the attaching bolts. Be careful so that the O-ring on the spacer ring is located correctly and that the gear pump's shaft engages the axial piston pump's output shaft.

- 22 Vent the axial piston pump, see *Axial piston pump with variable displacement, venting page 17*.

## CAUTION

**Vent the axial piston pump before starting the engine.**

**The oil in the axial piston pump may cavitate and cause product damage.**



- 23 Close the drain valve on the accumulator charging valve.

- 24 Turn on the main electric power and start the engine.

- 25 Check that the hose connections and seal between gear pump and axial piston pump are airtight.

- 26 Check the pump pressures, see *Hydraulic oil pump, checking page 12*.



- 27 Check the oil level in the hydraulic oil tank. The oil level shall be at the top of the level glass. Top up as needed.

### NOTE

*If the pump is replaced due to malfunction, change the oil and filter in the hydraulic system as well.*

## ⚠ CAUTION

**Overfilling the oil.**

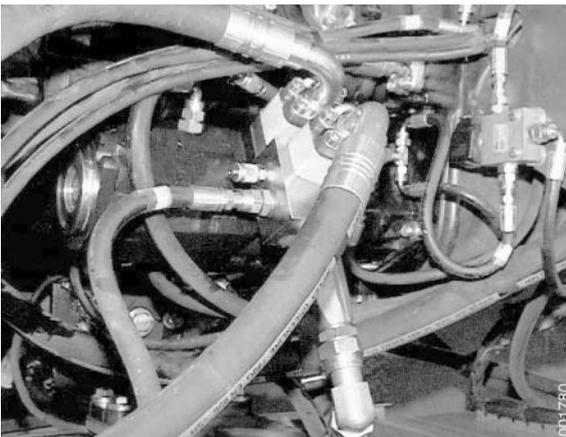
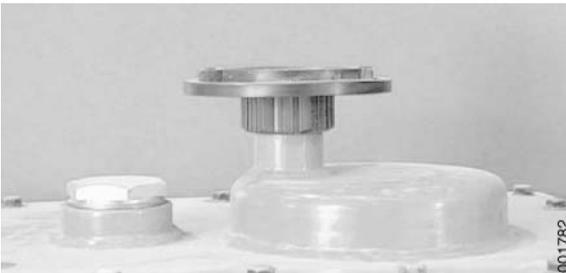
**Leakage and environmental damage.**

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

### Axial piston pump with variable displacement, venting

### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*



- 1 Remove the hydraulic oil tank breather filter.
- 2 Connect compressed air at max. pressure **max. 10 kPa** to the hydraulic oil tank's connection for breather filter.
- 3 Loosen the hoses to the hydraulic system's feed from the axial piston pump one at a time and let oil flow out. Tighten the connections when oil free of air flows out.
- 4 Remove the compressed air from the tank and fit the breather filter.
- 5 Turn on the main electric power and start the engine.
- 6 Let the engine idle for at least one minute. Check that all connections seal tight.
- 7 Lower the boom and raise it again very slowly so that the pump operates under minimum load while air pockets are eliminated.
- 8 Turn off the engine.
- 9 Wash the engine bay.

## 10.4.3 Pipes and hoses

### Pipes and hoses, general

*See Pipes and hoses, general page 18.*

## 10.5 Hoses, pipes and valves

### 10.5.1 Pipes and hoses

#### Pipes and hoses, general

Hoses with ORFS-couplings are used almost exclusively. For maximum service life and function, the following should be observed when replacing hoses.

1. To avoid stresses in the connection, there should be a length of straight hose after the connection.
2. The hose may not be twisted. (A twist of 7% reduces service life by 90%.)
3. Minimize the number of bends by using correct couplings.
4. Avoid sharp bends.
5. Keep the hoses clean internally. Leave the plugs in place as long as possible when installing.
6. Check the position of the O-rings and tighten to the correct torque, see tab *F Technical data*.

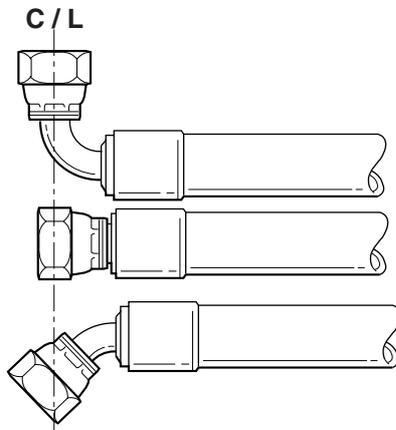
#### NOTE

*Straight coupling requires counterhold wrench so that the O-ring is not damaged.*

7. O-rings shall not be lubricated with oil when installed.

#### Hose length

Hose length is measured on a laid-out hose between the sealing surfaces. On angled connections, measure from the sealing surface's centre line [C/L] according to the figure.



C/L line for measuring hose length

001015

#### Cleanliness

The function and service life of hydraulic components depend to a great extent on how clean the hydraulic oil is. Therefore, it is very important to prevent dirt from entering the brake and hydraulic system.

Some simple advice to keep the hydraulic system clean.

- Always clean the area around a component before starting to work.
- Plug hose connections immediately after disconnecting. If possible, use correct plugs for the connection type. If plugs are missing, use clean plastic bags and cable ties or tape to seal the connection.
- Never reuse oil that has been drained from the machine.
- If possible, filter the oil before pouring it into the machine, oil barrels often contain impurities.

When filling hydraulic oil, fill through the caps at the hydraulic oil filters in the tank so that the oil is filtered.

## 10.5.2 Priority valve

### Priority valve, description

See section 5 *Steering*, group 5.2.2 *Priority valve*.

## 10.5.3 Shuttle valve

### Shuttle valve, description

A shuttle valve chooses between two pressure signals and sends the strongest. Shuttle valves are used to send load signals to the hydraulic oil pumps. This results in control of the pumps by the function that requires the highest pressure if several functions are activated at the same time.

Depending on options, there are two to four shuttle valves. The shuttle valves are located on a bracket for oil filling between the engine and transmission.

The shuttle valves choose between the following control signals:

1. Chooses between load signal from the control valve for lift, lower and extension as well as the control signal from the control valve for attachment. The shuttle valve sends control signals on to main pump 4, see *Axial piston pump with variable displacement, description page 9*.
2. Chooses between the load signal from the control valve for lift, lower and extension as well as the control pressure from the control valve. The shuttle valve sends the control signal on to control hydraulic pump 2, see *Axial piston pump with variable displacement, description page 9*.

3. 

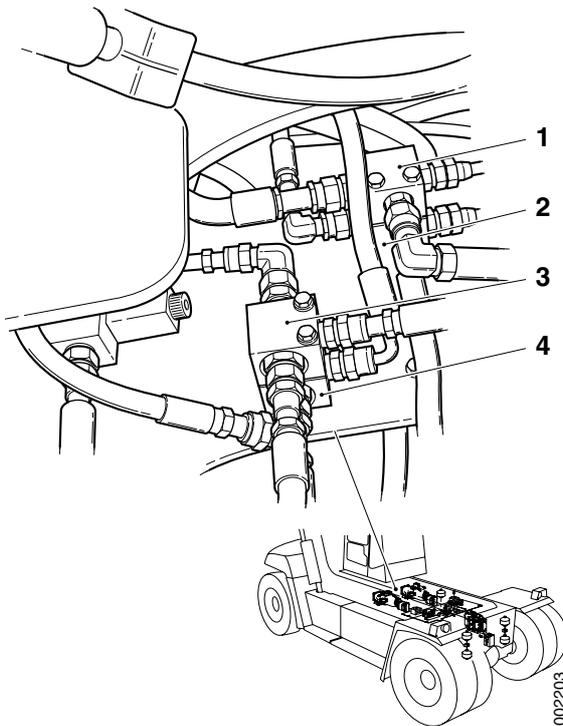
Chooses between the load signal from shuttle valve (position 4) or restriction to hydraulic oil pump 3 and 4, see *Axial piston pump with variable displacement, description page 9*.

This shuttle valve is found if the machine is equipped with joystick steering or mini-wheel.

4. 

Chooses between the load signal from shuttle valve (position 2) or control valve option frame to hydraulic oil pump 2, see *Axial piston pump with variable displacement, description page 9*.

This shuttle valve is found if the machine is equipped with support jacks, hydraulic sliding cab or cab lift and lowering.



1. Shuttle valve attachment

2. Shuttle valve control

3. Shuttle valve, mini-wheel or lever steering 

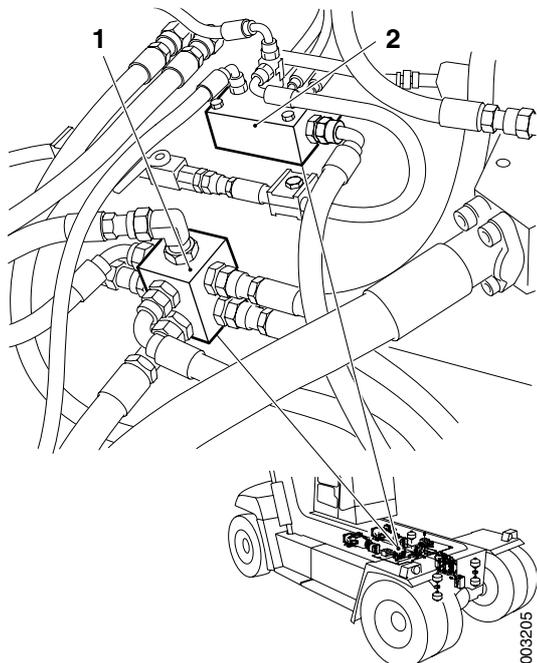
4. Shuttle valve, option frame 

## 10.5.4 Collection block filtered return

### Multiblock, filtered return lines, description

The multiblock receives several return lines from different components and routes them back to the tank through the tank filters.

The block is located on top of the hoisting beam in front of the transmission.



1. Multiblock, unfiltered return lines
2. Multiblock filtered return lines

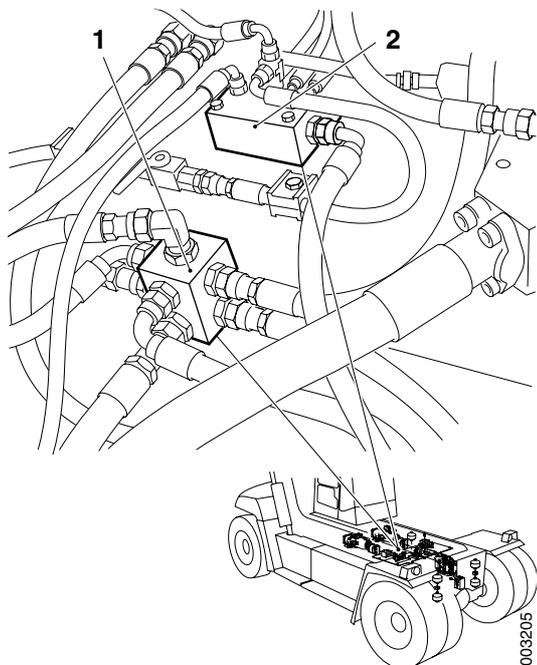
## 10.5.5 Collection block unfiltered return

### Multiblock, unfiltered return lines, description

The multiblock receives several return drain lines from different valves and routes them straight back to the tank.

The drain lines are highly sensitive to counterpressure. If pressure builds up in the drain lines the valves will not work properly.

The block is mounted on the side of the hoisting beam in front of the transmission.



1. Multiblock, unfiltered return lines
2. Multiblock filtered return lines

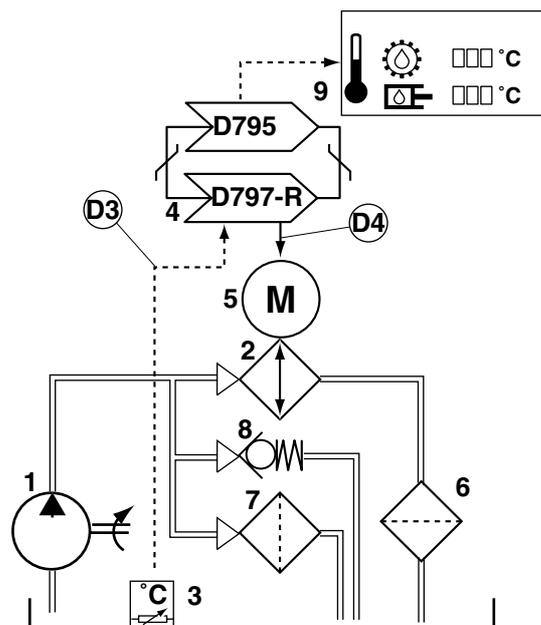
## 10.6 Temperature control, cleaning and hydraulic oil

### Temperature control, cleaning and hydraulic oil, function description

The hydraulic system's oil is cooled and cleaned by a separate pump circulating the oil through a cooler and filter. The cooler has a temperature-controlled electric fan that counteracts overheating.

Temperature-control consists of hydraulic oil tank, hydraulic oil pump, hydraulic oil cooler, cooling fan, hydraulic oil filter, fine filter, sensor hydraulic oil temperature, and by-pass valve.

The hydraulic oil pump pumps oil (from the tank) which is cooled in the hydraulic oil cooler and cleaned by the oil filters in the tank. Some of the oil is filtered by the fine filter. An electric cooling fan increases the air flow through the cooler when the temperature has to be lowered. A by-pass valve leads the hydraulic oil past the cooler directly to the tank if resistance through the cooler and filter becomes too high. The temperature sensor controls activation of fan and temperature display on the display screen.



Pos	Description	Signal value	Reference
1	The hydraulic oil pump pumps oil from the hydraulic oil tank.	-	<i>Gear pump with fixed displacement, description page 6</i>
2	The hydraulic oil cooler cools the oil.	-	<i>Hydraulic oil cooler, description page 23</i>
3	Sensor, hydraulic oil temperature (B776), sends a voltage signal proportional to the hydraulic oil temperature to Control unit frame rear (D797-R).	U = 0.5-4.5 V	<i>Sensor hydraulic oil temperature, description page 24</i> D3: Diagnostic menu, see section 8 Control system group 8.4.5.1 HYD, menu 1.

Pos	Description	Signal value	Reference
4	Control unit frame rear (D797-R) sends temperature on the CAN-bus and supplies voltage the cooling fan as needed.	Hydraulic fan active: U = 24 V	Tab 11 <i>Common electric</i> , group 11.5.3.3 <i>Control unit frame rear</i> D4: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.5.1 <i>HYD</i> , menu 1
5	Cooling fan (M668) increases air flow through the cooler.	-	<i>Cooling fan</i> , description page 24
6	Hydraulic oil filters clean the hydraulic oil.	-	<i>Hydraulic oil filter</i> , description page 28
7	Some of the oil is pumped through fine filter hydraulic oil and is extra cleaned.	-	<i>Fine filter hydraulic oil</i> , description page 31
8	If resistance through the oil cooler and hydraulic oil filter becomes too high, the by-pass valve cooler opens and leads oil past the cooler directly to tank.	-	<i>By-pass valve cooler</i> , description page 26
9	Control unit KID (D795) shows hydraulic oil temperature in the display.	Controlled by control and monitoring system, error shown with error code.	Tab 11 <i>Common electric</i> , group 11.5.3.12 <i>Control unit KID</i>

## 10.6.1 Tank heater

### Tank heater, safety



#### CAUTION

**The tank heater is connected to high voltage. Connection and reconnection of the tank heater may only be performed by personnel authorized for work with high voltage.**

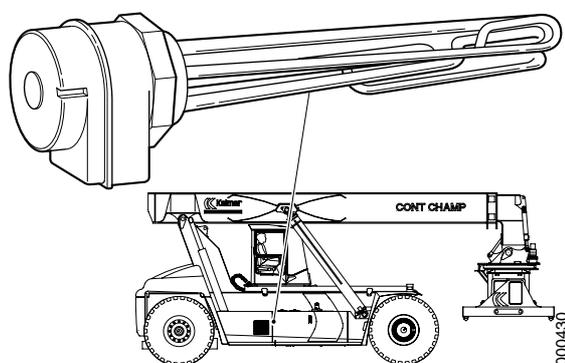
### Tank heater, description



The tank can be equipped with a heater. The tank heater is designed for cold climates.

The tank heater runs off high-tension current. Heater output is adapted through different connections and adaptation to different input currents, 110, 230 or 400 V AC. Higher tensions give higher heater output. The heater is mounted in a hole in the connection cover at the bottom of the short side of the tank.

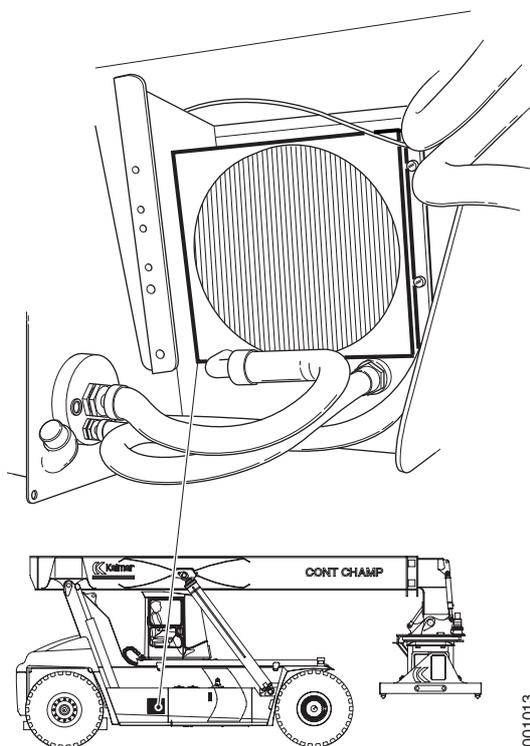
The tank heater can be fitted with an adjustable thermostat to maintain the temperature at a constant level. The thermostat is mounted directly on the heater element and can be adjusted by means of a knob on the junction box. The recommended temperature setting is 50°–70° C.



## 10.6.2 Hydraulic oil cooler

### Hydraulic oil cooler, description

An oil cooler of full-flow type with an electric cooling fan (same type of cooler as for the brake system) is used for the working hydraulics. The oil is cooled as it passes through the cooler. The cooler is situated behind the side panel on the right-hand side behind the hydraulic oil tank.



001013

### Hydraulic oil cooler, change

#### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

- 1 Machine in service position, see tab B Safety.
- 2 Drain the oil from the hydraulic oil tank, see *Hydraulic oil, changing* page 31.
- 3 Mark up and disconnect hydraulic hoses from the cooler. Let the oil in the cooler drain into the collection container.

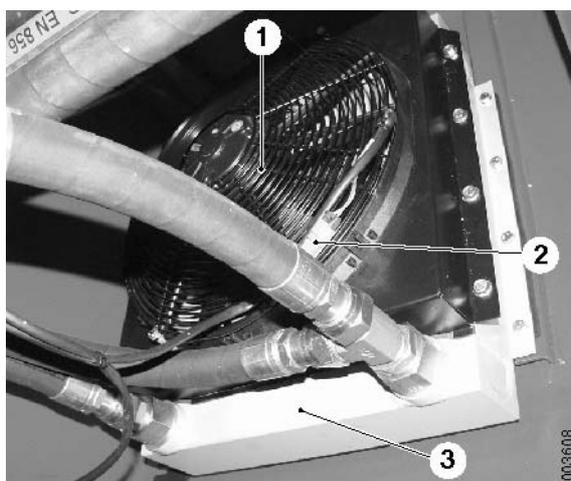
#### NOTE

*Plug all connections immediately to protect the hydraulic system from impurities.*

- 4 Disconnect the cabling from the cooling fan.
- 5 Undo the retaining bolts and lift the cooler away.
- 6 Transfer the cooling fan to the new oil cooler.
- 7 Install the cooler.
- 8 Connect the cabling to the cooling fan.
- 9 Connect the hydraulic hoses to the cooler.

#### NOTE

*Check that the O-rings are intact and fitted correctly.*



1. Cooling fan
2. Connector
3. Cooler



- 10 Fill oil in the hydraulic oil tank see *Hydraulic oil, changing* page 31. The oil level should be visible in the level glass.

## CAUTION

The hydraulic oil level is checked with the boom completely lowered and retracted.

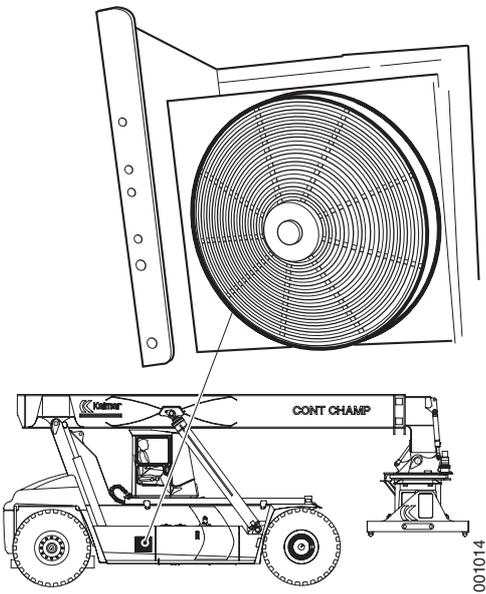
### 10.6.3 Cooling fan

#### Cooling fan, description

The electric cooling fan pushes the air. The cooling fan is located at the rear of the cooler. The fan draws air from the machine's outside through the cooler. Openings in the side cover allows air to pass through the cooler.

The cooler is supplied with voltage by Control unit frame rear (D797-R) when activated. The cooling fan is activated when the oil temperature in the hydraulic oil tank is 65 °C. The fan stops when the oil temperature is 55 °C.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.5.1 *HYD*, menu 1.



### 10.6.4 Sensor hydraulic oil temperature

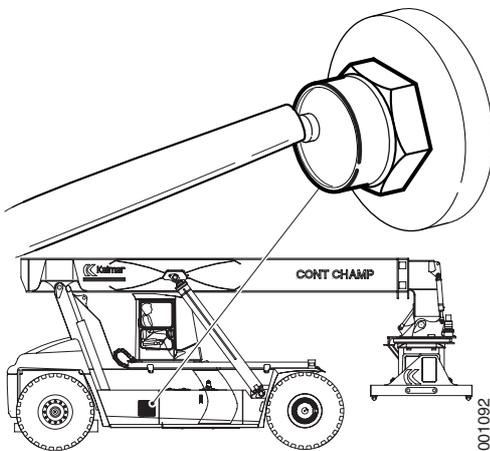
#### Sensor hydraulic oil temperature, description

Sensor hydraulic oil temperature (B776) senses the temperature of the hydraulic oil. The sensor is located on the hydraulic oil tank's rear short end.

The sensor senses the oil temperature in the tank and thus, it considers the accumulated heat in the hydraulic oil. This means that the cooling fan may continue to run after the machine has been parked and turned off.

Sensor hydraulic oil temperature (B776) is supplied with voltage by and sends a voltage signal proportional to oil temperature to Control unit, frame rear (D797-R).

The signal can be checked from the diagnostic menu, see section 8 *Control system*, group 8.4.5.1 *HYD*, menu 1



### Hydraulic oil temperature sensor, change

#### NOTE

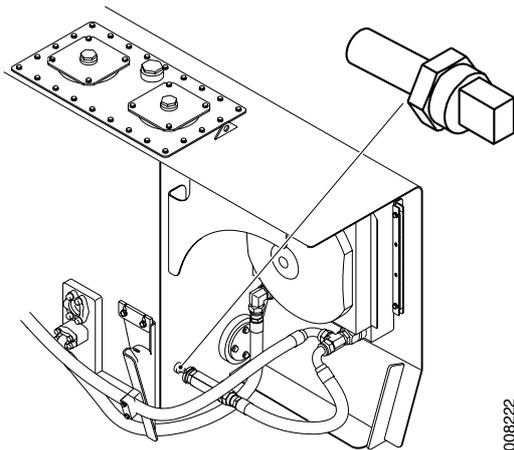
Read the safety instructions for oil before work, see tab B Safety.

- 1 Machine in service position, see tab B Safety.
- 2 Drain the oil from the hydraulic oil tank, see *Hydraulic oil, changing page 31*.
- 3 Disconnect the cabling from sensor hydraulic oil temperature (B776).
- 4 Change sensor hydraulic oil temperature (B776).

#### NOTE

Check that the O-rings are intact and fitted correctly.

- 5 Connect the cabling to the sensor.



008222

Sensor hydraulic oil temperature (B776)



001766

- 6 Fill oil in the hydraulic oil tank see *Hydraulic oil, changing page 31*. The oil level should be visible in the level glass.



### CAUTION

**The hydraulic oil level is checked with the boom completely lowered and retracted.**

DIAG HYD	1 (6)
HYDRAULIC OIL	
TEMP	XXX
FAN	XY

000141

Diagnostic menu Hyd, menu 1

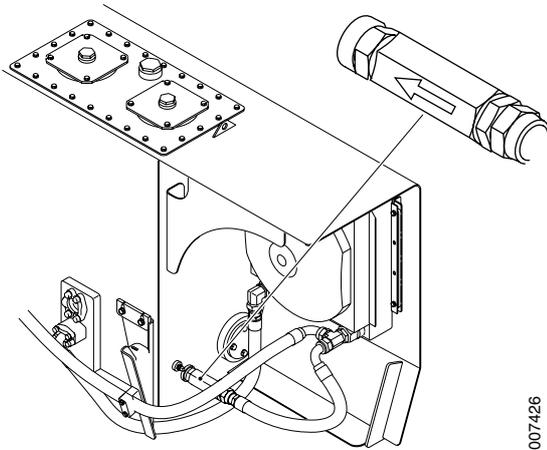
- 7 Use the display, go to diagnostic menu , see tab 8 *Control system, group 8.4.5.1 HYD, menu 1*.

TEMP indicates hydraulic oil temperature in °C. Check that correct temperature is shown.

## 10.6.5 By-pass valve cooler

### By-pass valve cooler, description

The by-pass valve protects the cooler from overpressures. The valve opens a passage past the cooler directly to tank if resistance in the cooler becomes too high.



007426

### By-pass valve cooler, changing

#### NOTE

Read the safety instructions for oil before work, see tab B Safety.

## IMPORTANT

**Ensure cleanliness around the filter and filling point when working on the hydraulic tank.**

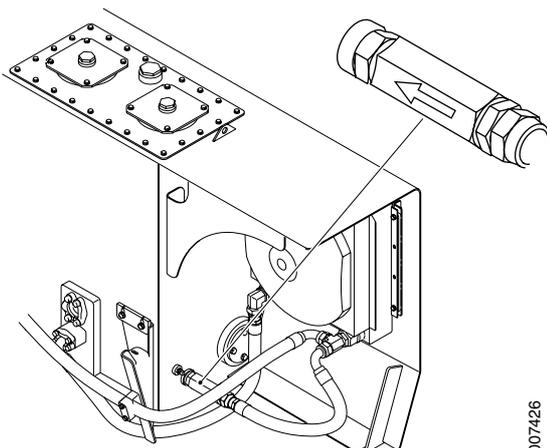
**Dirt particles may cause machine damage.**

- 1 Machine in service position, tab B Safety.
- 2 Depressurize the hydraulic system, see tab B Safety.
- 3 Drain the oil from the hydraulic oil tank, see *Hydraulic oil, changing* page 31.
- 4 Disconnect the by-pass valve from the tank.

#### NOTE

*Note how the by-pass valve faces, the valve is marked with an arrow.*

- 5 Install the new by-pass valve, turn the valve to face the same way as the old. Use Loctite when reinstalling the by-pass valve.



007426

By-pass valve



- 6 Fill oil in the hydraulic oil tank see *Hydraulic oil, changing* page 37. The oil level should be visible in the level glass.

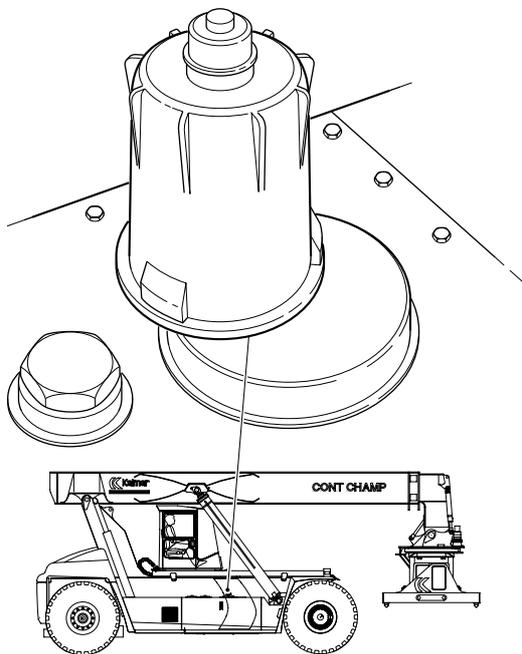
## IMPORTANT

The hydraulic oil level is checked with the boom completely lowered and retracted.

### 10.6.6 Breather filter hydraulic oil tank

#### Breather filter hydraulic oil tank, description

A breather filter of insert type is mounted on the hydraulic oil tank to protect the tank from impurities. On top of the filter housing is an indicator that shows when the filter is clogged and should be changed.

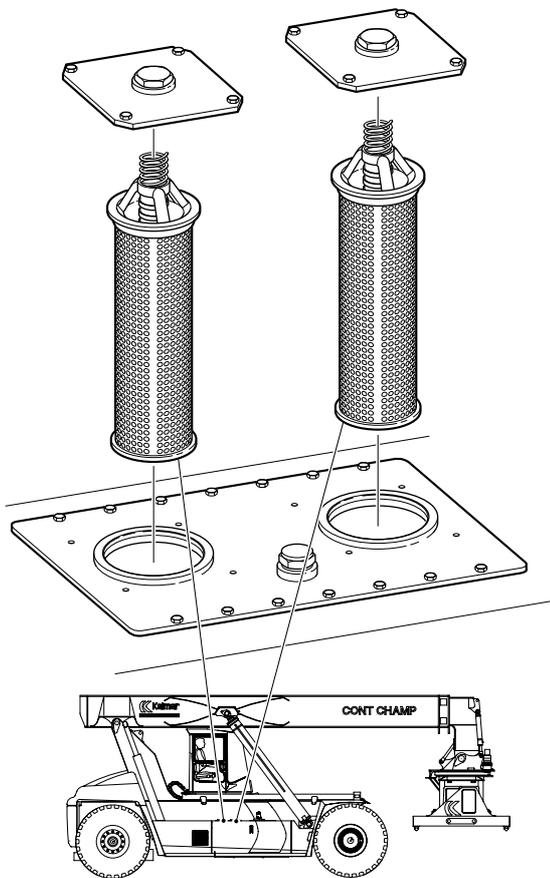


001454

## 10.6.7 Hydraulic oil filter

### Hydraulic oil filter, description

The oil in the hydraulic system is cleaned by two return filters located inside the hydraulic oil tank. The oil is pumped through the cooler and back through the filter by the cooling pump. Some of the return oil from the load handling function also passes through the filters.

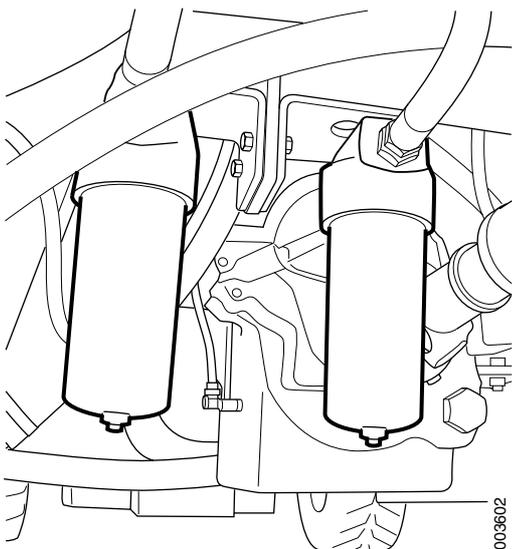


001455

### Hydraulic oil filter, description (high-pressure filter)



As optional equipment the machine can be fitted with two extra high-pressure filters mounted immediately after the axial piston pumps. These filters are located in front of the gearbox under the hoisting beam. They are used together with the hydraulic oil filters in the tank.



003602

## Hydraulic oil filter, changing

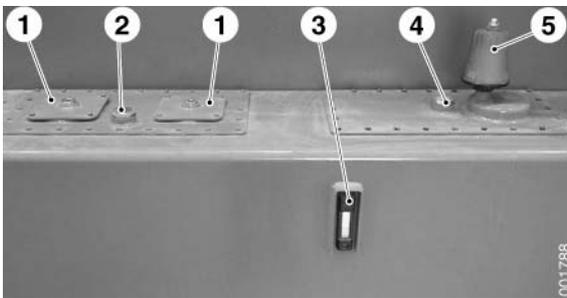
### NOTE

Read the safety instructions for oil before work, see tab B Safety.

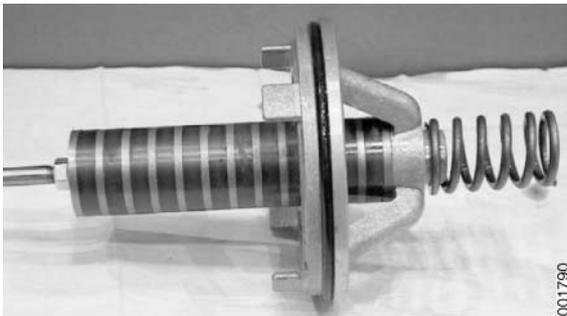
## IMPORTANT

**Ensure cleanliness around the filter and filling point when working on the hydraulic tank.**

**Dirt particles may cause machine damage.**



1. Cover plate for oil filter
2. Filler plug for hydraulic oil
3. Level glass, hydraulic oil
4. Filler plug for hydraulic oil
5. Breather filter, hydraulic oil tank



Magnetic rod

- 1 Turn off the engine and the main electrical power.
- 2 Remove the cover plates (position 1) over the hydraulic oil filters.
- 3 Lift up the filter unit and place it in the receptacle. Let the hydraulic oil drain.
- 4 Part the filter unit and remove the filter insert. Handle the filter insert as environmentally hazardous waste. Note position of the parts.
- 5 Clean the filter holder's parts. Be especially thorough with the magnetic rod.
- 6 Fit the new filters and assemble the filter units.
- 7 Install the filter units and the covers. Tighten the screws cross-wise.
- 8 Check the oil level in the hydraulic oil tank. The oil level shall be at the top of the level glass. Top up as needed.

### NOTE

*The hydraulic oil level is checked with the boom completely lowered and retracted.*

## Hydraulic oil filter (high pressure filter), changing



### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

## IMPORTANT

**Ensure cleanliness around the filter and filling point when working on the hydraulic tank.**

**Dirt particles may cause machine damage.**

- 1 Machine in service position, see tab B Safety.
- 2 Depressurize the hydraulic and brake systems, see tab B Safety.
- 3 Remove the drain plugs in the bottom of the filters.  
Let the oil drain, wait awhile since the oil drains slowly.
- 4 Remove the filter brackets.

### NOTE

*The filter brackets are heavy, loosen them carefully.*

- 5 Clean the filter brackets.
- 6 Remove the filter inserts.

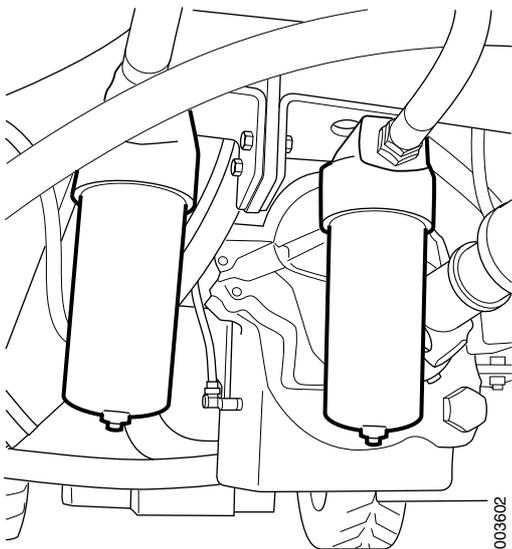
### NOTE

*Note position of the O-rings.*

- 7 Install the O-rings on the filter inserts and filter holders. Lubricate the O-rings with hydraulic oil.
- 8 Fit the new filter inserts on the filter bracket.
- 9 Fit the filter bracket and the drain plug.
- 10 Close the drain valve on the accumulator charging valve.
- 11 Turn on the main electric power and start the engine.
- 12 Check that the filter brackets do not leak.
- 13 Check the oil level in the hydraulic oil tank. The oil level shall be at the top of the level glass. Top up as needed.

### NOTE

*The hydraulic oil level is checked with the boom completely lowered and retracted.*



High pressure filter, under machine

## 10.6.8 Hydraulic oil

### Hydraulic oil, changing

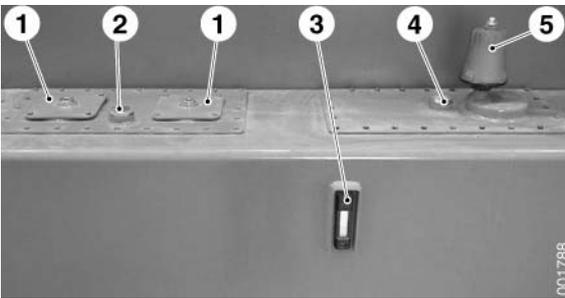
#### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

### IMPORTANT

**Ensure cleanliness around the filter and filling point when working on the hydraulic tank.**

**Dirt particles may cause machine damage.**



1. Cover for oil filter
2. Filling point hydraulic oil
3. Level glass hydraulic oil
4. Filling point hydraulic oil
5. Breather filter hydraulic oil tank

- 1 Machine in service position, see tab B Safety.
- 2 Remove the filler cap and pump out the hydraulic oil in a collection container.
- 3 When most possible oil has been pumped out. Place a collection container under the hydraulic oil tank's drain plug and drain the last of the hydraulic oil.
- 4 Fit the drain plug when the oil has drained.

#### NOTE

*Make sure that the seal washer is installed as well.*

- 5 If the hydraulic oil filters are to be changed, change them before the tank is filled with oil, see *Hydraulic oil filter, changing page 29* and *Hydraulic oil filter (high pressure filter), changing page 30*.
- 6 Fill new hydraulic oil through the filler holes on the filters' covers. This results in filtering of the oil that is filled and protects the hydraulic system from impurities.

Fill oil until the oil level is in the middle on the level glass. For volume and grade, see section tab F Technical data.

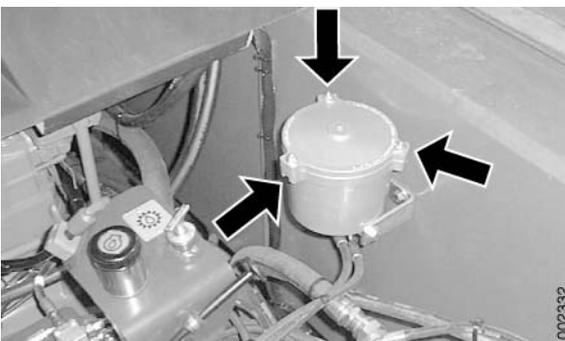
## 10.6.9 Hydraulic oil fine-filter

### Fine filter hydraulic oil, description

The fine filter is mounted on the frame member in the engine bay. It is connected to the hydraulic oil pump cooling and filtration. The filter is connected in parallel with the hydraulic oil filters in the hydraulic oil tank.

The oil is pumped from the hydraulic oil tank through the fine filter and then back to the hydraulic oil tank.

The fine filter cleans a smaller volume of oil although with higher filtration when the machine is in operation.



## Fine filter hydraulic oil, changing

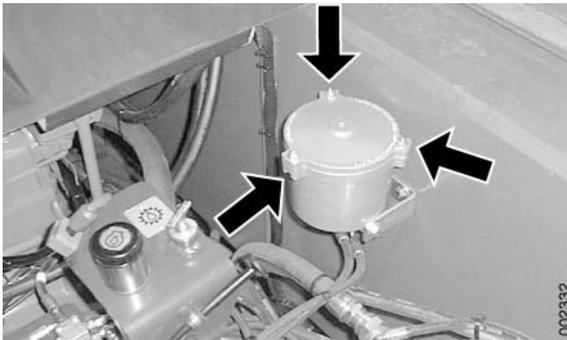
### NOTE

*Read the safety instructions for oil before work, see tab B Safety.*

### IMPORTANT

**Ensure cleanliness around the filter when working.**

**Dirt particles may cause machine damage.**



- 1 Machine in service position, see tab B Safety.
- 2 Remove the cover.
- 3 Lift up the filter cartridge and place it in the receptacle and let the hydraulic oil drain.
- 4 Fit the new filter cartridge and fit the cover on the fine filter.

## 10.6.10 Pipes and hoses

### Pipes and hoses, general

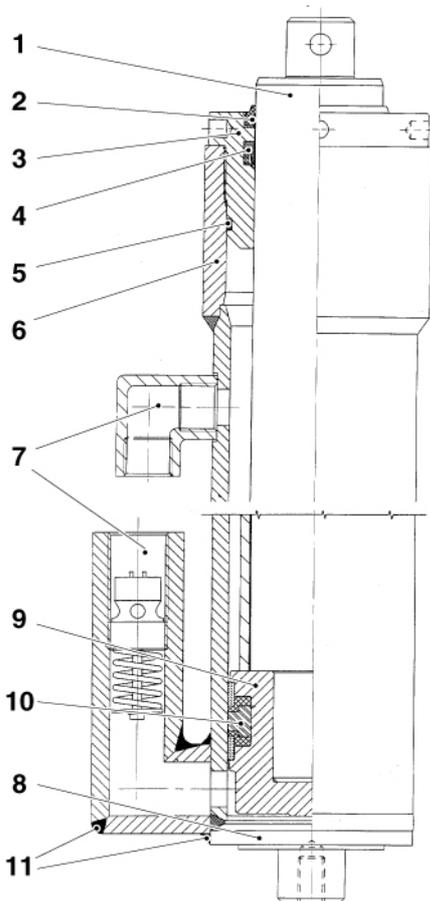
*See Pipes and hoses, general page 18.*

## 10.7 Hydraulic aux.

### 10.7.1 Hydraulic cylinders

#### Hydraulic cylinders, repairs

##### Fault tracing, leakage



001493

1. Piston rod
2. Scraper
3. Cylinder head
4. Piston rod seal
5. O-ring with thrust ring
6. Cylinder barrel
7. Sleeve coupling
8. Welded cylinder end
9. Piston
10. Piston seal, double-acting
11. Example of weld

### CAUTION

All fault tracing should be carried out with as low a pressure in the system as possible so that the leakage can be detected. High pressure causes the seals to close tighter, which prevents detection of leaks.

- 1 Carefully check the source of the leakage before taking any action. It may be possible to rectify the fault without disassembly.
- 2 Check for external leakage:
  - At cylinder end welds
  - At sleeve coupling welds
  - Between cylinder barrel and cylinder head  
This could be due to a defective O-ring or damaged O-ring sealing surfaces. Both faults can be rectified with the cylinder in situ.
  - Between cylinder head and piston rod  
This could be due to a damaged piston rod or damaged or worn piston rod seal.
- 3 Check for internal leakage. Pressurize the cylinder and check whether the piston sinks back.  
This could be due to a worn piston seal.

### Dismantling of cylinders

#### CAUTION

**Before dismantling always check that the piston rod is clean and free from all residual paint. Also check that connections and couplings are free from burrs and impact marks. Make sure that the chamfer up to the chromium surface of the piston rod is free from burrs and residual paint.**

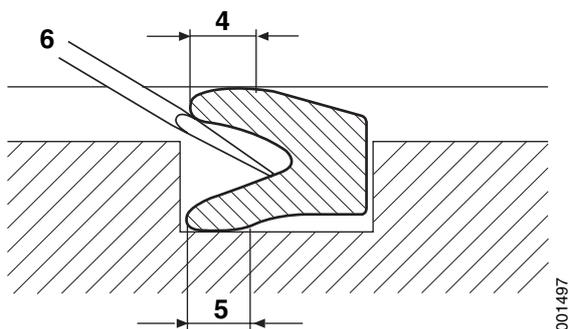
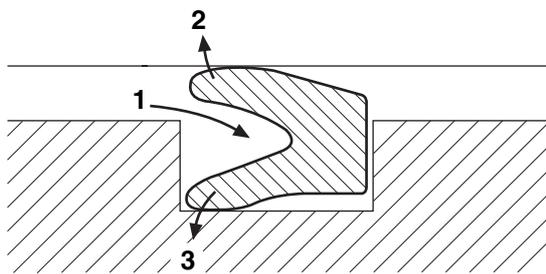
- 1 Remove the cylinder from its mounting and undo the connections.
- 2 Plug the cylinder connections and hoses without delay.
- 3 If the cylinder is opened - observe the strictest cleanliness.

### Inspection of surfaces

- 1 Inspect the sealing surfaces, always bearing mind the function of the seals and the type of sealing surfaces they have, see the following descriptions:
  - O-ring groove, internal and external
  - piston rod seal in the cylinder head
  - Sealing groove on the piston
  - cylinder barrel surface
  - piston rod surface. The piston rod is chromium plated with a layer thickness of 20-50 m. Slight damage to the chromium plating need not necessarily be the direct cause of leakage.
  - all sliding surfaces (dynamic surfaces), e.g. cylinder barrel and piston rod. These are always the hardest to seal.

#### CAUTION

**When mounting the cylinder head: Introduce it absolutely straight, preferably by hand and never strike it with a mallet. If the cylinder head is skew as it enters, this could damage the sealing lip of the piston rod seal and its sealing function would then be lost. This applies to all types of piston rod seal**



001497

## Function and removal of the seals

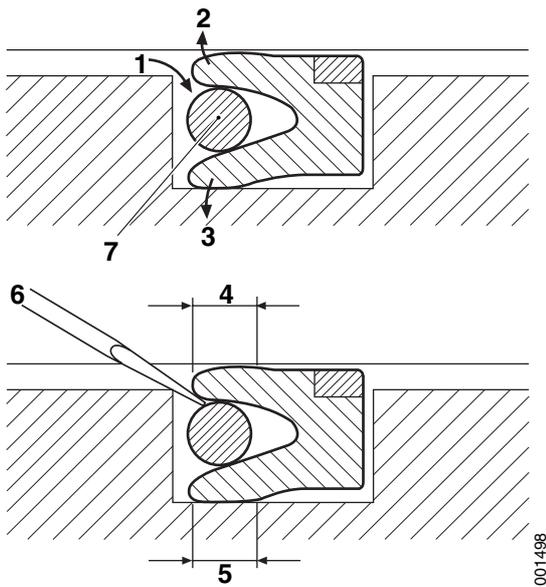
### Piston rod seal

The piston rod seal sits in a groove in the cylinder head and seals against the piston rod. This seal is highly vulnerable as it seals both dynamically and statically, i.e. it seals against a moving surface on the piston rod while the sealing surface against the cylinder head is fixed. There are different kinds of piston rod seal:

- Single V-ring seal
- Prestressed V-ring seal with thrust ring
- Compressible seal

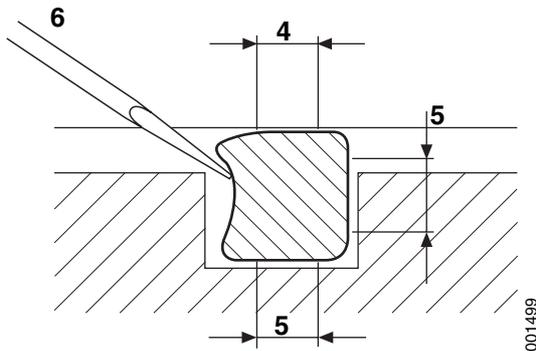
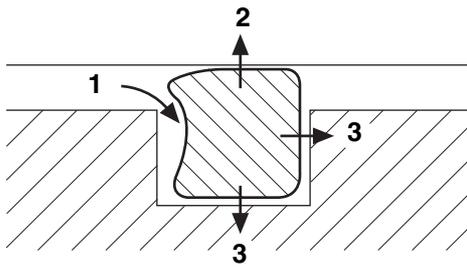
**The single V-ring seal** has a V-shaped section with two lips, each sealing in its own direction. The hydraulic pressure acts in the V shape and presses the sealing lips outwards against the sealing surfaces on the piston rod and in the cylinder barrel. Even minor damage to the sealing lips can cause major leakage. Check the sealing lips by carefully feeling all round the seal with a fingernail. Use a screwdriver to remove the seal, see illustration. Lever outwards and prise up the seal. It is extremely important always to insert the screwdriver in the V shape so that it cannot touch and so damage any sealing surface. A mark made by the screwdriver on a sealing surface will have a devastating effect and give rise to serious leakage.

1. Hydraulic pressure
2. The sealing lip is pressed outwards against the piston rod
3. The sealing lip is pressed inwards against the cylinder head
4. Sealing surface, piston rod
5. Sealing surface, cylinder head
6. Screwdriver

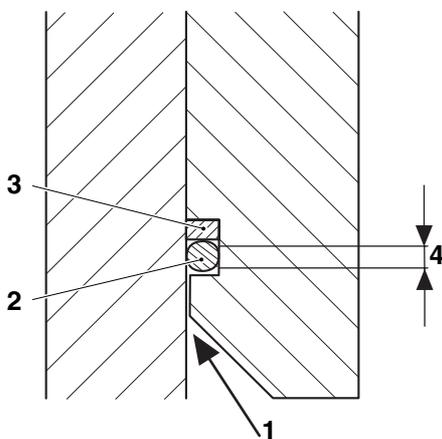


**In addition, the prestressed V-ring seal has an O-ring in the V-shaped space of the seal. The O-ring has a highly efficient sealing effect at low hydraulic pressures as even when not under load the sealing lips are pressed outwards against the sealing surfaces. It is just as susceptible to damage as the V-ring seal. Inspect in the same way. Use a screwdriver to remove the seal, see illustration. Lever outwards and prise up the seal. It is extremely important always to insert the screwdriver in the V shape so that it cannot touch and so damage any sealing surface. A mark made by the screwdriver on a sealing surface will have a devastating effect and give rise to serious leakage.**

1. Hydraulic pressure
2. The sealing lip is pressed outwards against the piston rod
3. The sealing lip is pressed inwards against the cylinder head
4. Sealing surface, piston rod
5. Sealing surface, cylinder head
6. Screwdriver
- 7, O-ring



1. Hydraulic pressure
2. The sealing lip is pressed outwards against the piston rod
3. The sealing lip is pressed inwards against the cylinder head
4. Sealing surface, piston rod
5. Sealing surface, cylinder head
6. Screwdriver



1. Hydraulic pressure
2. O-ring
3. Thrust ring
4. Sealing surface, cylinder head

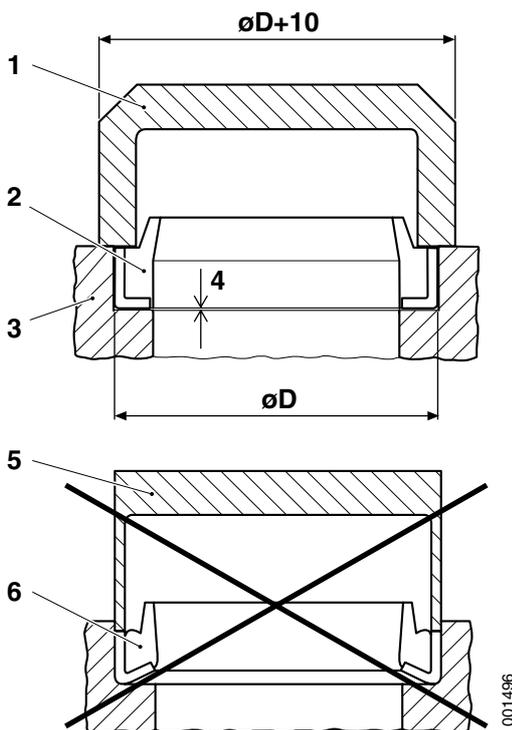
**The compressible piston rod seal** consists of a solid rubber section and has a larger sealing surface than the V-ring seals. Use a screwdriver to remove the seal, see illustration. Lever outwards and prise up the seal. With this type of seal where the sealing surfaces cover such a large part of the sealing groove it is especially important to ensure that the screwdriver does not slip and leave any marks

### Thrust ring and O-ring

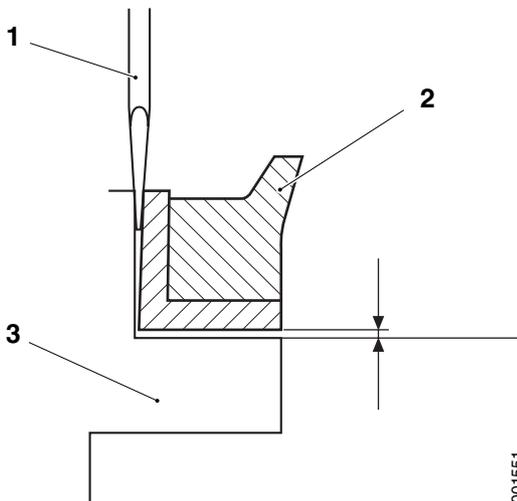
The thrust ring and O-ring combination is used for sealing between two fixed surfaces, such as between cylinder barrel and cylinder head.

The purpose of the thrust ring is to lend rigidity to the O-ring so that it is not deformed. The O-ring is pressed against the thrust ring and the sealing surface by the hydraulic pressure in the cylinder.

When fitting the cylinder head: Exercise care to avoid damaging the O-ring.



1. Correct assembly tool
2. Scraper, correctly fitted
3. Cylinder head
4. Clearance between scraper and bottom of cylinder head recess
5. Incorrect assembly tool
6. Deformed scraper



1. Screwdriver
2. Scraper
3. Cylinder head

### Scraper

The purpose of the scraper is to scrape the piston rod clean and prevent impurities from entering the cylinder barrel.

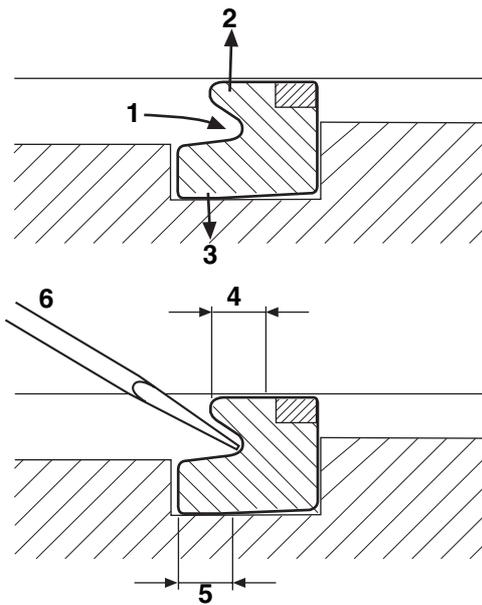
The scraper should be fitted using a special assembly tool. This tool should have a larger outside diameter than the scraper so that the pressing force exerted on the scraper ceases at the precise moment when the scraper is pressed into position. If the scraper is pressed in additionally the metal cap will be deformed (see lower illustration) with poorer scraper functionality as a result.

To prevent the scraper from bottoming in its recess in the cylinder head, the recess is slightly deeper than the width of the scraper.

A screwdriver can be used to remove the scraper. The screwdriver should always be applied to the outer edge of the scraper, see illustration. Carefully tap the screwdriver down between scraper and cylinder head. Then prise out the scraper. Make good any damage to the cylinder head.

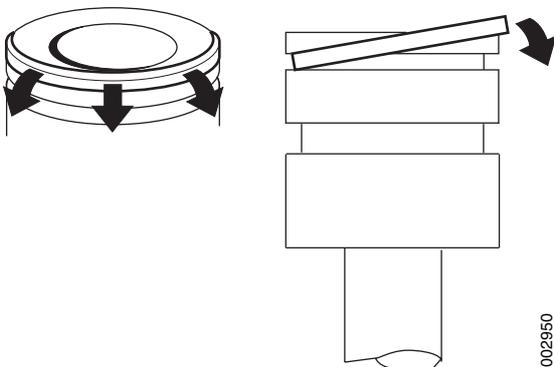
### CAUTION

**No tool must be applied from the inside. This could give rise to burrs on the cylinder head which could in turn damage the piston rod. Burrs may also damage the piston rod seal when fitting the piston.**



002370

1. Hydraulic pressure
2. The seal is pressed outwards against the cylinder barrel.
3. The seal is pressed inwards against the piston
4. Sealing surface, cylinder barrel
5. Sealing surface, piston
6. Screwdriver



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**On the single-acting V-ring seal** it is always the long side that seals against the fixed surface and the short side that seals against the moving surface.

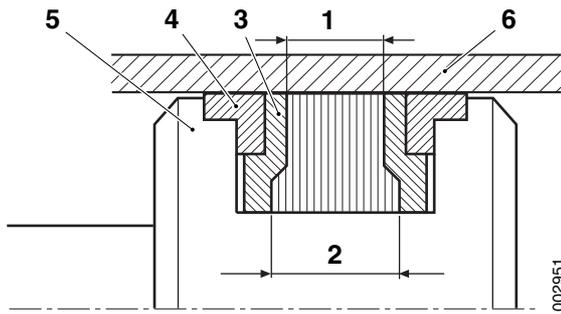
Use a screwdriver to remove the seal, see illustration. Lever outwards and prise up the seal. It is extremely important always to insert the screwdriver in the V shape so that it cannot touch and so damage any sealing surface. A mark made by the screwdriver on a sealing surface will have a devastating effect and give rise to serious leakage.

The seal must always be fitted as an assembly together with the thrust ring.

Always assemble by hand. No tools should be used as they could easily damage the surface of the piston.

For easier assembly the seal can be heated in hot water to make it soft.

Lubricate with hydraulic oil.



1. Moving sealing surface against cylinder barrel
2. Fixed sealing surface with piston
3. Guide ring
4. Thrust ring
5. Piston crown
6. Cylinder barrel

### Double-acting piston seal

The double-acting seal functions with pressure from both sides, e.g. in a steering cylinder

All of the interior surface of the cylinder barrel is a sealing surface and it is therefore extremely important that it is completely free from damage.

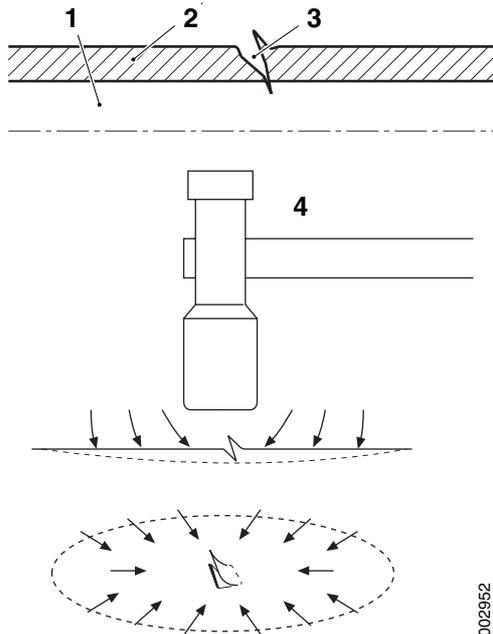
Exercise care when fitting the piston in the cylinder barrel, making sure that the seal is not damaged by the cylinder barrel threads.

### Dismantling:

- 1 Remove guide rings and thrust rings.
- 2 Move the seal over to one side of the sealing groove.
- 3 Press it up so that there is a gap between seal and piston.
- 4 Without damaging the surface of the piston - cut off the seal with a knife.
- 5 Carefully examine the seal to find any damage that can cause leakage. This will be easier if you bend the seal sharply bit by bit and feel over the sealing surface with a fingernail.

### Assembly:

- 1 All double-acting piston seals are of similar design: a middle sealing body, then thrust rings and farthest out guide rings.
- 2 First fit the sealing body, then the thrust rings and finally the guide rings - all must be done by hand without tools to avoid damage.



1. Piston rod
2. Chromium plating
3. Impact marks
4. Highly-polished hammer

### Repairing the piston rod surface

A small impact mark on a piston rod may be sufficient to cause leakage. The chromium plating on the piston rod has a thickness of 20-50 µm and can be treated to make good minor damage. This may be a satisfactory alternative to costly disassembly.

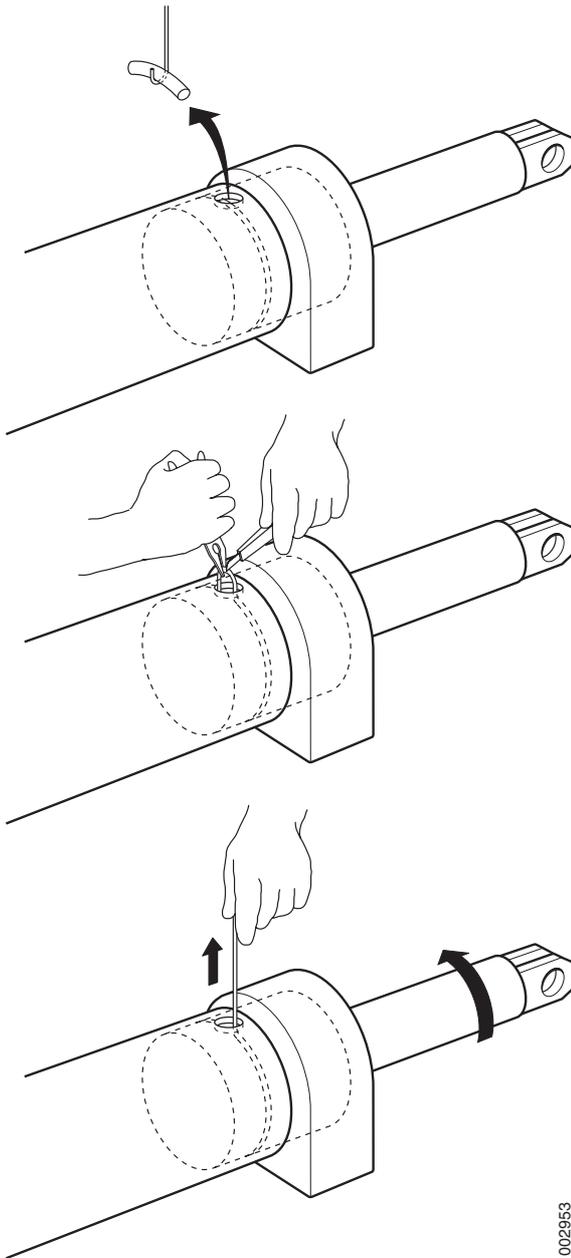
- 1 Locate the damage using your fingertips and fingernails.
- 2 Use a small, highly-polished hammer and work the surrounding material inwards towards the damage, starting from the outside.
- 3 Instead of a small sharp mark there will now be a small uniform concavity in the chromium plating.
- 4 Polish with emery cloth, progressing from number 240 to 600. Wrap the emery cloth round a file to give it good support. Note that there must always be chromium plating present at the damage.
- 5 It is important to treat small impact marks before disassembly and assembly to avoid damaging the cylinder head.
- 6 Repairing larger damage on a piston rod
  - fill the damage with weld metal, use chromium or stainless steel electrodes
  - remove all slag completely
  - file the weld down to the same level as the chrome
  - polish evenly using emery cloth

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### Dismantling steering cylinders

It can prove extremely difficult to extract the piston rod from the cylinder barrel on steering cylinders because the O-ring in the cylinder head fastens in the retaining ring groove in the cylinder barrel. It is therefore best to remove the O-ring before trying to withdraw the piston rod from the cylinder.

- 1 Unscrew the end washer at the cylinder head.
- 2 Unscrew the connecting nipple for the hydraulic hose.
- 3 Introduce the piston rod with piston crown until the O-ring is visible through the nipple hole.
- 4 Bend the end of a length of heavy-duty steel wire, piano wire or the like into the shape of a hook. Use this to snag the O-ring.
- 5 Pull the O-ring up slightly and hold it with a pair of needle-nose pliers.
- 6 Continue to pull the O-ring out through the hole.
- 7 Hold the O-ring steady and cut it with a knife.
- 8 Rotate the piston rod while pulling the O-ring out through the hole.
- 9 Remove the retaining ring from the cylinder barrel.
- 10 Carefully extract the piston rod from the cylinder barrel.



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## Table of Contents 11 Common electric

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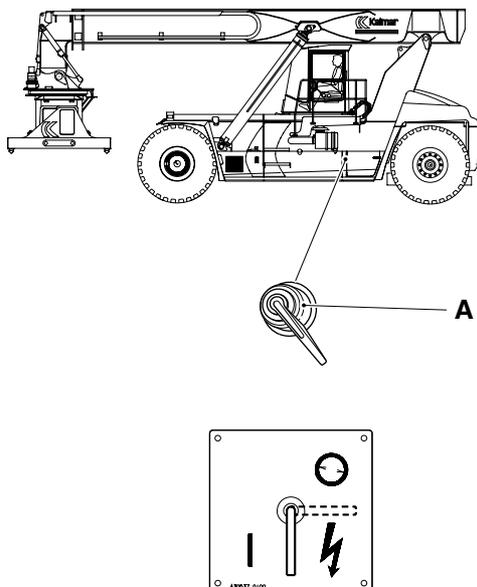
# 11 Common electric

## 11.2 Electric protection

### 11.2.1 Battery disconnecter

#### Battery disconnecter, description

The plus terminal of the series-connected batteries is connected to the machine's electrical system via the battery disconnecter. The battery disconnecter cuts off all voltage feed from the batteries to the machine's electrical system.



A. Position for battery disconnecter

## IMPORTANT

**Never turn off the voltage with the battery disconnecter when the engine is running, the alternator may be damaged.**

**The battery disconnecter may not be used for emergency stop!**

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### 11.2.2 Fuses

#### Fuses, changing

Checking and changing main fuses:

1. Switch off the power supply (battery disconnecter).
2. Remove the plastic cover.
3. Check whether the fuses are intact. Change when needed.

The rating of the fuses is 25 A.

Checking and changing fuses:

1. Switch off the power supply (battery disconnecter).
2. Remove the cover over the electronic box.
3. Inspect or change the fuses.

The fuse chart provides information about each fuse.

### 11.2.3 Manoeuvre switch

#### Operation breaker, description

See *Operation breaker voltage (15E)*, functional description page 11.

## 11.3 Batteries (storage)

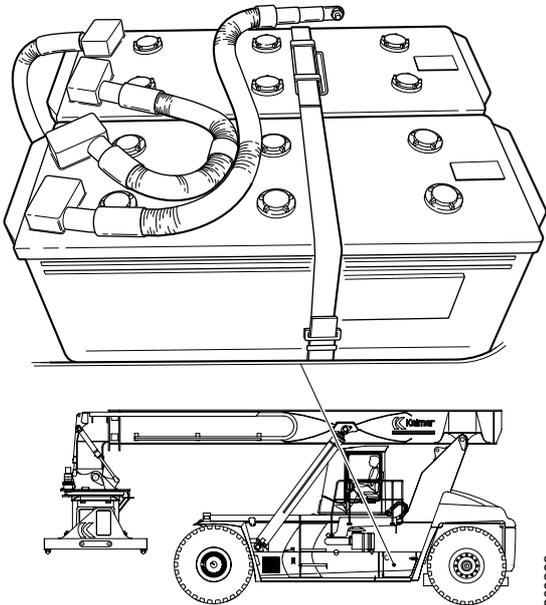
### 11.3.1 Start battery

#### Start battery, description

The machine's electrical system is supplied by two series-connected 12 V batteries.

The negative terminal is connected to the frame. The positive terminal is connected to the battery disconnecter.

The batteries are charged by the alternator, see *Alternator, description (engine alternative Volvo) page 6*.



#### **WARNING**

**Battery electrolyte contains corrosive sulphuric acid.**

**Risk of corrosive injuries, health hazard!**

**In case of contact with skin, immediately wash off any battery electrolyte. Wash with soap and plenty of water. If electrolyte comes into contact with the eyes, flush immediately with plenty of water and seek immediate medical advice.**

#### **WARNING**

**Risk of explosion!**

**Personal injury!**

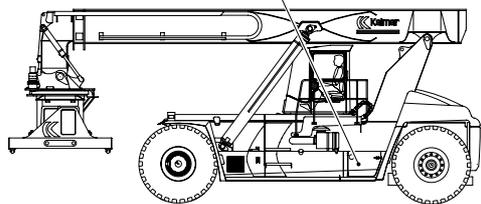
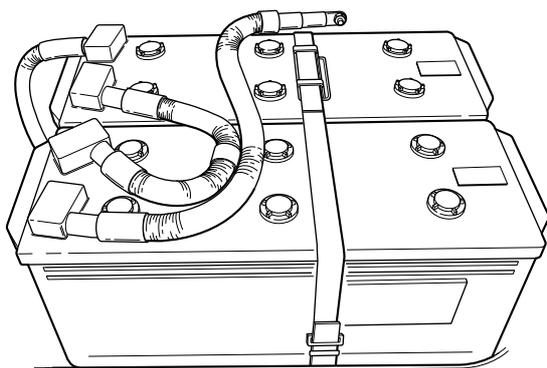
**During charging, hydrogen forms around the batteries. Sparks can ignite the hydrogen gas causing an explosion. Do not disconnect the battery with the battery disconnecter.**

#### **WARNING**

**Risk of explosion if battery shorted (also runs battery down).**

**Fire hazard, personal injury!**

**The battery's terminals may not be connected to each other or commonly to ground (chassis).**



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### Starter battery, change

- 1 Machine in service position, see tab *B Safety*.
- 2 Disconnect the cables from the battery terminals. Disconnect the negative cable first.
- 3 Change batteries.
- 4 Connect the cables to the battery terminals. Connect the negative cable last of all.

### NOTE

*Exercise care when reconnecting the cables to avoid a short circuit.*

## 11.4 Alternator (generation)

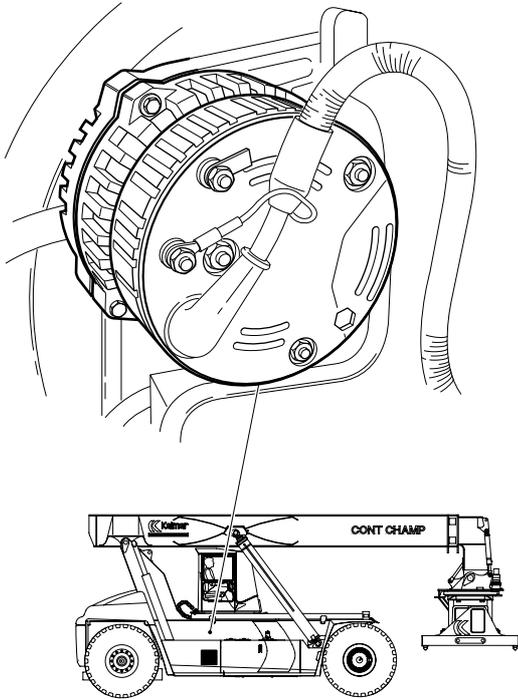
### 11.4.1 Alternator

#### Alternator, description (engine alternative Volvo)

The alternator generates current during operation and supplies this to the batteries. The alternator produces AC current and has an integrated charge regulator.

The alternator is driven by the engine via a belt. Faults are indicated by the warning lamp for low battery charging.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, section 8.4.6.4 *ENGINE*, menu 4.



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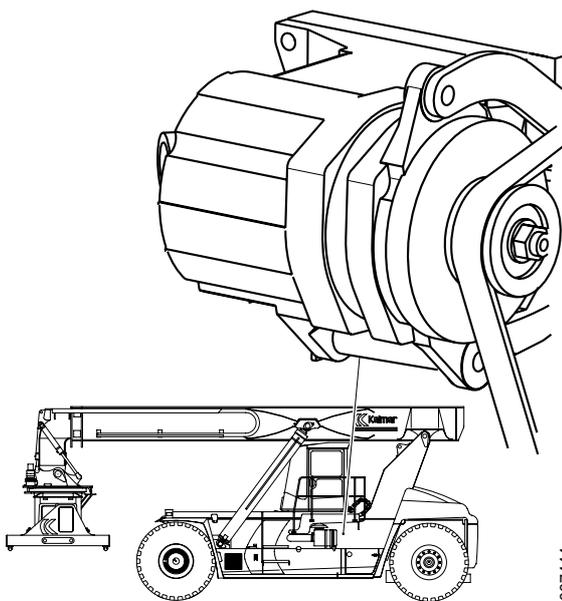
The illustration shows engine alternative Volvo TWD1240VE

#### Alternator, description (engine alternative Cummins QSM11)

The alternator generates current during operation and supplies this to the batteries. The alternator produces AC current and has an integrated charge regulator.

The alternator is driven by the engine via a belt. Faults are indicated by the warning lamp for low battery charging.

The signal can be checked from the diagnostic menu, see section 8 *Control system*, section 8.4.6.4 *ENGINE*, menu 4.



007444

#### Alternator, change

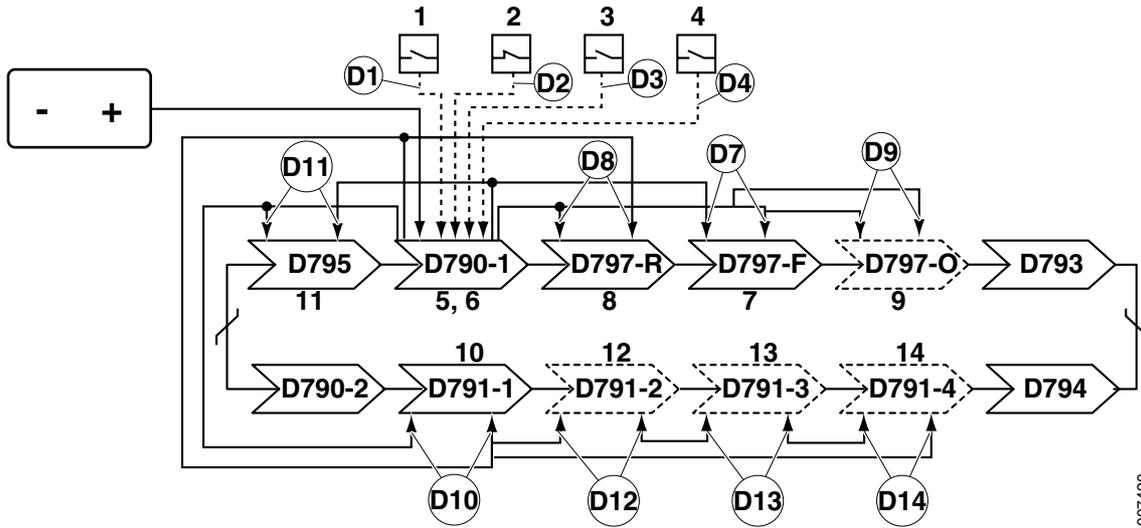
See *subcontractor information, engine*.

## 11.5 Distribution of electricity

### 11.5.1 Voltage feed

#### 11.5.1.2 Redundant voltage feed of control units

##### Redundant voltage feed for control units, description of operation



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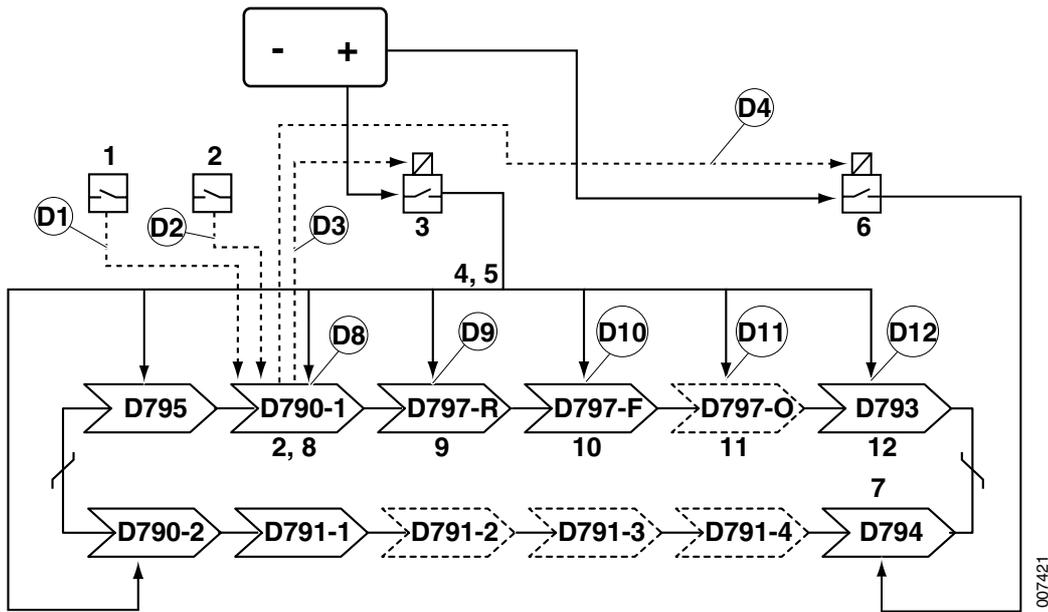
Pos	Explanation	Signal description	Reference
1	Break-contact operator door (S 266-LE) or break-contact operator door (S 266-LE) sends voltage signal to Control unit cab (D790-1) when the door is opened.	U = 24 V	Tab 9 Frame, body, cab and accessories, group 9.10.2 Doors D1: Diagnostics menu, see tab 8 Control and monitoring system , group 8.4.2.12 LIGHTS, menu 12 or 8.4.11.2 SLIDING-CAB, menu 1
2	Switch interior lighting on Control unit KIT (D790-2) cab voltage signal to Control unit cab (D790-1).	-	Tab 9 Frame, body, cab and accessories, group 9.6.12 Interior lighting D2: Diagnostics menu, see tab 8 Control and monitoring system, group 8.4.2.12 LIGHTS, menu 12
3	Switch hazard lights (S109) sends voltage signal to Control unit cab (D790-1).	U = 24 V	Tab 9 Frame, body, cab and accessories, group 9.6.7 Warning light Hazard D3: Diagnostics menu, see tab 8 Control and monitoring system, group 8.4.2.8 LIGHTS, menu 8
4	Ignition (S150) is turned to position I and sends voltage signal to Control unit cab (D790-1).	U = 24 V	Tab 9 Frame, body, cab and accessories, group 9.1 Controls and instrumentation D4: Diagnostics menu, see tab 8 Control and monitoring system, group 8.4.1.4 CAN/POWER, menu 4
5	Control unit cab (D790-1) activates a holding circuit that activates the control logic of the control unit.	-	Control unit cab, description page 18

Pos	Explanation	Signal description	Reference
6	Control unit cab (D790-1) activates redundant voltage feed to other control units.  Control unit cab (D790-1) has 4 outputs for redundant voltage feed, other control units have two inputs for redundant voltage feed. In case of a malfunction of one voltage feed the control unit is supplied by the other feed.	U <sub>K11:7</sub> = 24 V U <sub>K11:8</sub> = 24 V U <sub>K11:9</sub> = 24 V U <sub>K11:10</sub> = 24 V	<i>Control unit cab, description page 18</i>
7	Control unit cab (D790-1) supplies voltage to other control units' control logic via redundant voltage feed.	U <sub>K2:7</sub> = 24 V U <sub>K2:8</sub> = 24 V	<i>Control unit frame front, description page 19</i> D7: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.8 CAN/POWER, menu 8
8		U <sub>K2:7</sub> = 24 V U <sub>K2:8</sub> = 24 V	<i>Control unit frame rear, description page 20</i> D8: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.10 CAN/POWER, menu 10
9 +		U <sub>K2:7</sub> = 24 V U <sub>K2:8</sub> = 24 V	<i>Control unit frame option, description page 21</i> D9: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.12 CAN/POWER, menu 12
10		U <sub>K2:7</sub> = 24 V U <sub>K2:8</sub> = 24 V	<i>Control unit attachment, description page 22</i> D10: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.16 CAN/POWER, menu 16
11		U <sub>K2:7</sub> = 24 V U <sub>K2:8</sub> = 24 V	<i>Control unit KID, description page 30</i> D11: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.14 CAN/POWER, menu 14
12 +		U <sub>K2:7</sub> = 24 V U <sub>K2:8</sub> = 24 V	<i>Control unit attachment option, description page 23</i> D12: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.17 CAN/POWER, menu 17
13 +		U <sub>K2:7</sub> = 24 V U <sub>K2:8</sub> = 24 V	<i>Control unit attachment left leg pair, description page 24</i> D13: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.18 CAN/POWER, menu 18
14 +		U <sub>K2:7</sub> = 24 V U <sub>K2:8</sub> = 24 V	<i>Control unit attachment right leg pair, description page 25</i> D14: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.19 CAN/POWER, menu 19

### 11.5.1.3 Ignition voltage (15)

#### Ignition voltage (15), description of operation

Prior condition	Reference value	Reference
Battery disconnecter	In position 1	<i>Battery disconnecter, description page 3</i>
Redundant voltage feed	Activated	<i>Redundant voltage feed for control units, description of operation page 7</i>
Redundant CAN-bus	Communication established	<i>Redundant CAN-bus, description page 44</i>



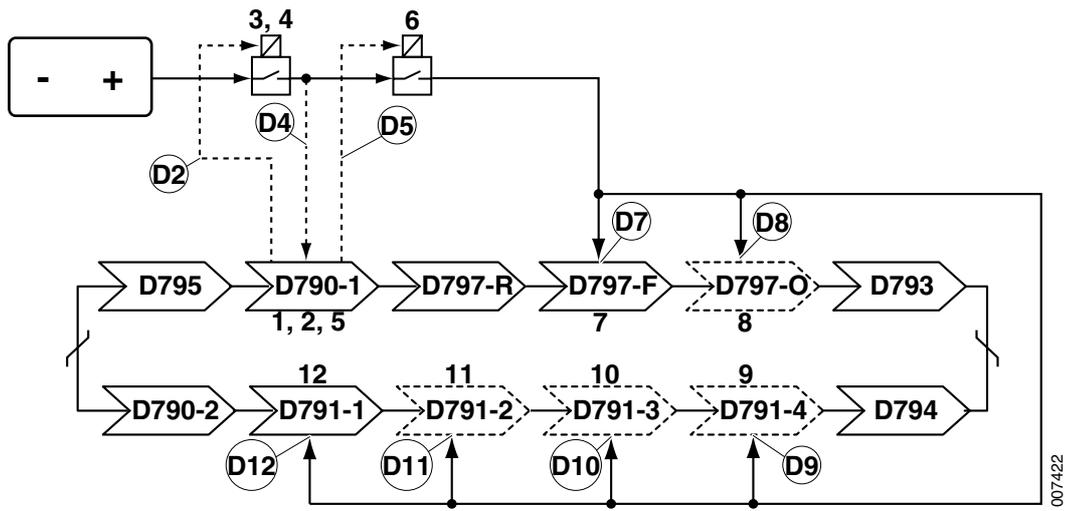
Pos	Explanation	Signal description	Reference
1	Warning light comes on and sends a voltage signal to Control unit cab (D790-1).	U = 24 V	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.6.7 <i>Warning light Hazard</i> D1: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.2.8 <i>LIGHTS</i> , menu 8
2	The ignition is turned to position I and sends a voltage signal to Control unit cab (D790-1).	U = 24 V	Tab 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instrumentation</i> D2: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.4 <i>CAN/POWER</i> , menu 4
3	Control unit cab (D790-1) supplies voltage to Relay ignition voltage K315-1 in electrical distribution box frame and Relay ignition voltage K315-2.	U = 24 V	<i>Control unit cab, description page 18</i> D3: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.4 <i>CAN/POWER</i> , menu 4
4	Relay ignition voltage K315-1, supplies voltage to fuse holder in electrical distribution box cab and in electrical distribution box frame.	U = 24 V	-

Pos	Explanation	Signal description	Reference
5	The fuses feed voltage to control units, relays, solenoid valves and other electronic components.	$U = 24 \text{ V}$	-
6	Relay ignition voltage K315-2 supplies voltage to Control unit engine (D794).	$U = 24 \text{ V}$	<i>Control unit engine, description (engine alternative Volvo TWD1240VE) page 27</i>
7	Drivetrain's CAN-bus establishes communication.	Controlled by control and monitoring system, error shown with error code.	<i>CAN-bus drivetrain, description page 47</i>
8	Ignition voltage to Control unit cab (D790-1).	$U_{K1:2} = 24 \text{ V}$ $U_{K1:3} = 24 \text{ V}$ $U_{K1:4} = 24 \text{ V}$	<i>Control unit cab, description page 18</i> D8: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.6 CAN/POWER, menu 6
9	Ignition voltage to Control unit frame rear (D797-R).	$U_{K2:1} = 24 \text{ V}$ $U_{K2:9} = 24 \text{ V}$	<i>Control unit frame rear, description page 20</i> D9: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.10 CAN/POWER, menu 10
10	Ignition voltage to Control unit frame front (D797-F).	$U_{K2:1} = 24 \text{ V}$ $U_{K2:9} = 24 \text{ V}$ $U_{K2:10} = 24 \text{ V}$	<i>Control unit frame front, description page 19</i> D10: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.8 CAN/POWER, menu 8
11 	Ignition voltage to Control unit frame option (D797-O).	$U_{K2:10} = 24 \text{ V}$	<i>Control unit frame option, description page 21</i> D11: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.12 CAN/POWER, menu 12
12	Ignition voltage to Control unit transmission (D793).	$U_{A1} = 24 \text{ V}$	<i>Control unit transmission, description page 26</i> D12: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.15 CAN/POWER, menu 15

11.5.1.4 Manoeuvre switch voltage

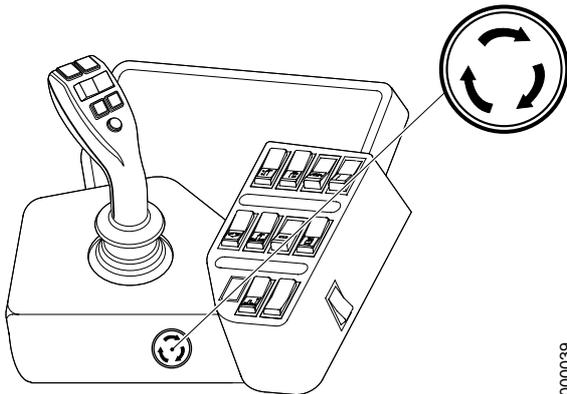
Operation breaker voltage (15E), functional description

Prior condition	Reference value	Reference
Redundant voltage feed	Activated	Redundant voltage feed for control units, description of operation page 7
Ignition voltage	Activated	Ignition voltage (15), description of operation page 9
Operation breaker	Not activated	Tab 9 Frame, body, cab and accessories, group 9.1 Controls and instrumentation



Pos	Explanation	Signal description	Reference
1	Ignition voltage is activated by Control unit cab (D790-1).	Controlled by control and monitoring system, error shown with error code.	Ignition voltage (15), description of operation page 9
2	Control unit cab (D790-1) supplies voltage to Relay control breaker voltage (K3009-1) in electrical distribution box frame.	$U_{K3009-1/86} = 24\text{ V}$	Control unit cab, description page 18 D2: Diagnostics menu, see tab 8 Control and monitoring system, group 8.4.1.5 CAN/POWER, menu 5
3	Relay control breaker voltage (K3009-1) supplies voltage to Relay control breaker voltage (K3009-2) in electrical distribution box frame.	$U_{K3009-2/87} = 24\text{ V}$	Electrical distribution box frame, description page 16 D3: Diagnostics menu, see tab 8 Control and monitoring system, group 8.4.1.5 CAN/POWER, menu 5
4	Relay control breaker voltage (K3009-1) sends a voltage signal to Control unit cab (D790-1) which verifies that Relay control breaker voltage (K3009-1) is active but that Relay control breaker voltage (K3009-2) is inactive. This verifies that the operation breaker is working.	$U_{K3009-1/87} = 24\text{ V}$ $U_{K3009-2/87} = 0\text{ V}$	Electrical distribution box frame, description page 16 D4: Diagnostics menu, see tab 8 Control and monitoring system, group 8.4.1.5 CAN/POWER, menu 5

Pos	Explanation	Signal description	Reference
5	Control unit cab (D790-1) activates Relay control breaker voltage (K3009-2) in electrical distribution box.	$U_{K3009-2/86} = 24\text{ V}$	<i>Control unit cab, description page 18</i> D5: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.5 <i>CAN/POWER</i> , menu 5
6	Relay control breaker voltage K3009-2 supplies voltage to control breaker circuit.	$U_{K3009-2/87} = 24\text{ V}$	<i>Electrical distribution box frame, description page 16</i>
7	The control units are supplied with control breaker voltage as long as switch control breaker is not pressed in.  The control units on the attachment are supplied with electric power, only control breaker voltage, and that's why all attachment functions stop working if the control breaker is activated.	Control breaker in resting position: $U_{K2:6} = 24\text{ V}$	<i>Control unit frame front, description page 19</i> D7: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.8 <i>CAN/POWER</i> , menu 8
8 +	If switch control breaker is pressed down, the ignition voltage to Control unit cab (D790-1) is cut off and thus the control current to Relay control breaker voltage (K3009-1) and Relay control breaker voltage (K3009-2). Electric power feed to the control units is cut off and the functions stop working.	Control breaker in resting position: $U_{K2:6} = 24\text{ V}$	<i>Control unit frame option, description page 21</i> D8: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.12 <i>CAN/POWER</i> , menu 12
9 +	As an additional safety feature, Control unit cab (D790-1) sends the status of the operation breaker switch on the CAN bus. This means that the functions are also stopped at signal level.	Control breaker in resting position: $U_{K2:1} = 24\text{ V}$ Control breaker in resting position: $U_{K2:11} = 24\text{ V}$	<i>Control unit attachment right leg pair, description page 25</i> D9: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.19 <i>CAN/POWER</i> , menu 19
10 +		Control breaker in resting position: $U_{K2:1} = 24\text{ V}$ Control breaker in resting position: $U_{K2:11} = 24\text{ V}$	<i>Control unit attachment left leg pair, description page 24</i> D10: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.18 <i>CAN/POWER</i> , menu 18
11 +		Control breaker in resting position: $U_{K2:1} = 24\text{ V}$ Control breaker in resting position: $U_{K2:11} = 24\text{ V}$	<i>Control unit attachment option, description page 23</i> D11: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.17 <i>CAN/POWER</i> , menu 17
12		Control breaker in resting position: $U_{K2:1} = 24\text{ V}$ Control breaker in resting position: $U_{K2:9} = 24\text{ V}$ Control breaker in resting position: $U_{K2:10} = 24\text{ V}$ Control breaker in resting position: $U_{K2:11} = 24\text{ V}$	<i>Control unit attachment, description page 22</i> D12: Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.16 <i>CAN/POWER</i> , menu 16



Operation breaker

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### Control breaker, checking

- 1 Start the machine and active any load handling function.
- 2 Activate lift
- 3 Press in the control breaker and check that the lift movement stops.
- 4 Reset the control breaker (turn in the arrows' direction) and check that the lift function works again.

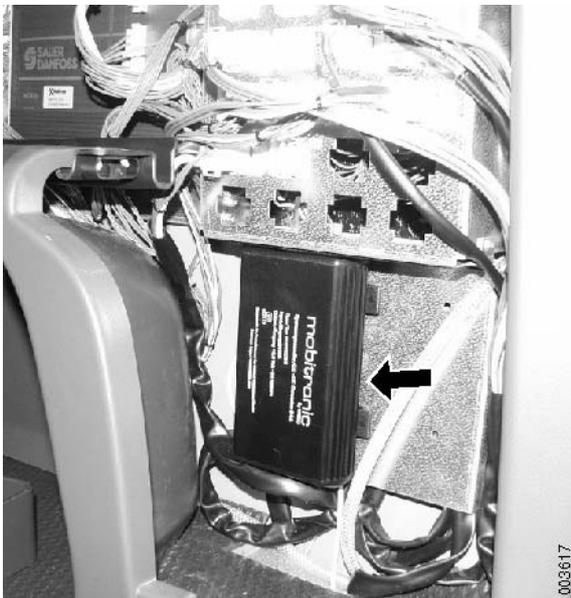
## 11.5.1.5 Voltage converter

### Voltage converter, description



The voltage converter is located under a protective casing to the left behind the operator's seat.

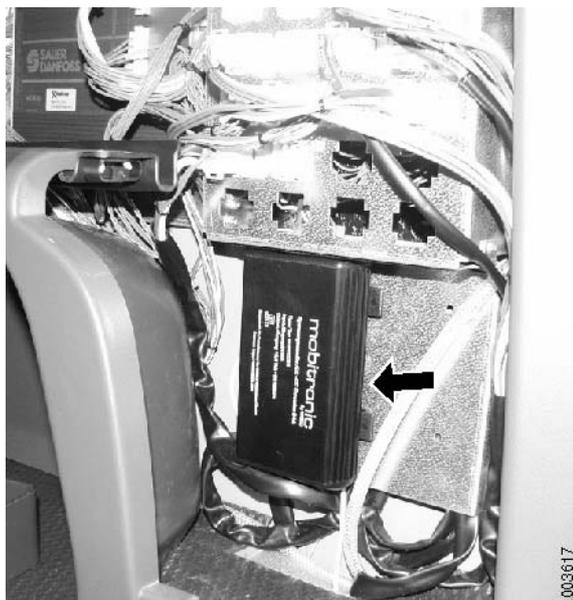
The voltage converter converts 24 Volt to 12 Volt. 12 V voltage is available for accessories through socket X067 in the cab's electrical distribution box. (15 and 30 voltage, earth and 12V.)



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**Voltage converter, change**

- 1 Machine in service position, see tab *B Safety*.
- 2 Remove the cover panels behind the driver seat.
- 3 Disconnect the electric cables from the converter.
- 4 Remove the voltage converter.
- 5 Fit in reverse order.



Voltage converter located diagonally behind the driver seat.

## 11.5.2 Electrical distribution box

### 11.5.2.1 Electrical distribution box cab

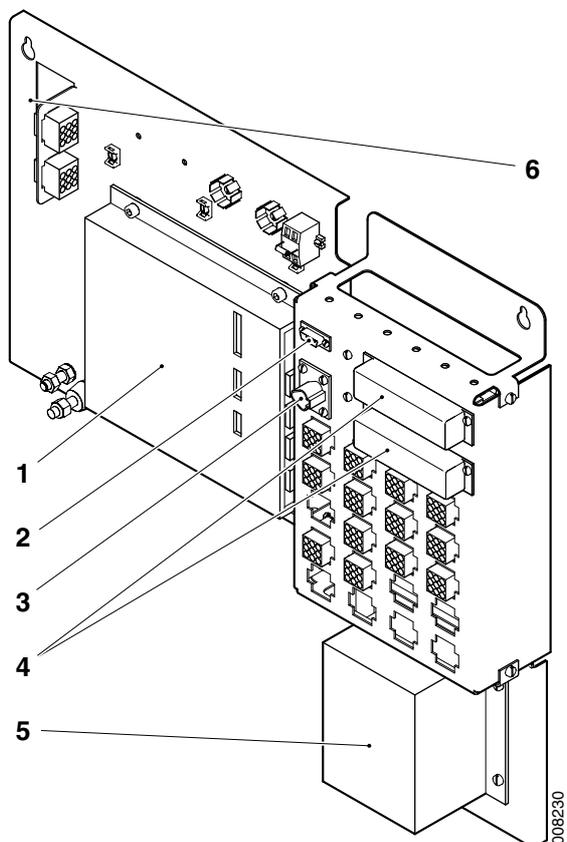
#### Electrical distribution box cab, description

The electrical distribution box is mounted on the rear wall of the cab, on the left. Located there are:

- Control unit cab (D790-1)
- Circuit fuses
- Buzzer for alarm if, for example, the operator leaves the machine without the parking brake being applied
- Connectors
- Relays
-  Voltage converter 24 V to 12 V
- Connector customer accessory. Output voltage 24 V, max. 10 A.  
Connector 2-pin Universal mate-n-lock, for part number see Parts catalogue.

#### NOTE

*This connector is not on the machine if the machine is equipped with voltage converter.*



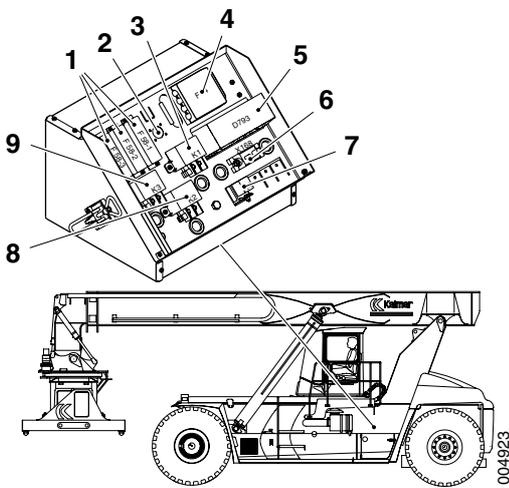
1. Control unit cab (D790-1)
2. Socket for programming control units
3. Socket for CAN bus drivetrain
4. Fuse holder
5. Voltage converter 
6. Connector customer accessory 24V / 10A

### 11.5.2.2 Electrical distribution box frame

#### Electrical distribution box frame, description

The electrical distribution box is mounted on the side of the machine. Also located there are:

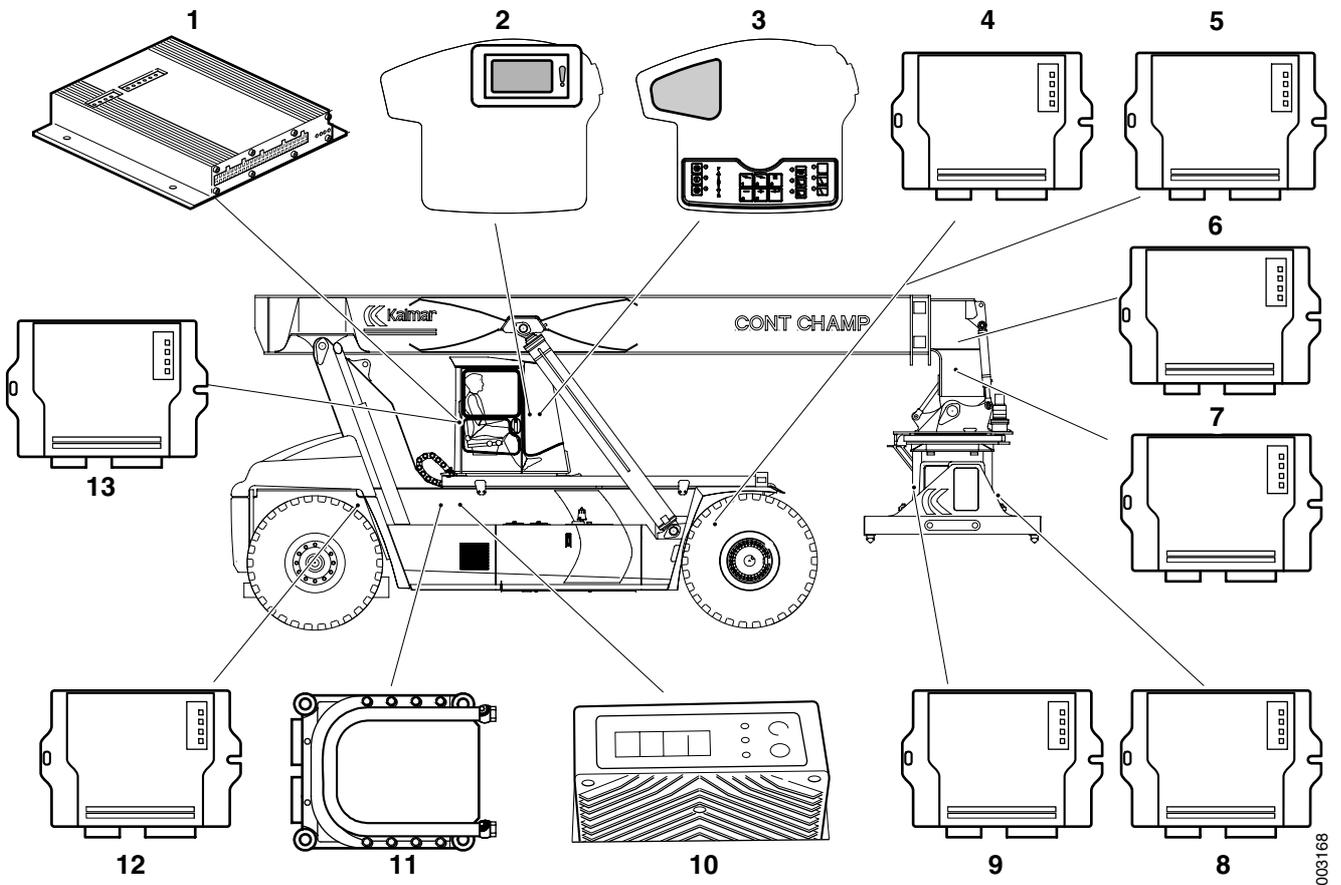
- Circuit fuses
- Socket for programming Control unit transmission (D793)
- Main fuses
- Control unit transmission (D793)
- Power relays for voltage feed to the machine's functions.



1. Circuit fuses
2. Socket for programming Control unit transmission (D793)
3. Power relay (K315-1)
4. Main fuses
5. Control unit transmission (D793)
6. Main fuse
7. Relay (K315-2)
8. Power relay (K3009-1)
9. Power relay (K3009-2)

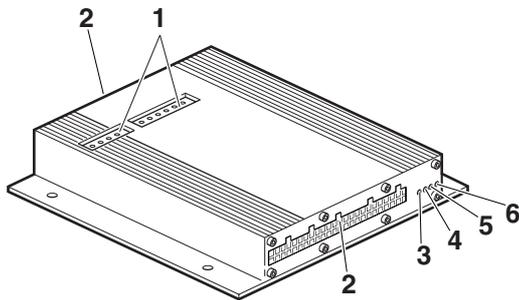
### 11.5.3 Control units

#### Control units, position



- 1. Control unit cab (D790-1)
  - 2. Control unit KID (D795)
  - 3. Control unit KIT (D790-2)
  - 4. Control unit frame front (D797-F)
  - 5. Control unit frame option (D797-O) **+**
  - 6. Control unit attachment (D791-1)
  - 7. Control unit attachment option (D791-2) **+**
  - 8. Control unit attachment left legs (D791-3) **+**
  - 9. Control unit attachment right leg pair (D791-4) **+**
  - 10. Control unit transmission (D793)
  - 11. Control unit engine (D794)
  - 12. Control unit frame rear (D797-R)
  - 13. Control unit cab option (D790-3) **+**
- Only on machines with both combi attachment and mini-wheel or combi attachment and joystick steering

0003168



1. Connection terminals for fan, work lights, windshield washers
2. Connection terminals for other
3. Light 1, battery voltage
4. Light 2, redundant voltage feed, redundant CAN bus and power supply
5. Light 3, communication
6. Light 4, fault indication

### 11.5.3.1 Control unit cab

#### Control unit cab, description

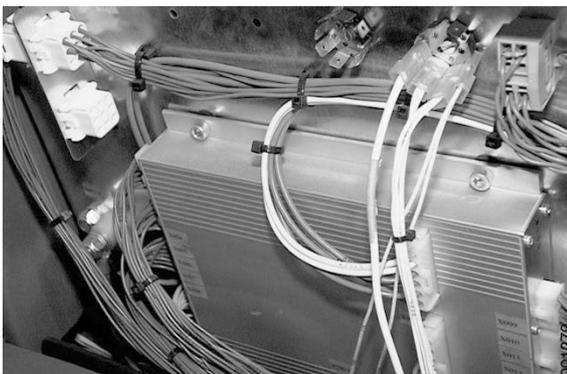
Control unit cab (D790-1) is the control unit in the control and monitoring system. Control unit cab (D790-1) sends wake-up signals to other control units and controls, and monitors their functions. It administers the work in the control unit network. The control unit controls the redundant voltage feed and handles communication between redundant CAN bus the gateway for CAN bus for drivetrain. Control unit cab (D790-1) also handles all input signals from controls in the cab and sends out these signals on the CAN bus.

The control unit cab has four indicator lights that indicate the control unit's function (see illustration).

Light 1	Green light on when there is battery voltage to unit. Light is physically controlled by voltage feed to control unit.
Light 2	Flashes green when redundant voltage feed to control units and redundant CAN bus communication are active. No power in the system.  Green light when power electronics and 15-voltage are supplied with voltage.
Light 3	Long single flash yellow at communication with Control unit display (D795), which is a basic condition for troubleshooting.  Short single flash yellow at communication with Control unit engine (D794) and Control unit transmission (D793)  Double flash yellow (short and long) at communication with display and engine or transmission.
Light 4	Red light on at active error.

#### Control unit cab, change

- 1 Machine in service position.
- 2 Remove the cover from the electrical distribution box.
- 3 Unplug connectors from Control unit cab (D790-1).
- 4 Change control unit.
- 5 Check that the new control unit matches the machine's forklift number (Z-number).
- 6 Calibrate the new control unit, see tab 8 *Control system*, group 8.5.2.3 *Calibrate DRIVE-TRAIN*.
- 7 Set the fresh air damper to completely closed and completely open, wait a few seconds in each position so that the damper has time to reach the end-position.

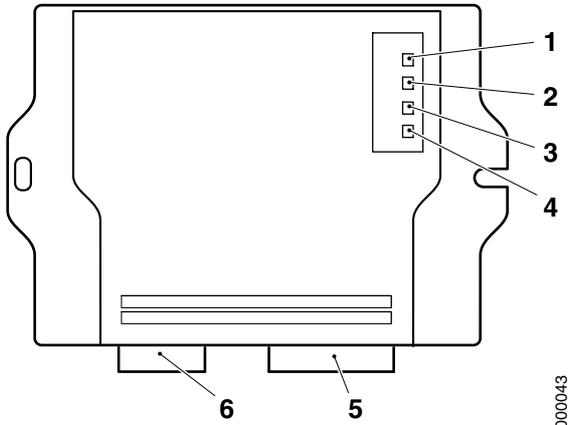


**11.5.3.2 Control unit frame front**

**Control unit frame front, description**

Control unit frame front (D797-F) handles input data from sensors and sends control signals to relays and solenoid valves in the machine's front half.

The control unit has four indicator lights that indicate the control unit's function (see illustration).

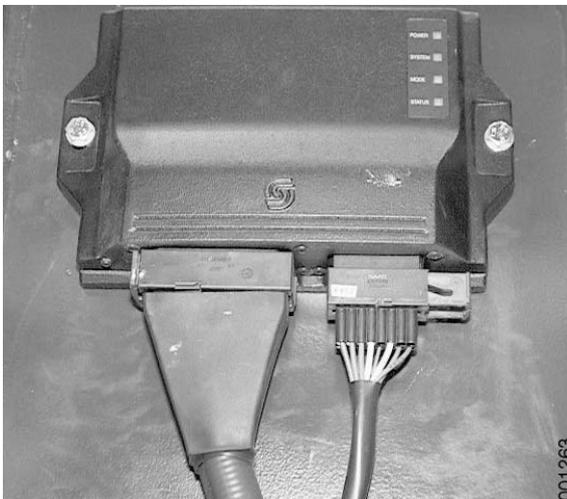


- 1. Light 1, battery voltage
- 2. Light 2, redundant voltage feed and power supply
- 3. Light 3, communication
- 4. Light 4, fault indication
- 5. Control signals (input and output signals)
- 6. Power feed (redundant voltage feed control units, redundant CAN bus) and input data

Light 1	Green light on when there is battery voltage to unit. The light is physically controlled by the voltage feed to the control unit.
Light 2	Green light flashing when there is no voltage to one of the following, redundant voltage feed left, redundant voltage feed right or 15-voltage.  Green light on when there is voltage to redundant voltage feed, left, redundant voltage feed, right and 15-voltage.
Light 3	Single flash yellow at communication with display (KID) or Control unit cab (D790-1).  Double flash yellow at communication with display and Control unit cab (D790-1).
Light 4	Red light on at active error.

**Control unit frame front, change**

- 1 Machine in service position.
- 2 Disconnect the cabling from Control unit frame front (D797-F).
- 3 Change control unit.
- 4 Check that the new control unit matches the machine's forklift number (Z-number).
- 5 Calibrate the new control unit, see tab 8 *Control system*, group 8.5.2.1 *Calibrate SCALE* (pressure sensor).
- 6 Verify lowering speed, see tab 7 *Load handling*, group 7.2 *Lifting/lowering*. In case of deviations, contact Kalmar Industries AB.



**! DANGER**

**The lowering speed must be correct. If lowering speed is too high, there is a risk of turn-over.**

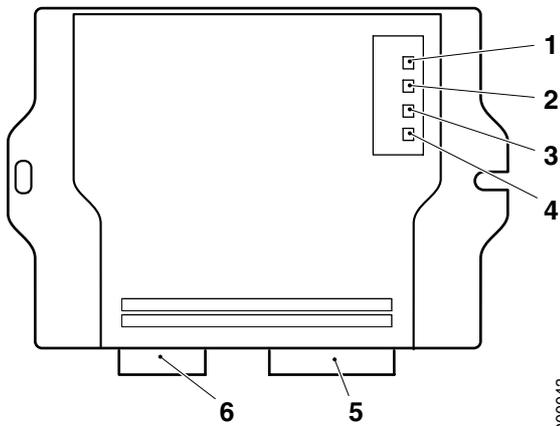
**The machine may absolutely not be operated before lowering speed has been verified.**

### 11.5.3.3 Control unit frame rear

#### Control unit frame rear, description

Control unit frame rear (D797-R) handles input data from sensors and sends control signals to relays and solenoid valves in the machine's rear half.

The control unit has four indicator lights that indicate the control unit's function (see illustration).

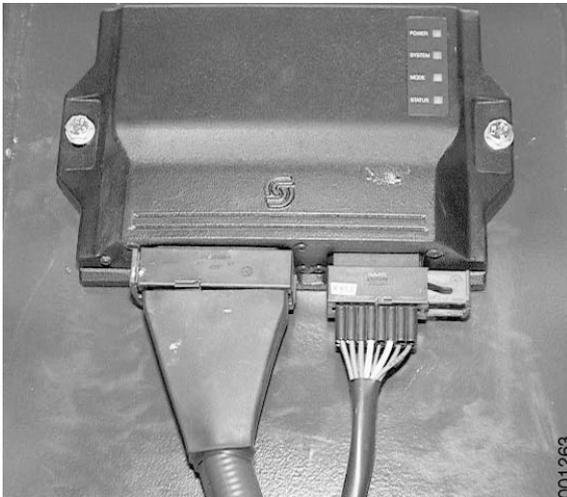


1. Light 1, battery voltage
2. Light 2, redundant voltage feed and power supply
3. Light 3, communication
4. Light 4, fault indication
5. Control signals (input and output signals)
6. Power feed (redundant voltage feed control units, redundant CAN bus) and input data

Light 1	Green light on when there is battery voltage to unit. The light is physically controlled by the voltage feed to the control unit.
Light 2	Green light flashing when there is no voltage to one of the following, redundant voltage feed left, redundant voltage feed right or 15-voltage. Green light on when there is voltage to redundant voltage feed, left, redundant voltage feed, right and 15-voltage.
Light 3	Single flash yellow at communication with display (KID) or Control unit cab (D790-1). Double flash yellow at communication with display and Control unit cab (D790-1).
Light 4	Red light on at active error.

#### Control unit frame rear, change

- 1 Machine in service position.
- 2 Disconnect the cabling from Control unit Rear (KDU D797-R).
- 3 Change control unit.
- 4 Check that the new control unit coincides with the machine truck number (Z number).
- 5 Calibrate the new control unit, see tab 8 *Control system*, group 8.5.2.1 *Calibrate SCALE* (length sensor, angle sensor).



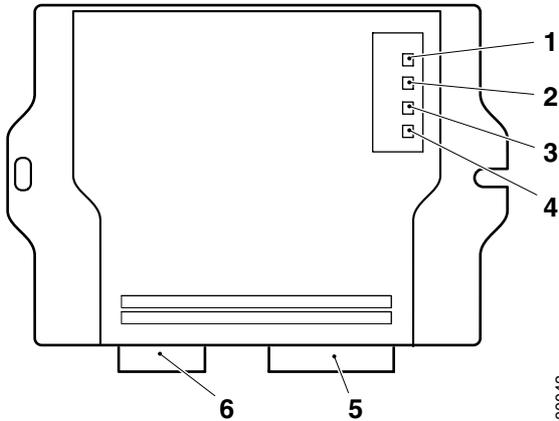
### 11.5.3.4 Control unit frame option

#### Control unit frame option, description



Control unit frame option (D797-O) is a unit that handles input data from sensors and sends control signals to relays and solenoid valves for optional functions in machine's front half.

The control unit has four indicator lights that indicate the control unit's function (see illustration).



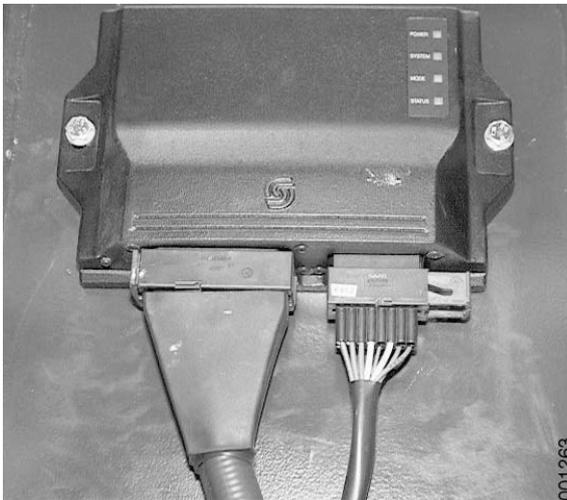
- 1. Light 1, battery voltage
- 2. Light 2, redundant voltage feed and power supply
- 3. Light 3, communication
- 4. Light 4, fault indication
- 5. Control signals (input and output signals)
- 6. Power feed (redundant voltage feed control units, redundant CAN bus) and input data

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Light 1	Green light on when there is battery voltage to unit. The light is physically controlled by the voltage feed to the control unit.
Light 2	Green light flashing when there is no voltage to one of the following, redundant voltage feed left, redundant voltage feed right or 15-voltage.  Green light on when there is voltage to redundant voltage feed, left, redundant voltage feed, right and 15-voltage.
Light 3	Single flash yellow at communication with display (KID) or Control unit cab (D790-1).  Double flash yellow at communication with display and Control unit cab (D790-1).
Light 4	Red light on at active error.

#### Control unit frame option, change

- 1 Machine in service position.
- 2 Disconnect the cabling from the control unit.
- 3 Change control unit.
- 4 Check that the new control unit coincides with the machine truck number (Z number).
- 5 The control unit is not calibrated.



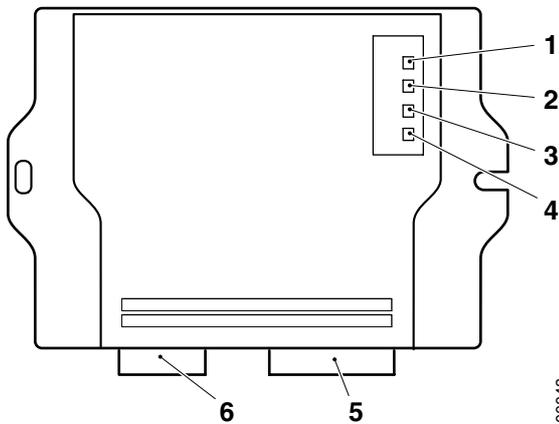
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### 11.5.3.5 Control unit attachment

#### Control unit attachment, description

Control unit attachment (D791) handles input data from sensors and sends control signals to relays and solenoid valves for functions for top lift attachment.

The control unit has four indicator lights that indicate the control unit's function (see illustration).

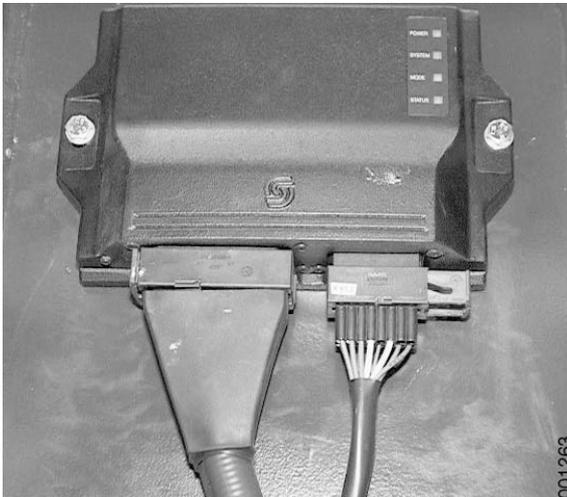


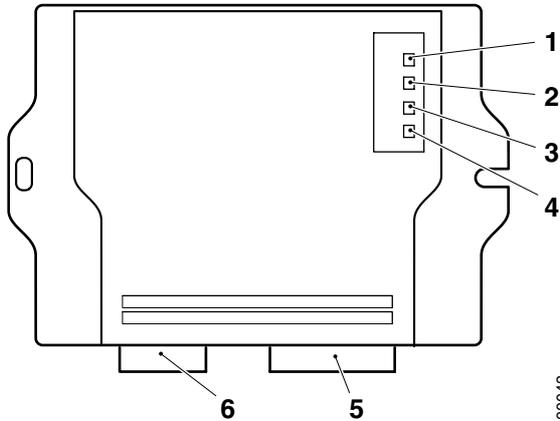
1. Light 1, battery voltage
2. Light 2, redundant voltage feed and power supply
3. Light 3, communication
4. Light 4, fault indication
- 5, Control signals (input and output signals)
6. Power feed (redundant voltage feed control units, redundant CAN bus) and input data

Light 1	Green light on when there is battery voltage to unit. The light is physically controlled by the voltage feed to the control unit.
Light 2	Green light flashing when there is no voltage to one of the following, redundant voltage feed left, redundant voltage feed right or 15-voltage. Green light on when there is voltage to redundant voltage feed, left, redundant voltage feed, right and 15-voltage.
Light 3	Single flash yellow at communication with display (KID) or Control unit cab (D790-1). Double flash yellow at communication with display and Control unit cab (D790-1).
Light 4	Red light on at active error.

#### Control unit attachment, change

- 1 Machine in service position.
- 2 Disconnect the cabling from the control unit.
- 3 Change control unit.
- 4 Check that the new control unit coincides with the machine truck number (Z number).
- 5 The control unit is not calibrated.





- 1. Light 1, battery voltage
- 2. Light 2, redundant voltage feed and power supply
- 3. Light 3, communication
- 4. Light 4, fault indication
- 5. Control signals (input and output signals)
- 6. Power feed (redundant voltage feed control units, redundant CAN bus) and input data

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### 11.5.3.6 Control unit attachment option

#### Control unit attachment option, description



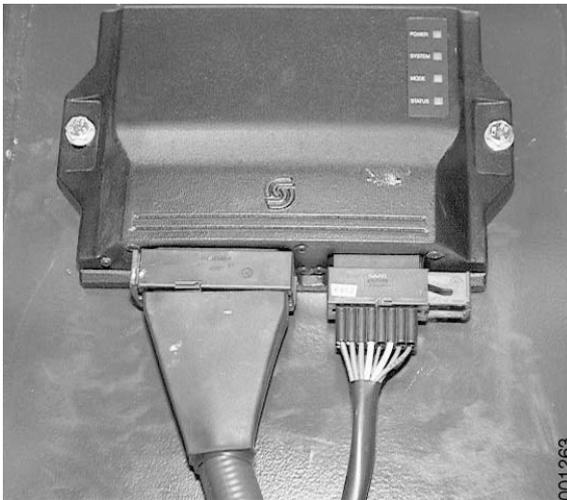
Control unit attachment option (D791-2) handles input data from sensors and sends control signals to relays and solenoid valves for optional functions on top lift attachment.

The control unit has four indicator lights that indicate the control unit's function (see illustration).

Light 1	Green light on when there is battery voltage to unit. The light is physically controlled by the voltage feed to the control unit.
Light 2	Green light flashing when there is no voltage to one of the following, redundant voltage feed left, redundant voltage feed right or 15-voltage.  Green light on when there is voltage to redundant voltage feed, left, redundant voltage feed, right and 15-voltage.
Light 3	Single flash yellow at communication with display (KID) or Control unit cab (D790-1).  Double flash yellow at communication with display and Control unit cab (D790-1).
Light 4	Red light on at active error.

#### Control unit attachment option, change

- 1 Machine in service position.
- 2 Disconnect the cabling from the control unit.
- 3 Change control unit.
- 4 Check that the new control unit coincides with the machine truck number (Z number).
- 5 The control unit is not calibrated.



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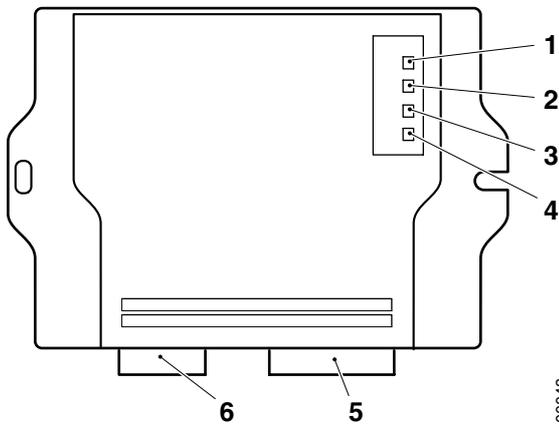
### 11.5.3.7 Control unit attachment left legs

#### Control unit attachment left leg pair, description



Control unit attachment left leg pair (D791-3) handles input data from sensors and sends control signals to relays and solenoid valves to control the left leg pair on attachment with lift legs. See tab 7 *Loadhandling*, group 7.9.2 *Twistlock and lift legs*.

The control unit has four indicator lights that indicate the control unit's function (see illustration).

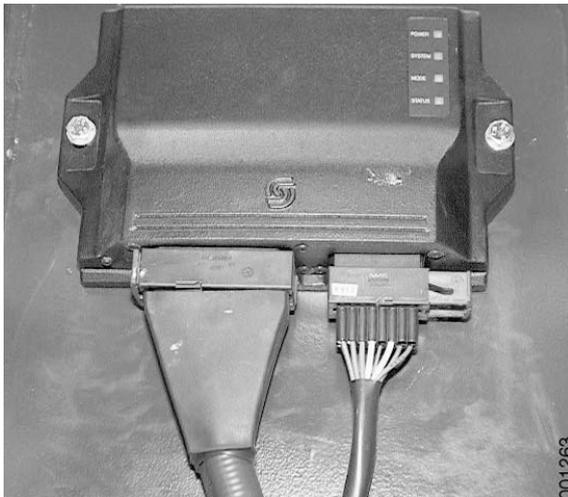


- 1. Light 1, battery voltage
- 2. Light 2, redundant voltage feed and power supply
- 3. Light 3, communication
- 4. Light 4, fault indication
- 5. Control signals (input and output signals)
- 6. Power feed (redundant voltage feed control units, redundant CAN bus) and input data

Light 1	Green light on when there is battery voltage to unit. The light is physically controlled by the voltage feed to the control unit.
Light 2	Green light flashing when there is no voltage to one of the following, redundant voltage feed left, redundant voltage feed right or 15-voltage.  Green light on when there is voltage to redundant voltage feed, left, redundant voltage feed, right and 15-voltage.
Light 3	Single flash yellow at communication with display (KID) or Control unit cab (D790-1).  Double flash yellow at communication with display and Control unit cab (D790-1).
Light 4	Red light on at active error.

#### Control unit attachment left leg pair, change

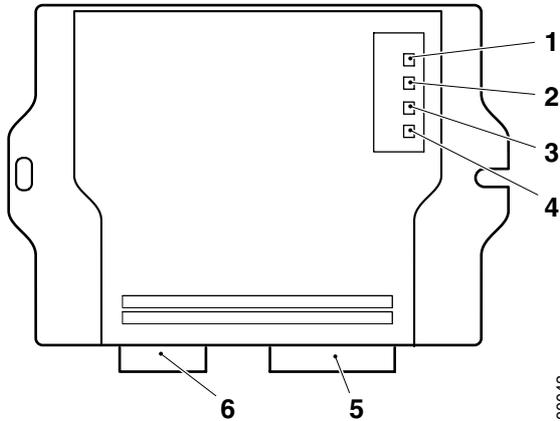
- 1 Machine in service position.
- 2 Disconnect the cabling from the control unit.
- 3 Change control unit.
- 4 Check that the new control unit matches the machine's forklift number (Z-number).
- 5 The control unit is not calibrated.



DIAG COMBI	14 (17)	
SEQUENCE MODE	LE	RI
FRONT	X	X
REAR	X	X

Diagnostic menu Combi, menu 14

- 6 Start the machine and drive to an open space. Run the lowering sequence for support jacks up and down. Use diagnostic menu Combi, menu 14 and check that the lift legs go through all sequence modes from 1-5.



- 1. Light 1, battery voltage
- 2. Light 2, redundant voltage feed and power supply
- 3. Light 3, communication
- 4. Light 4, fault indication
- 5. Control signals (input and output signals)
- 6. Power feed (redundant voltage feed control units, redundant CAN bus) and input data

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### 11.5.3.8 Control unit attachment right legs

#### Control unit attachment right leg pair, description



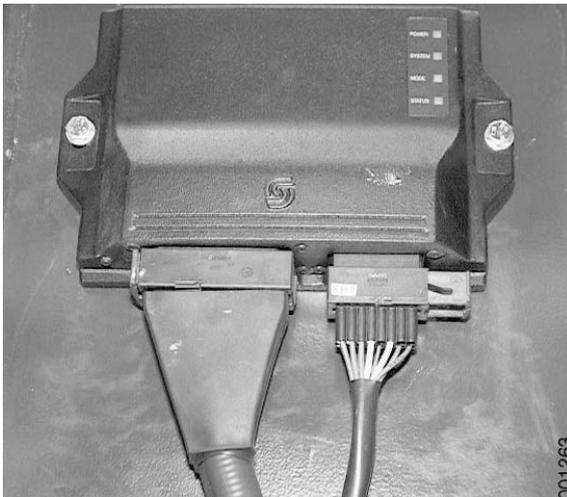
Control unit attachment right leg pair (D791-4) handles input data from sensors and sends control signals to relays and solenoid valves to control the right leg pair on attachment with lift legs. See tab 7 *Load-handling, group 7.9.2 Twistlock and lift legs*.

The control unit has four indicator lights that indicate the control unit's function (see illustration).

Light 1	Green light on when there is battery voltage to unit. The light is physically controlled by the voltage feed to the control unit.
Light 2	Green light flashing when there is no voltage to one of the following, redundant voltage feed left, redundant voltage feed right or 15-voltage.  Green light on when there is voltage to redundant voltage feed, left, redundant voltage feed, right and 15-voltage.
Light 3	Single flash yellow at communication with display (KID) or Control unit cab (D790-1).  Double flash yellow at communication with display and Control unit cab (D790-1).
Light 4	Red light on at active error.

#### Control unit attachment right leg pair, change

- 1 Machine in service position.
- 2 Disconnect the cabling from the control unit.
- 3 Change control unit.
- 4 Check that the new control unit matches the machine's forklift number (Z-number).
- 5 The control unit is not calibrated.



001263

DIAG COMBI	14 (17)	
SEQUENCE MODE	LE	RI
FRONT	X	X
REAR	X	X

000227

- 6 Start the machine and drive to an open space. Run the lowering sequence for support jacks up and down. Use diagnostic menu Combi, menu 14 and check that the lift legs go through all sequence modes from 1-5.

Diagnostic menu Combi, menu 14

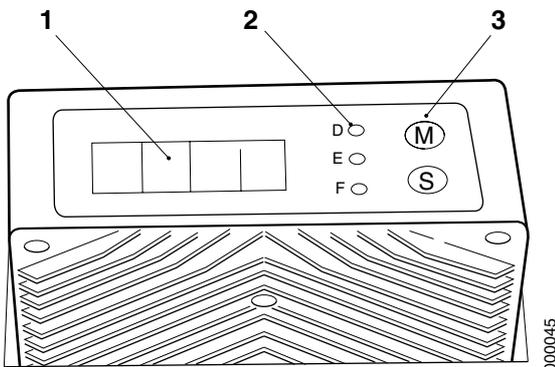
### 11.5.3.9 Control unit transmission

#### Control unit transmission, description

Control unit transmission TCU (D793) is a part of the drivetrain's control and it handles transmission functions, selection of gear when loaded and rpm, etc.

Control unit transmission TCU (D793) is connected in a separate CAN bus communication with the engine, which is connected to Control unit cab (D790-1). Control unit cab (D790-1) sends in turn information from the drivetrain on to other units.

The control unit has two function keys and three status lights on the unit (see illustration):



1. Display
2. Status lights
3. Function keys

Function key M	Select display group
Function key S	Select status within display group.
Status light D	Yellow light indicates test mode.
Status light E	Yellow light indicates error in unit.
Status light F	Red light indicates at reset.

Control units can show information on the display in three display groups with different status. The function keys M and S are used to move in the display and to select display group and status.

The following states are available in the display:

#### Display group I

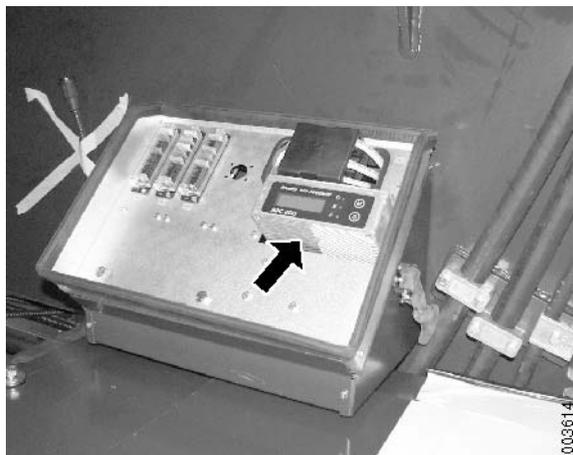
- GPOS, shows rotational direction transmission
- VSPD, shows speed in km/
- dist, shows travelled distance in km or miles

#### Display group II

- CPOS, shows gear position
- Tspd, shows measured turbine speed in km/h or mph
- Espd, shows measured turbine speed in rpm
- Ospd, shows measured output speed transmission in rpm
- Srat, shows relationship turbine speed (Tspd)/ engine speed (Espd)
- TQ I, shows measured torque (Nm) on transmission in
- Ttmp, shows measured temperature in oil sump (Celsius or Fahrenheit)
- Ctmp, shows measured temperature in converter (Celsius or Fahrenheit)

#### Display group III

- Err, shows error codes (current and history)



### Control unit transmission, change

- 1 Machine in service position.
- 2 Disconnect the cabling from control unit TCU.
- 3 Change control unit.
- 4 Check that the new control unit coincides with the machine truck number (Z number).
- 5 Calibrate the new control unit, see tab 8 *Control system*, group 8.5.2.3 *Calibrate DRIVE-TRAIN* and tab 2 *Transmission*, group 2.8 *Control system transmission*.

### 11.5.3.10 Control unit engine

#### Control unit engine, description (engine alternative Volvo TWD1240VE)

Control unit engine (D794) is a part of the drivetrain's control system and handles engine function, fuel injection, etc.

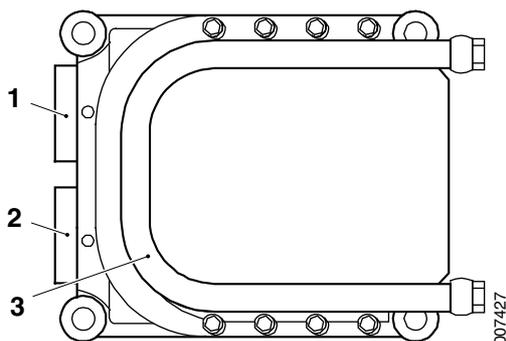
Control unit engine (D794) is connected in a separate CAN-bus communication with the transmission which is connected to Control unit cab (D790-1). In turn, Control unit cab (D790-1) sends information from drivetrain to other control units.

The control unit is located on the engine has no function keys or display. All functions are controlled via the CAN-bus and an external control and monitoring system.

The control unit monitors the following values to optimize engine performance.

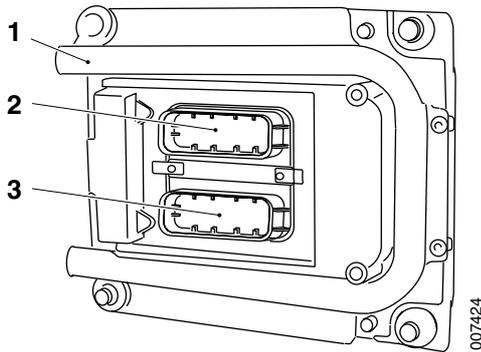
- engine rpm
- camshaft's position
- boost pressure
- charge-air temperature
- coolant temperature
- oil pressure
- oil temperature
- water in fuel
- fuel pressure
- coolant level

The data gives exact information about the operating conditions and makes it possible for the control unit to, for example, calculate the correct fuel volume and to check the condition of the engine.



Control unit, engine

1. Connector 1 (black)
2. Connector 2 (red)
3. Cooling channel for control unit (fuel)



Control unit, engine

1. Cooling channel for control unit (fuel)
2. Connector A (black)
3. Connector B (grey)

### Control unit engine, description (engine alternative Volvo TAD1250VE)

Control unit engine (D794) is a part of the drivetrain's control system and handles engine function, fuel injection, etc.

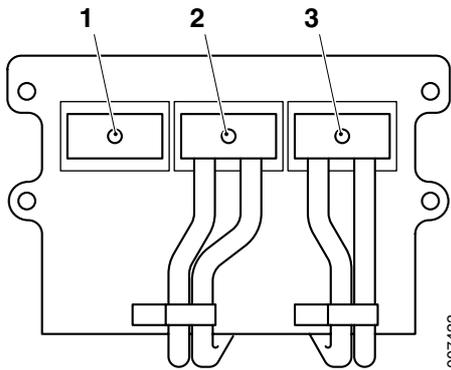
Control unit engine (D794) is connected in a separate CAN-bus communication with the transmission which is connected to Control unit cab (D790-1). In turn, Control unit cab (D790-1) sends information from drivetrain to other control units.

The control unit is located on the engine has no function keys or display. All functions are controlled via the CAN-bus and an external control and monitoring system.

The control unit monitors the following values to optimize engine performance.

- engine rpm
- camshaft's position
- boost pressure
- charge-air temperature
- coolant temperature
- oil pressure
- oil temperature
- oil level
- crankcase pressure
- water in fuel
- fuel pressure
- coolant level

The data gives exact information about the operating conditions and makes it possible for the control unit to, for example, calculate the correct fuel volume and to check the condition of the engine.



007423

1. Connector OEM
2. Connector Actuator
3. Connector Sensor

### Control unit engine, description (engine alternative Cummins)

Control unit engine (D794) is a part of the drivetrain's control system and handles engine function, fuel injection, etc.

Control unit engine (D794) is connected in a separate CAN-bus communication with the transmission which is connected to Control unit cab (D790-1). In turn, Control unit cab (D790-1) sends information from drivetrain to other control units.

The control unit is located on the engine has no function keys or display. All functions are controlled via the CAN-bus and an external control and monitoring system.

The control unit monitors the following values to optimize engine performance.

- engine rpm
- boost pressure
- charge-air temperature
- coolant temperature
- oil pressure
- oil temperature
- coolant level
- water in fuel
- air pressure

The data gives exact information about the operating conditions and makes it possible for the control unit to, for example, calculate the correct fuel volume and to check the condition of the engine.

### Control unit engine, change

See *supplier documentation engine*.

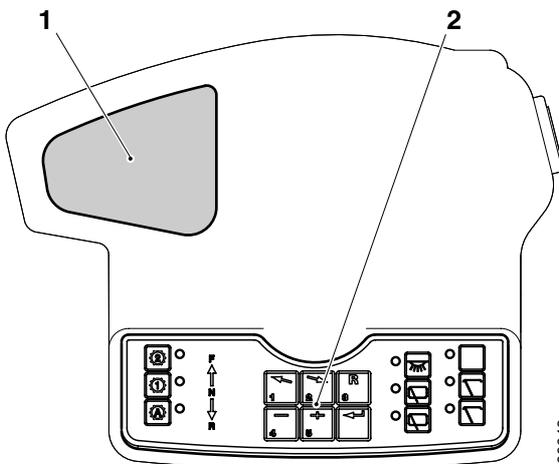
## 11.5.3.11 Control unit KIT

### Control unit KIT, description

Control unit KIT (D790-2) handles functions for the gear selector lever and multi-function lever, direction indicator lever as well as start key position II and III. It also handles the panel for keys (B) for the control and monitoring system and its panel for warning and indicator lights (A).

Control unit KIT (D790-2) has several separate function keys and indicator lights on the unit (see illustration).

See operator's manual for detailed information about warning lights, indicator lights and function keys.



000049

1. Panel for warning and indicator lights
2. Panel for keys



### Control unit KIT, change

- 1 Machine in service position.
- 2 Remove the steering wheel and separate the steering wheel panel.
- 3 Disconnect KIT from the steering wheel panel.
- 4 Detach the connectors.
- 5 Remove the warning and indicator lamp panel.
- 6 Fit in reverse order.
- 7 KIT is not calibrated.

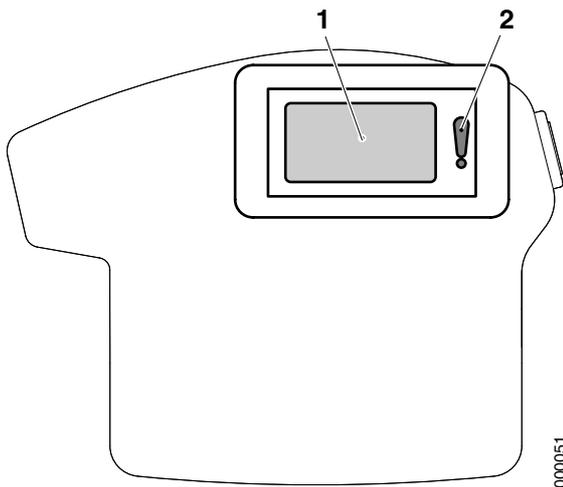
### 11.5.3.12 Control unit KID

#### Control unit KID, description

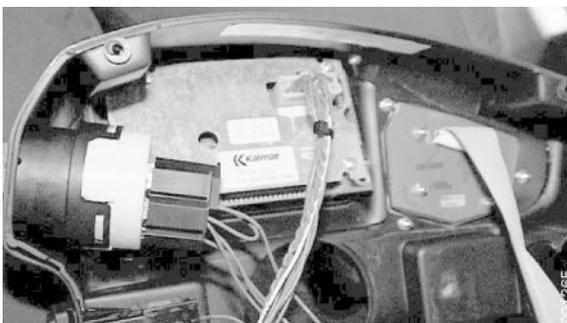
Control unit KID (D795) shows the operator the information that the control and monitoring system sends in the form of messages, for example, status, error indications, etc.

There is an indicator light to the right of the display that is activated with a red light when there is a serious malfunction in the control and monitoring system. Error code and information are shown on the display.

See operator's manual for detailed information about the display.

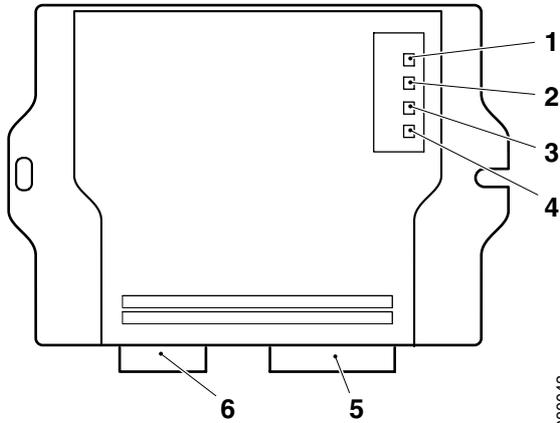


1. LCD display
2. Series of diodes that constitute indicator light for serious malfunction



#### Control unit KID, change

- 1 Machine in service position.
- 2 Remove the steering wheel and separate the steering wheel panel.
- 3 Detach the connector from KID.
- 4 Detach KID from the steering wheel panel.
- 5 Fit in reverse order.
- 6 KID is not calibrated.



- 1. Light 1, battery voltage
- 2. Light 2, redundant voltage feed and power supply
- 3. Light 3, communication
- 4. Light 4, fault indication
- 5. Control signals (input and output signals)
- 6. Power feed (redundant voltage feed control units, redundant CAN bus) and input data

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### 11.5.3.13 Control unit cab option

#### Control unit cab option, description



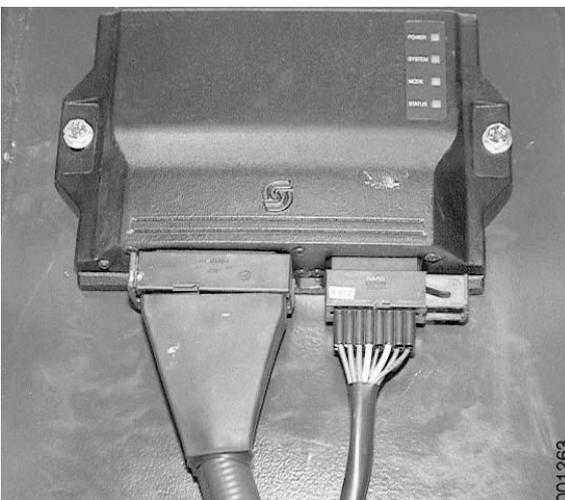
Control unit cab option (D790-3) is only found on machines with both Combi attachment and joystick or Combi attachment and mini-wheel. The control unit handles signals to and from joystick or mini-wheel and sends information on to the CAN-bus.

The control unit has four indicator lights that indicate the control unit's function (see illustration).

Light 1	Green light on when there is battery voltage to the unit. The light is physically controlled by voltage feed to the control unit.
Light 2	Flashes green when a voltage feed is absent, redundant voltage feed left, right or 15-voltage. Lights green when redundant voltage feed, left and right, and 15-voltage are fed with voltage.
Light 3	Yellow single flash at communication with either Control unit KID (D795) or Control unit cab (D790-1). Yellow double flash at communication with both Control unit KID (D795) and Control unit cab (D790-1).
Light 4	Red light on at active error.

#### Control unit cab option, change

- 1 Machine in service position.
- 2 Disconnect the cabling from the control unit.
- 3 Change control unit.
- 4 Check that the new control unit coincides with the machine truck number (Z number).
- 5 The control unit is not calibrated.



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## 11.5.5 Cable harness

### Connectors, overview

The list includes all connectors on the machine with a brief description of their locations and to which functions the signals in them are related.

Connector	Location	Function
X001	Control unit cab (D790-1)	Power supply and earth connection Control unit cab (D790-1)
X002	Control unit cab (D790-1)	Windscreen wipers Cooling fan Actuator motor, recirculation
X004	Control unit cab (D790-1)	Climate control unit
X005	Control unit cab (D790-1)	Switch option Switch warning light (Hazard) Climate control unit Extra sensors Throttle pedal
X006	Control unit cab (D790-1)	Dimmer instrument lighting Switch work lights Switch option Seat heater Throttle pedal Brake pedal
X007	Control unit cab (D790-1)	Control lever Indicator lamp support leg down
X008	Control unit cab (D790-1)	Control lever Switch by-pass Switch control breaker Switch, parking brake Switch, sliding cab Switch, support legs Switch 30-35 stop Switch option Switch, twistlocks
X009	Control unit cab (D790-1)	Combi unit Overheight Lever steering or mini steering wheel
X009A	Extension X009A	Lever steering or mini steering wheel

Connector	Location	Function
X010	Control unit cab (D790-1)	Sensor, end position cab Water valve Seat heating Relay, work lighting Hour counter Relay, Compressor Power supply relays K315-1, K3009-1, K3009-2 and K315-2 Windscreen washing Windscreen wiper, roof
X011	Control unit cab (D790-1)	Starter switch Lighting, Control unit KID (D795) Switches, cab doors Buzzer Interior lighting Power supply, Control unit cab (D790-1) Horn Switch, seat Feedback relay K3009-1 Seat heating
X012	Control unit cab (D790-1)	Windscreen wiper, rear Windscreen wiper, roof
X013	Control unit cab (D790-1)	CAN-bus RS232
X015	Control unit KIT (D790-2)	CAN-bus Power supply and earth connection, Control unit KIT (D790-2)
X016	Control unit KIT (D790-2)	Ignition
X017	Control unit KIT (D790-2)	Control, windscreen wipers Control, gear Control, main and dipped beams
X018	Control unit KIT (D790-2)	Sensor, steering wheel lock Switch, direction indicators
X018A	Extension X018	Sensor, steering wheel lock
X020	Control unit KID (D795)	CAN-bus RS232 Printer Power supply and earth connection, Control unit KID (D795)
X021	Control unit, cab option (D790-3)	Lever steering or mini steering wheel

Connector	Location	Function
X022	Control unit, cab option (D790-3)	Power supply and earth connection, Control unit cab option (D790-3) CAN bus, Control unit, cab option (D790-3)
X033	Climate control unit	Control, fan Control, temperature Control, air distribution
X034	Climate control unit	Heater fan Water valve
X035	Climate control unit	Valve, air distribution Sensor, air temperature
X036	Climate control unit	Actuator motor, recirculation Sensor, air temperature
X038	Instrument panel, cab	Throttle pedal Release pedal
X039	Electrical distribution box cab	Hour counter Relay, Compressor, seat with air suspension Switch warning light (Hazard) Switch, cab door Actuator motor, recirculation Fan motor, heating Water valve, ECC
X048	Electrical distribution box cab	Termination resistance
X049	Electrical distribution box cab	CAN-bus
X050	Electrical distribution box cab	D-sub RS232 Control unit cab (D790-1)
X051	Electrical distribution box cab	Power supply, Control unit cab (D790-1) CAN-bus
X052	Electrical distribution box cab	CAN-bus Control relays K315-1, K3009-1, K3009-2 and K315-2
X054	Electrical distribution box cab	Interior lighting Work lighting Warning lights
X055	Electrical distribution box cab	Windscreen wiper, roof Current, CD player Current, COM radio

Connector	Location	Function
X056	Electrical distribution box cab	Warning lights Work lighting, boom Work lighting, cab
X057	Electrical distribution box cab	Windscreen wiper, rear Power supply, rearview camera
X058	Electrical distribution box cab	Motor, windscreen washers Start interlock, engine heater
X059	Electrical distribution box cab	CAN bus Power supply, Control unit, cab option (D790-3)
X060	Electrical distribution box cab	CAN-bus Interior lighting
X060A	Extension X060	CAN-bus Interior lighting
X061	Electrical distribution box cab	Earth connection, Control unit KID (D795) Power supply, Control unit KIT (D790-2) Windscreen wipers, front Actuator, recirculation
X061A	Extension X061	Earth connection, Control unit KID (D795) Power supply, Control unit KIT (D790-2)
X062	Electrical distribution box cab	Horn Map lighting Cigarette lighter 12V
X063	Electrical distribution box cab	Seat heater Compressed-air damped seat
X064	Electrical distribution box cab	Sensor, end position cab
X071-1	Electrical distribution box cab	Power supply, cab
X071-2	Electrical distribution box cab	Earth connection, cab
X072	To Right Behind Seat	Power outlet
X073	Right side of instrument panel	Cigarette lighter socket 12 V
X080	Instrument panel, cab	Switch work lights Switch, main beams Switch, warning lights (Hazard flashers) Switch, seat heater Switch, option

Connector	Location	Function
X081	Instrument panel, cab	Switch, option Switch warning light (Hazard) Extra sensors Hour counter
X082	Instrument panel, cab	Switch, cab door, left side
X168	Electrical distribution box frame	Switch, boom and attachment
X200	Boom attachment	CAN-bus Redundant power supply control units
X201	Electrical distribution box frame	Earth connection and power supply, Control unit transmission (D793)
X202	Boom attachment	Sensor, boom length Sensor, boom angle Sensor, damping boom out Sensor, damping boom in Sensor, damping boom up Sensor, damping boom down Earth connection and power supply, sensor boom Solenoid valve, regeneration extension Solenoid valve, blocking extension Work lighting, boom
X203	Electrical distribution box frame	Termination resistance
X205	Electrical distribution box frame	CAN-bus Control unit, transmission (D793)
X206	Boom attachment	Rotating warning beacon boom Work lighting, boom
X210	Between engine and gearbox	Power supply and earth connection, Control unit engine (D794) CAN bus, Control unit engine (D794)
X211	Control unit, frame front (D797-F)	42-pin connector for Control unit, frame front (D797-F)
X212	Control unit, frame front (D797-F)	Power supply and earth connection, Control unit, frame front (D797-F) CAN bus, Control unit, frame front (D797-F) Temperature, brake fluid Operation breaker
X221	Control unit frame rear (D797-R)	42-pin connector for Control unit, frame rear (D797-R)

Connector	Location	Function
X222	Control unit frame rear (D797-R)	Power supply and earth connection, Control unit, frame rear (D797-R) CAN bus, Control unit, frame rear (D797-R) Temperature hydraulic oil Fuel gauge Operation breaker D+ alternator
X231	Control unit, frame option (D797-O)	42-pin connector for Control unit, frame option (D797-O)
X232	Control unit, frame option (D797-O)	Power supply and earth connection, Control unit, frame option (D797-O) CAN bus, Control unit, frame option (D797-O) Operation breaker
X233	Control unit, frame option (D797-O)	Sensor support leg Solenoid valve support leg up and down
X235	Control unit, frame option (D797-O)	Solenoid valve, steering right and left (lever steering or mini steering wheel)
X246	AC compressor	Power supply sensor pressure refrigerant
X251	Control unit transmission (D793), electrical distribution box frame	30-pin connector for Control unit, transmission (D793)
X252	Control unit transmission (D793), electrical distribution box frame	18-pin connector for Control unit, transmission (D793)
X253	Gearbox	Solenoid valves, transmission Pressure sensor, transmission
X254	Electrical distribution box frame	Power supply and earth connection, Control unit transmission (D793)
X259	Gearbox	Temperature sensor, transmission oil for radiator
X260	Electrical distribution box frame	CAN bus, Control unit transmission (D793)
X261	Electrical distribution box frame	RS232 Control unit transmission (D793)
X264	Electrical distribution box frame	Solenoid valve brake transmission
X265	Cab	Rearview camera
X270	Lamp bracket left frame	Main and dipped beams Warning lights Direction indicators Side marker lights
X271	Lamp bracket front	Main and dipped beams Warning lights Direction indicators Side marker lights

Connector	Location	Function
X272	Lamp bracket left rear	Reversing light Rear lights Brake lights Direction indicators Side marker lights
X273	Lamp bracket right rear	Reversing light Rear lights Brake lights Direction indicators Side marker lights
X278	Between engine and gearbox	Magnetic clutch, compressor Solenoid valve activation of hydraulics for top lift Sensor, refrigerant pressure Solenoid valve deactivation of hydraulics
X279	Engine	Power supply and earth connection, Control unit engine (D794) CAN-bus Drivetrain
X282	Cable connected to Printer	RS232 Printer
X301	Boom attachment	Fuse holder, power supply and earth connection for boom and attachment
X400	Boom nose	Fuse holder, power supply and earth connection for boom and attachment
X401	Boom nose	CAN bus control units on boom nose and attachment Redundant power supply control units on boom nose and attachment
X403A	Attachment, right side	Sensor, abutment right side Sensor, twistlocks right side
X403B	Attachment, right side	Sensor, abutment right side Sensor, twistlocks right side
X404	Attachment left side	Sensor, abutment left side Sensor, twistlocks left side
X405	Boom nose	Indicator lamp, locked twistlocks Indicator light unlocked twistlocks Indicator lamp, abutment
X406	Attachment centre section	Extra work lighting combi unit
X408	Boom nose	Indicator lamp overheight legs raised
X411	Control unit attachment (D791-1)	42-pin connector for Control unit attachment (D791-1)

Connector	Location	Function
X412	Control unit attachment (D791-1)	Power supply and earth connection, Control unit attachment (D791-1) CAN bus Control unit attachment (D791-1) Operation breaker
X414	Boom nose	CAN bus and Power supply Control unit attachment right leg pair (D791-4)
X415	Boom nose	Combi unit
X416	Attachment centre section	Rotation stop
X421	Control unit attachment option (D791-2)	42-pin connector for Control unit attachment option (D791-2)
X422	Control unit attachment option (D791-2)	Power supply and earth connection, Control unit attachment option (D791-2) CAN bus Control unit attachment option (D791-2) Operation breaker
X428	Boom	Rotating warning beacon
X431	Control unit attachment left leg pair (D791-3)	42-pin connector for Control unit attachment left leg pair (D791-3)
X432	Control unit attachment left leg pair (D791-3)	Power supply and earth connection, Control unit attachment left leg pair (D791-3) CAN bus Control unit attachment left leg pair (D791-3) Operation breaker
X433	Control unit attachment left leg pair (D791-3)	Warping Indicator lamp abutment combi unit
X434	Combi unit left side front	Sensor clamping position left front leg Sensor, abutment Left front leg
X435	Combi unit left side rear	Sensor, clamping position left rear leg Sensor, abutment left rear leg
X441	Control unit attachment right leg pair (D791-4)	42-pin connector for Control unit attachment right leg pair (D791-4)
X442	Control unit attachment right leg pair (D791-4)	Power supply and earth connection, Control unit attachment right leg pair (D791-4) CAN bus Control unit attachment right leg pair (D791-4) Operation breaker
X443	Control unit attachment right leg pair (D791-4)	Solenoid valve tilt in and out Indicator lights: Front legs up and down Indicator lights: Clamping position front and rear legs
X444	Combi unit right side front	Sensor, Clamping position right front leg Sensor, abutment right front leg

Connector	Location	Function
X445	Combi unit right side rear	Sensor, Clamping position right rear leg Sensor, abutment rear front leg
X489	Attachment centre section	Sensor, overheight leg up and down Indicator lamp, overheight leg up and down Solenoid valve overheight legs up and down
X901	Voltage converter, cab	Voltage converter 24V/12V or only Splice
X905	Cab panel	12 V socket for Com radio

### Signal types, general

The control units on the machine process several different types of signal to receive signals from sensors and monitors and to control solenoid valves, lamps, etc. The different types of signal are described in the table below.

Signal type	Explanation	Area of use
<b>Analogue input signals</b>		
Rheostat	Resistance input 0–200 $\Omega$ . Linear working range with accuracy of 3%.	For example, sensor for fuel level.
Temperature	Rheostat input with non-linear working range. Resistance value corresponds to temperature and working range is approx. -40 to 150 °C. There are two different resistance curves, one for Control unit cab (D790-1) and one for control units on frame and attachment. Accuracy is $\pm 0.5$ °C within the range of 0–100 °C (excluding sensor measurement error). Outside this range of 0–100 °C, accuracy is $\pm 2$ °C.	For example, the sensor for hydraulic oil temperature and climate control unit's temperature sensor.
Voltage	An analogue signal 0–5 V. Working range is 0.5 to 4.5 V.	For example, accelerator and analogue controls in cab (control lever and heater control).
<b>Analogue output signals</b>		
Current feedback voltage out, PWM	A modulated signal between 0 V and system voltage, that is 24 V. Working range is 0 to 2 A. A modulated signal is a digital signal translated to analogue (continuous) signal, adapted for a purpose, for example, control of solenoid valve. The resistance drops when the spool in a solenoid valve becomes warm, which gives a lower current through the valve's spool which may lead to the valve's servo pressure not changing. An internal amperemeter measures the current in the circuit and adjusts the voltage level according to this to maintain the desired current valve of the valve's spool.	Hydraulics, for example, lift/lower movement of boom. Used when output signal affects proportional solenoid valves.
Voltage out, PNP PWM	A modulated signal between 0 V and system voltage, that is 24 V. Requires a grounding point as reference.	For example, interior lighting and switch illumination.

Signal type	Explanation	Area of use
Voltage out reversed polarity, NPN PWM	A modulated signal between 0 V and system voltage, that is 24 V. Requires 24 V as reference.	For example, cab fan.
<b>Digital input signals</b>		
Digital input signal with pull-down and search lighting	Signal in, $U < 5$ V gives logical zero (0) Signal in, $U > 16$ V gives logical one (1) In case of no signal, the input is grounded.	For example, the input signal from a breaker switch with background lighting.
Digital input signal with pull-down	Signal in, $U < 5$ V gives logical zero (0) Signal in, $U > 12$ V gives logical one (1) In case of no signal, the input is grounded. Band width 300 Hz, that is, intended for slow sensors.	For example, position sensor (inductive sensors) and brake pressure (pressure monitors).
<b>Digital output signals</b>		
High-side driver, 1.5 A	Logical one (1) gives voltage out, $U \geq 22.5$ V Max. load 1.5 A Open load 0.15 A Max. current instantaneous load, 8 A	For example, running lights, solenoid valves.
High-side driver, 5 A	Logical one (1) gives voltage out, $U \geq 22.5$ V Max. load 5 A Open load 0.9 A Max. current instantaneous load, 35 A	For example, work lights and wiper motors.
High-side driver, 10 A	Logical one (1) gives voltage out, $U \geq 22.5$ V Max. load 10 A Open load 1.9 A Max. current instantaneous load, 70 A	For example, cooling fan. This output is only found on the control units on the frame and attachment.
H-bridge	Logical one (1) gives voltage out, $U \geq 22.5$ V or grounded output, $U = 0$ V. Max. load 0.5 A Open load 0.15 A Max. current instantaneous load, 8 A The H-bridge works with two outputs in pairs. In case of logical one (1), an output gives voltage at the same time as the other output is grounded. In case of logical zero (0), the outputs shift voltage level.	For example, water valve climate control unit (acts both ways).

## 11.6 Communication

### 11.6.1 CAN-bus

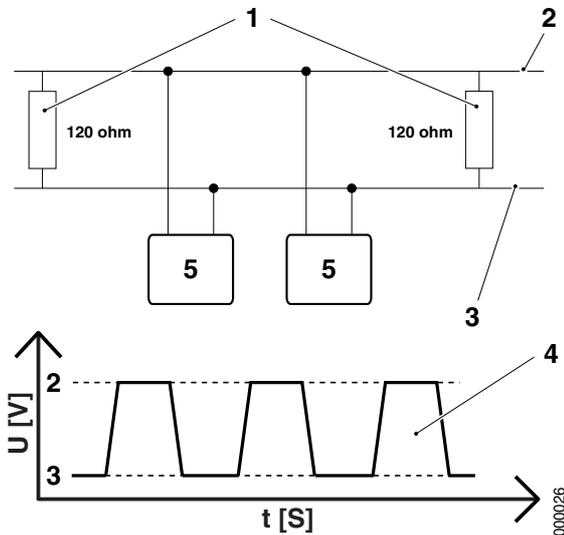
#### CAN-bus, description

Communication between the control units takes place using CAN-buses (Controller Area Network) based on the ISO 11898 standard and CAN specification 2.0B.

The CAN bus is a fast control bus with logic hardware circuits. A simple technique giving a high degree of reliability (low fault frequency), which essential for the ability of control signals to control systems according to changing conditions.

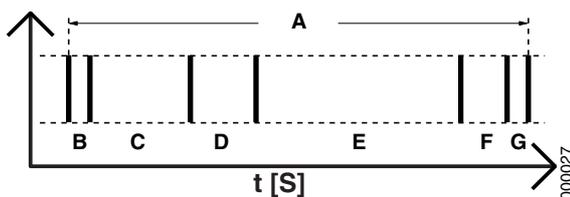
CAN specifies:

- that the signal traffic is transferred in twisted-pair conductors.
- that termination resistance (position 1) is necessary (matched to the impedance of the conductors) so that pulse trains (position 4) will have a sharp signal.
- that the signal value is indicated by the difference in potential between the conductors, CAN + and CAN - (positions 2 and 3).
- form of signal messages.



Message continues and signal runs high (voltage high) or low (voltage low).

1. Termination resistance (120 ohm)
2. CAN + (voltage high)
3. CAN - (voltage low)
4. Pulse
5. control unit



Message continues and signal runs high (voltage high) or low (voltage low).

- A. Long message
- B. Start bit
- C. Identity field / Priority
- D. Control field (length of data segment)
- E. Data segment
- F. Control amount for error detection
- G. Confirmation bit (Acknowledge)

#### Message

Messages are of two types:

- CAN Standard, has identity field of 11 bits
- CAN Extended, has identity field of 29 bits

CAN operates with messages sent in frames of 8 bytes (64 bits). A complete message is approximately 100 bits long. The illustration shows how a message is constructed.

#### Start bit (B)

Indicates that the transmission of a frame, i.e. a message, is now beginning.

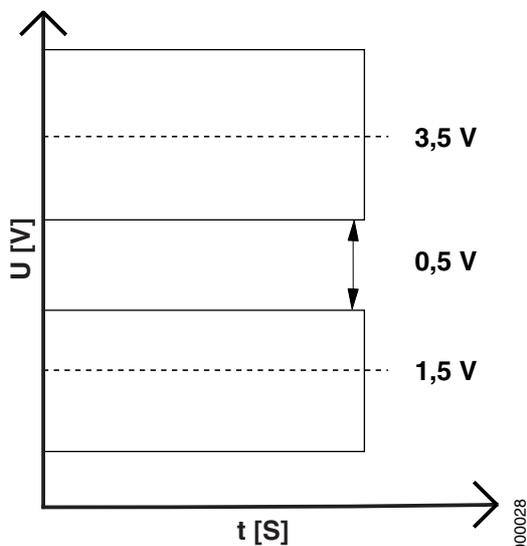
#### Identity field (C)

Describes what kind of information the message contains, e.g. measurement information on engine speed.

Does not indicate the control unit address. CAN does not concern itself with addressing but all control units receive messages and pass them on.

#### Control field (D):

Indicates the length of the next data segment.



Potential levels CAN + and CAN -

**Data segment (E)**

Contains the information that is to be forwarded to control units in the network.

**Check sum for error detection (F)**

Calculates a message check sum which enables error detection of sent messages by the receiving control unit.

**Confirmation (G)**

The sending control unit sets a bit to logic one (1) when the message is being sent. The first control unit to receive the message passes it on and sets a bit to logic zero (0).

**Communication**

The CAN network consists of control units and segments. A segment (bus) is a twisted-pair conductor that carries CAN + and CAN - signal levels from control unit to control unit.

Each control unit measures the potential difference on its two inputs and this potential difference gives a logic zero or logic one. The illustration shows an approved area according to the standard for potential levels. CAN + has a recommended value of 3.5 V and CAN - a value of 1.5 V. In the worst case an approved potential difference may be only 0.5 V but for reliable communication in practice a potential difference of 2 V is recommended.

Pulse trains can only be observed with an oscilloscope, not with a digital multimeter.

All control units in the network listen when a message is transmitted. The message is saved in a control unit and information of interest is processed. The first control unit to receive the message confirms that it has been received (sets confirmation bit). The transmitting control unit then knows that the message has been received by at least one control unit.

One control unit at a time transmits messages while other control units listen and wait until the bus is free. If two messages should be transmitted at the same time, transmission of the message with the lowest priority is terminated (highest value in identity field). This ensures that messages need not be retransmitted in the case of a communications conflict but only in the case of a bus fault (defective message).

The CAN-bus exchanges around 100 messages per second in the network.

Different bus systems can be used, e.g. random transmission or primary (master) / secondary (slave).

**HLP High Layer Protocol**

CAN specifies only the messages and how communication is to take place, i.e. a protocol. In order to handle the network the CAN protocol needs the addition of an HLP which specifies:

- flow control
- transport of data above a length of 8 bits in 8 bit messages (division)
- how control units are addressed in networks

- how bits in the message's data field shall be interpreted

## 11.6.2 Redundant CAN-bus

### Redundant CAN-bus, description

The redundant CAN bus handles communication between all control units on the machine except Control unit transmission (D793) and Control unit engine (D794). These have a separate CAN bus, see *CAN-bus drivetrain, description page 47*.

Redundant CAN bus means that the control units are linked together in a network that communicates via CAN bus (see *CAN-bus, description page 42*) and that there exist duplicate communications paths in the network. The network is divided up into control units and segments (a segment is the cabling between control units). The number of active segments depends on how many control units the machine in question has and this depends on its equipment (options).

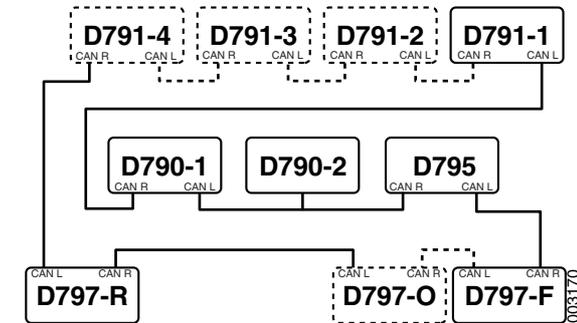
The network is based on the CAN kingdom principle, which means that a control unit is the central and controlling unit (master). In this case it is Control unit cab (D790-1). Other control units in the network are secondary (slaves) and handle special areas such as components in the cab.

The control units have two connections for the CAN bus, CAN-L (left) and CAN-R (right). The control units are connected in series to each other in a loop.

The redundant CAN bus can handle the dropout of a segment. On startup the link is analysed and if a segment is defective the message will be transmitted via another path.

Should several segments drop out, one or more control units will lose communication and operate independently, often with extremely limited functionality.

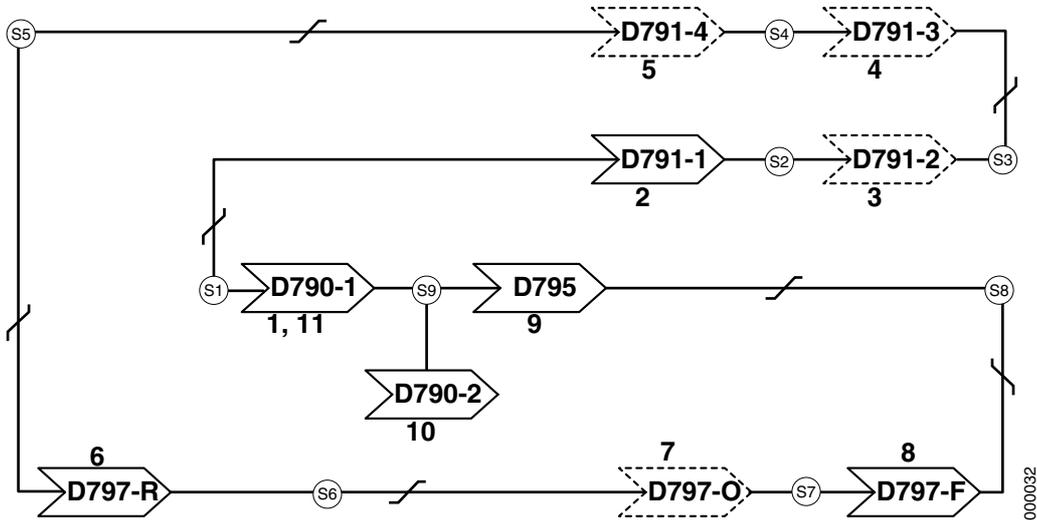
A CAN bus fault is indicated by an error code and a warning in the display. If several CAN bus segments are defective, the system only shows an error code for the first defective segment.



Schematic diagram redundant CAN bus

Connection of redundant CAN bus

Prior condition	Reference value	Reference
Battery disconnecter	In position 1	Battery disconnecter, description page 3
Redundant voltage feed	Activated.	Redundant voltage feed for control units, description of operation page 7



Pos	Explanation	Signal description	Reference
1	Control unit cab (D790-1) establishes redundant CAN bus communication by sending the enquiry on the CAN bus via CAN-R.	Controlled by control and monitoring system, error shown with error code.	Control unit cab, description page 18 Diagnostics menu, see tab 8 Control and monitoring system , group 8.4.1.1 CAN/POWER, menu 1 and 8.4.1.2 CAN/POWER, menu 2
2	Control unit attachment (D791-1) sends an answer back on the CAN bus via CAN-L and passes on the enquiry via CAN-R.  Termination resistance in the control nodes ensures communication segment by segment.	A click sound can be heard when the termination resistance is connected.	Control unit attachment, description page 22 Diagnostics menu, see tab 8 Control and monitoring system , group 8.4.1.1 CAN/POWER, menu 1 and 8.4.1.2 CAN/POWER, menu 2
3 +	Control unit attachment option (D791-2) sends an answer back on the CAN bus via CAN-L and passes on the enquiry via CAN-R.  Termination resistance in the control nodes ensures communication segment by segment.	A click sound can be heard when the termination resistance is connected.	Control unit attachment option, description page 23 Diagnostics menu, see tab 8 Control and monitoring system , group 8.4.1.1 CAN/POWER, menu 1 and 8.4.1.2 CAN/POWER, menu 2

Pos	Explanation	Signal description	Reference
4 +	Control unit attachment left legs (D791-3) sends an answer back on the CAN bus via CAN-L and passes on the enquiry via CAN-R.  Termination resistance in the control nodes ensures communication segment by segment.	A click sound can be heard when the termination resistance is connected.	<i>Control unit attachment left leg pair, description page 24</i>  Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.1 <i>CAN/POWER</i> , menu 1 and 8.4.1.2 <i>CAN/POWER</i> , menu 2
5 +	Control unit attachment right leg pair (D791-4) sends an answer back on the CAN bus via CAN-L and passes on the enquiry via CAN-R.  Termination resistance in the control nodes ensures communication segment by segment.	A click sound can be heard when the termination resistance is connected.	<i>Control unit attachment right leg pair, description page 25</i>  Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.1 <i>CAN/POWER</i> , menu 1 and 8.4.1.2 <i>CAN/POWER</i> , menu 2
6	Control unit frame rear (D797-R) sends an answer back on the CAN bus via CAN-L and passes on the enquiry via CAN-R.  Termination resistance in the control nodes ensures communication segment by segment.	A click sound can be heard when the termination resistance is connected.	<i>Control unit frame rear, description page 20</i>  Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.1 <i>CAN/POWER</i> , menu 1 and 8.4.1.2 <i>CAN/POWER</i> , menu 2
7 +	Control unit frame option (D797-O) sends an answer back on the CAN bus via CAN-L and passes on the enquiry via CAN-R.  Termination resistance in the control nodes ensures communication segment by segment.	A click sound can be heard when the termination resistance is connected.	<i>Control unit frame option, description page 21</i>  Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.1 <i>CAN/POWER</i> , menu 1 and 8.4.1.2 <i>CAN/POWER</i> , menu 2
8	Control unit frame front (D797-F) sends an answer back on the CAN bus via CAN-L and passes on the enquiry via CAN-R.  Termination resistance in the control nodes ensures communication segment by segment.	A click sound can be heard when the termination resistance is connected.	<i>Control unit frame front, description page 19</i>  Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.1 <i>CAN/POWER</i> , menu 1 and 8.4.1.2 <i>CAN/POWER</i> , menu 2
9	Control unit KID (D795) sends an answer back on the CAN bus via CAN-L and passes on the enquiry via CAN-R.  Termination resistance in the control nodes ensures communication segment by segment.	A click sound can be heard when the termination resistance is connected.	<i>Control unit KID, description page 30</i>  Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.1 <i>CAN/POWER</i> , menu 1 and 8.4.1.2 <i>CAN/POWER</i> , menu 2
10	Control unit KIT (D790-2) is not connected to the Redundant CAN bus. Control unit KIT (D790-2) Does not communicate until ignition voltage (15) is activated.	A click sound can be heard when the termination resistance is connected.	<i>Control unit KIT, description page 29</i>

Pos	Explanation	Signal description	Reference
11	<p>If all control units have answered, Control unit cab (D790-1) disconnects the segment to Control unit attachment (D791-1).</p> <p>If any control unit has not answered, Control unit cab (D790-1) uses both CAN-L and CAN-R to maintain communication. In addition, analysis is performed to ascertain which segment is defective.</p>	Controlled by control and monitoring system, error shown with error code.	Diagnostics menu, see tab 8 <i>Control and monitoring system</i> , group 8.4.1.1 <i>CAN/POWER, menu 1</i> and 8.4.1.2 <i>CAN/POWER, menu 2</i>

### 11.6.3 CAN-bus driveline

#### CAN-bus drivetrain, description

The drivetrain CAN-bus is based on the SAE J1939 standard where selected messages are used to control engine and transmission.

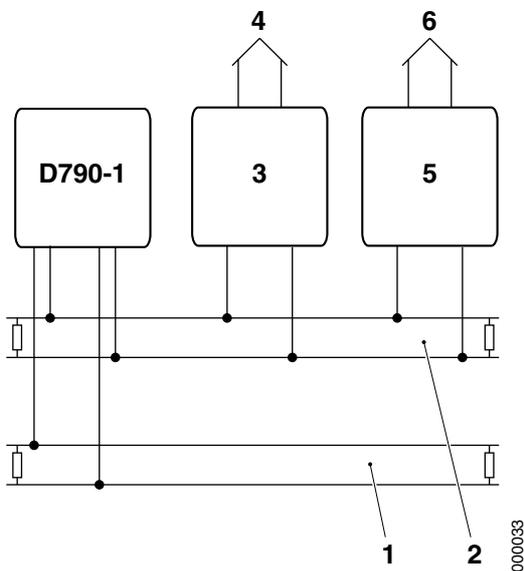
SAE J1939 is a standard from SAE (Society of Automotive Engineers) for data communication in vehicles. The standard sets forth rules governing hardware interfaces, bit times and the composition of messages.

The control units for engine and gearbox come from the respective engine and gearbox suppliers.

The machine uses only one gearbox model while several different engines are fitted. All engine alternatives use the standard and messages concerning each engine are therefore all based on the same structure.

Communication with Control unit engine (D794) and Control unit transmission (D793) is separated from the redundant CAN bus.

The signals can be checked with the diagnostics menu, see tab 8 *Control system*, group 8.4.1.3 *CAN/POWER, menu 3*.



- 1. Redundant CAN-bus
- 2. CAN bus drivetrain
- 3. Control unit engine (EDC)
- 4. Engine
- 5. Control unit, gearbox (TCU)
- 6. Gearbox

000033

## 11.6.4 Communication between PC and machine

### Communication between PC and machine, description

The machine has three or four sockets for communication between control units and PC. Two are located in electrical distribution cab and one or two in electrical distribution cab frame. It is the socket for communication with engine alternative Volvo that varies.

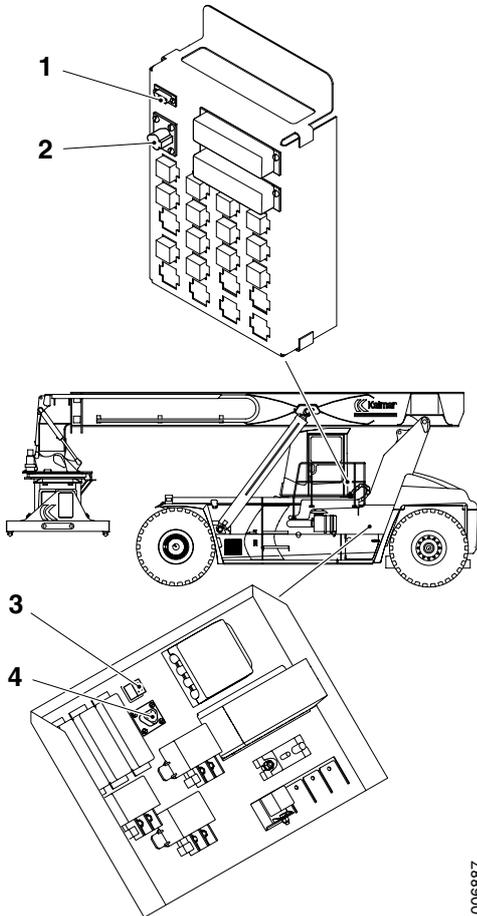
Sockets for programming control units in electrical distribution box cab (position 1) are used for programming the control units in the cab, on the frame, and on the attachment.

Socket for CAN-bus drivetrain in the electrical distribution box cab (position 2) is used for communicating with the engine alternative and transmission via CAN-bus.

VODIA-socket in electrical distribution box frame (position 3) (only engine alternative Volvo) is used to connect Volvo's diagnostic tool VODIA.

The socket for programming Control unit transmission (D793) in electrical distribution box frame (position 4) is used to program Control unit transmission (D793).

For further details on communication between computer and machine, contact Kalmar Industries AB.



006887

1. Diagnostic socket machine
2. Diagnostic socket engine, CAN-bus drivetrain (engine alternative Cummins QSM11)
3. Diagnostic socket engine, VODIA (engine alternative Volvo)
4. Diagnostic socket transmission

## 11.6.5 RMI (Remote Machine Interface)

### RMI (Remote Machine Interface), description



Remote Machine Interface is a tool for listening to the machine at a distance. The interface consists of a control unit which is connected to the machine, antenna for communication, and GPS-antenna () for positioning.

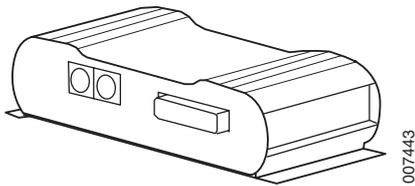
The interface records the communication on the CAN-bus and sends the information to a central RMI-server. The control unit in the machine can send the information via GSM, GPRS, WLAN, Radio-modem, SMS, or e-mail in case of a malfunction.

From the RMI-server, the data from the machine can be analyzed and processed to read out different values. For example, when it is time for service or if there are error codes stored in the machine.

 As an option, there is a GPS-antenna, making it possible to read off the machine's position.

### NOTE

*RMI only sends data from the machine, no data can be sent to the machine. RMI cannot be used to control the machine.*



007443

RMI-interface



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## Table of Contents D Error codes

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# Error codes

## Error codes, explanation

The error codes are explained in table form for Engine, Transmission as well as Control and monitoring system. They are sorted according to error code number.

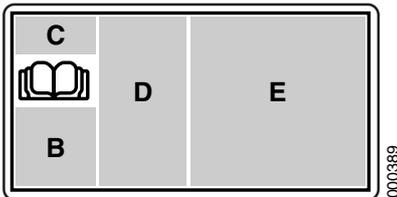
The error code table has the following information:

- Code, error code's number, shown in field C on display.
- Description, explanation of the error code and when it's generated.
- Limitation, in case of certain error codes certain functions are impaired or limited to protect the machine and operator.
- Action, information of what should be checked to find the cause of the error code.
- Diagnostic menu, reference to suitable diagnostic menu to fix the problem, read signal value or check the function.

In the description of the diagnostic menus there are, in addition to the explanation of the display figure, reference to circuit diagrams that are found in section *E Diagrams* and reference to function group for further information about functions and components.

- Function group, is a reference to which function group that the error code is connected, this field shall be sued to search for more information when needed. With the function group, different types of information can be found.

In sections 0-12 there is a description of the function and its components, component position and work instructions for different work.

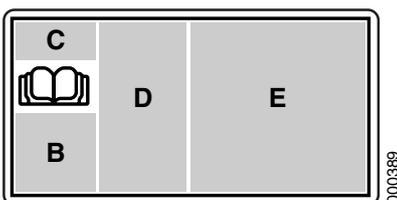


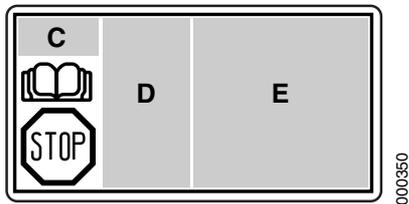
- B. Error code level (symbol)
- C. Error code number
- D. Cause of error (symbol)
- E. Function (symbol)

## Error code menu, description

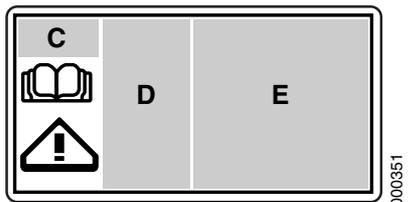
The control and monitoring system's display is divided into four fields where information is shown (see figure to the left).

- Field B: Error code level shown with a symbol.
- Field C: Indicates error code.
- Field D: Indicates type of error.
- Field E: Indicates which function is affected by error code.
- The book symbol means that there's information in the operator's manual.

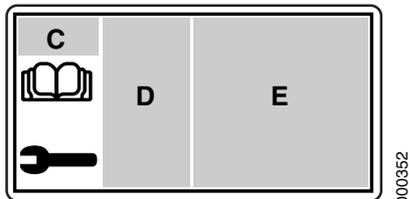




000350



000351



000352

### Field B: Error code level

The control and monitoring system gives error code information in three levels which are indicated with a symbol in the lower left corner (B) on the display unit.

- Stop

Indicates a serious malfunction that may affect operator safety or cause machine breakdown. The error code must be dealt with immediately. Stop working with the machine and contact service immediately.

The error code is shown automatically on the display.

- Warning

Indicates machine malfunction that should be taken care of as soon as possible. After finished work shift with the machine, contact service as soon as possible.

The error code is shown automatically on the display.

- Information

Information for the operator that something should be taken care of, for example, a defective bulb. Rectify the cause of the error code as soon as possible. See section 6 *Inspection and maintenance*.

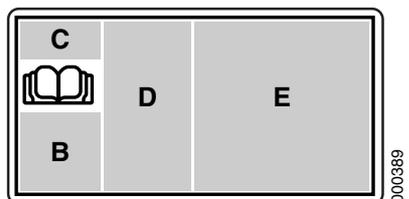
The error code is stored in the error code list under operating menu for service.

### Field C: Error code number

The control and monitoring system gives error codes from three sub-systems:

- Machine:

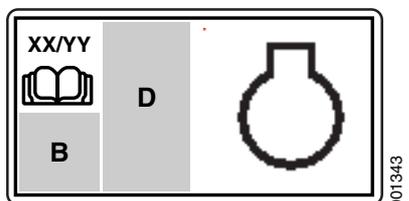
Shown with error code number XXX on display.



000389

- Engine:

Shown with error code number XXX/YY on display.



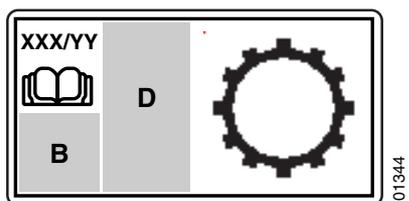
001343

### NOTE

*If several error codes come from the engine, the error code level is shown for the most serious error code.*

- Transmission:

Shown with error code number XX/YY on display.



001344

**Field D: Type of error**

1 .



2 .



3 .



4 .



5 .



6 .

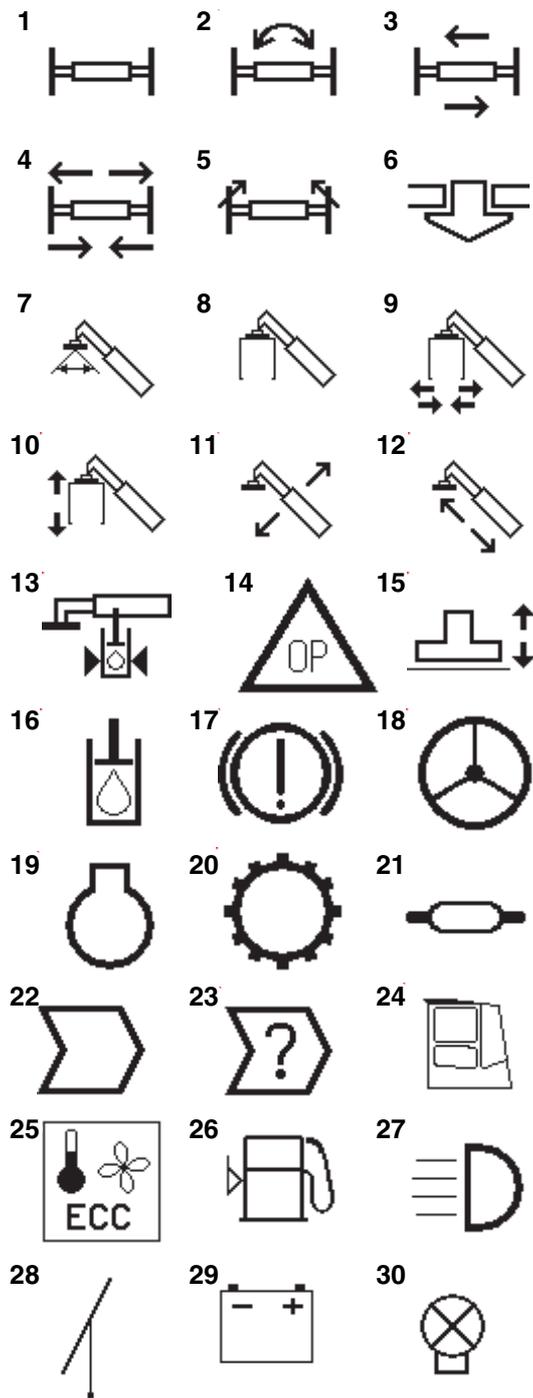


7 .



1. Temperature too high/too low.
2. Incorrect signal to solenoid valve.
3. Incorrect hydraulic pressure.
4. Incorrect sensor signal.
5. Incorrect signal from control.
6. Incorrect signal to bulb.
7. Incorrect signal, for example, open circuit.

000396

**Field E: Affected function**

1. Attachment
2. Rotation of attachment
3. Sideshift attachment
4. Length adjustment attachment
5. Leveling attachment
6. Twistlocks
7. Tilt attachment
8. Bottom lift attachment
9. Bottom lift attachment, clamping position
10. Bottom lift attachment, legs up/down
11. Boom up/down
12. Boom in/out
13. Pressure sensor lift cylinder (overload protection, OP)
14. No overload protection.
15. Support jacks up/down
16. Hydraulic functions
17. Brake system
18. Steering
19. Engine
20. Transmission
21. Central lubrication
22. Control unit
23. Hardware-related error
24. Cab
25. Climate control unit
26. Fuel system
27. Headlights
28. Windshield wipers
29. Battery voltage
30. Bulb for lighting

000397

## Reading out error code

### NOTE

In case of an error code, perform the recommended actions according to the error code table to find the problem.

Error codes are stored as active and inactive. Active errors are shown in the error code menu.

Always use error code menus for reading out error codes, otherwise there's a risk of missing error codes.

- 1 Turn the start key to position I.

### WARNING

**Risk of machine damage.**

**In case of error codes of level “WARNING” and “STOP”, serious machine damage may result if the engine is started.**

**Do not start the engine until the cause of the error code has been identified or repaired.**

- 2 Navigate to the service menu and press Enter.

- 3 Safety menu is shown. Hold Enter pressed in for at least two seconds.

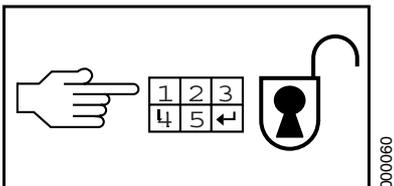
- 4 The error code list is shown on the display. Active error code is shown on display where field C shows error code number together with X(Y). X shows sequence number for shown error code and (Y) shows number of active error codes.

Scroll between error codes with key 1 and 2 (arrow function).

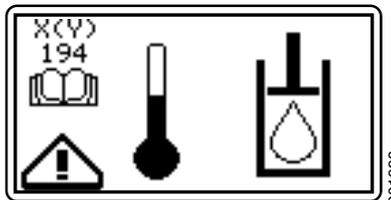
Error codes disappear from list when the cause has been repaired.



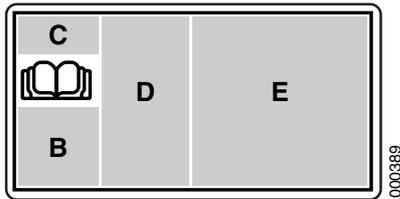
000056



000060



001998



- 5 Note error code number (field C) to not forget.
  - Error code level is shown with a symbol in field B
  - Error code is shown in field C
  - Error cause is shown with a symbol in field D
  - Function affected by the error, shown with a symbol in field E

The book symbol is an instruction for the operator to read the operator's manual.
- 6 Use the error code tables to find more information about the error code.
- 7 After action, check that no active error codes remain for the function in question.

# 1 Engine

## Error codes engine, general

When contacting engine suppliers, use Volvo/Cummins codes.

- Display indicates error code according to SAE J1939  
SPN / FMI
- Flash indicates error code according to a flash code specified by the engine supplier.
- J1587 indicates error code according to SAE J1587 (for Volvo: Vodia).  
PID, PPID, SID, PSID / FMI

Table 1. Specification FMI

FMI	Description	SAE-text
0	Too high value.	Valid data, but higher than normal operating range.
1	Too low value.	Valid data, but lower than normal operating range.
2	Incorrect data.	Intermittent or incorrect data.
3	Electric problem.	Abnormally high voltage or short-circuiting to higher voltage.
4	Electric problem.	Abnormally low voltage or short-circuiting to lower voltage.
5	Electric problem.	Abnormally low current or open circuit.
6	Electric problem.	Abnormally high current or short-circuiting to frame ground.
7	Mechanical problem.	Incorrect response from mechanical system.
8	Mechanical problem or electric problem.	Abnormal frequency.
9	Communication error.	Abnormal update rate.
10	Mechanical problem or electric problem.	Abnormally large variations.
11	Unknown error.	Non-identifiable error.
12	Component problem.	Defective unit or component.
13	Incorrect calibration.	Values outside calibration values.
14	Unknown error.	Special instructions.
15	Unknown error.	Reserved for future use.

## Error codes engine (engine alternative Volvo)

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
94/FMI	3.6	PID94/FMI	Sensor fuel pressure short-circuited to voltage, ground, or open circuit.	No limitation.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/2:3 Volvo TAD1250VE: D794/B:16	-
94/FMI	3.8	PID94/FMI	Low fuel pressure (feed).	No limitation.	Change fuel filter. Change fuel pre-filter. Check if pressure can be built up with the hand pump.	-	-
97/1	2.1	PID97/1	Water in fuel.	No limitation.	Drain water separator. Clean metal filter in the fuel feed's hose connection on the engine. Check fuel filter and fuel pre-filter.	-	-
97/3	2.9	PID97/3	Sensor water in fuel short-circuiting to ground or open circuit.	No limitation.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/2:4 Volvo TAD1250VE: D794/B:8	-
98/FMI	5.7	PID98/FMI	Low oil level.	No limitation.	Check oil level.	-	Engine, menu 6
98/FMI	5.9	PID98/FMI	Sensor oil level short-circuiting to voltage, ground, or open circuit.	No limitation.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TAD1250VE: D794/B:3, B:4, A:31	ENGINE, menu 6

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
100/1	6.6	PID100/1	Low engine oil pressure.	Engine is shut off.	Check oil level. Change oil filter. Check the system pressure valves and the safety valve in the lubrication system. Check the sensor.	-	ENGINE, menu 6
100/3	3.1	PID100/3	Sensor oil pressure cable short-circuited to voltage.	No limitation.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:14 Volvo TAD1250VE: D794/B:11	ENGINE, menu 6
100/4	3.1	PID100/4	Sensor oil pressure, open circuit, or short-circuiting to ground.	No limitation.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:14 Volvo TAD1250VE: D794/B:11	ENGINE, menu 6
102/0	3.5	PID102/0	Boost pressure too high.	No limitation.	Check the turbo-charger. Check the sensor. Check fuel quality and injectors.	-	ENGINE, menu 6
102/1	3.5	PID102/1	Boost pressure too low.	Reduced engine power.	Check the air filter. Check the turbo-charger. Check the sensor. Check the fuel feed pressure.	-	ENGINE, menu 6
102/3	3.4	PID102/3	Sensor boost pressure, cable short-circuited to voltage.	Engine smokes more than normal during acceleration or when loaded.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:3 Volvo TAD1250VE: D794/A:22	ENGINE, menu 7

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
102/4	3.4	PID102 /4	Sensor boost pressure, cable short-circuited to ground or open circuit.	Engine smokes more than normal during acceleration or when loaded.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:3 Volvo TAD1250VE: D794/A:22	ENGINE, menu 7
105/0	6.2	PID105 /0	High charge-air temperature.	Engine is shut off.	Check coolant level. Check that the charge-air cooler is clean. Check thermostat. Check the sensor.	-	ENGINE, menu 7
105/3	3.2	PID105 /3	Sensor charge-air temperature, cable short-circuited to voltage or open circuit.	No limitation.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:2 Volvo TAD1250VE: D794/A:47	ENGINE, menu 7
105/4	3.3	PID105 /4	Sensor charge-air temperature, cable short-circuited to ground or open circuit.	No limitation.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:2 Volvo TAD1250VE: D794/A:47	ENGINE, menu 7
106/FMI	3.4	PID106 /FMI	Sensor boost pressure, short-circuiting to voltage, frame ground, or open circuit.	Engine smokes more than normal during acceleration or when loaded.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:3 Volvo TAD1250VE: D794/A:22	ENGINE, menu 6
106/FMI	3.5	PID106 /FMI	Boost pressure too high.	No limitation.	Check cable harness between the control unit and the component. Check the sensor.	-	ENGINE, menu 6

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
110/0	6.1	PID110/0	High coolant temperature.	Volvo TWD1240VE: Engine is shut off. Volvo TAD1250VE: No limitation.	Check coolant level. Check that radiator is clean. Check thermostat. Check the cap on the expansion tank. Check if there's air in coolant system. Check the sensor.	-	ENGINE, menu 7
110/3	3.3	PID110/3	Sensor coolant temperature, cable short-circuited to voltage or open circuit.	Preheating is activated even if engine is warm.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:25 Volvo TAD1250VE: D794/B:27	ENGINE, menu 7
110/4	3.3	PID110/4	Sensor coolant temperature, cable short-circuited to ground.	Preheating is activated even if engine is warm.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:25 Volvo TAD1250VE: D794/B:27	ENGINE, menu 7
111/1	2.2	PID111/1	Low coolant level.	Volvo TAD1250VE: Engine is shut off. Volvo TAD1250VE: No limitation.	Check the coolant level, top up if needed. Check the sensor.	-	-
111/FMI	2.3	PID111/FMI	Sensor coolant level, short-circuited to voltage.	Volvo TWD1240VE: Engine is shut off. Volvo TAD1250VE: No limitation.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/2:7 Volvo TAD1250VE: D794/B:23	-
153/FMI	7.7	PID153/FMI	Crankcase ventilation pressure too high.	No limitation.	Clean crankcase ventilation. Check wear of cylinder liner, piston, and piston rings.	-	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
153/ FMI	7.7	PID153 /FMI	Sensor crankcase ventilation pressure, short-circuiting to voltage, frame ground, or open circuit.	No limitation.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TAD1250VE: D794/B:28	-
158/ FMI	3.9	PID158 /FMI	Low battery voltage.	Engine may be difficult to start.	Check and charge the batteries. Check the alternator. Check the battery cables.	-	-
172/ FMI	7.9	PID172 /FMI	Sensor air temperature inlet, short-circuited to voltage, ground, or open circuit.	No limitation.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:2  Volvo TAD1250VE: D794/A:47	ENGINE, menu 7
175/0	5.8	PID175 /0	High engine oil temperature.	Reduced engine power.	Check oil level. Check the lubrication system's thermostat. Check the sensor.	-	ENGINE, menu 7
175/3	3.7	PID175 /3	Sensor oil temperature, cable short-circuited to voltage or open circuit.	No limitation.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:1  Volvo TAD1250VE: D794/A:31, B:3, B:4	ENGINE, menu 7
175/4	3.7	PID175 /4	Sensor oil temperature, cable short-circuited to ground.	No limitation.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:1  Volvo TAD1250VE: D794/A:31, B:3, B:4	ENGINE, menu 7
190/ FMI	2.6	PID190 /FMI	Engine rpm too high.	No limitation.	Ease off throttle or select higher gear.	-	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
608/ FMI	-	PPID9 8/FMI	Signal error for start and stop.	No limitation.	Check CAN-bus drivetrain.	-	CAN/ POWER, menu 3
620/3 1079/2	9.3	SID232 /3	Voltage feed to sensors, cable short-circuited to voltage.	Several error codes for defective sensor. Reduced engine power. Incorrect instrument values.	Check cable harness between the control unit and the component.	Volvo TWD1240VE: D794/1:5  Volvo TAD1250VE: D794/B:17	-
620/4 1079/3	9.3	SID232 /4	Voltage feed to sensors, cable short-circuited to ground.	Several error codes for defective sensor. Reduced engine power. Incorrect instrument values.	Check cable harness between the control unit and the component.	Volvo TWD1240VE: D794/1:4  Volvo TAD1250VE: D794/B:17	-
626/3	5.4	PID45/ 3	Preheating relay, cable short-circuited to voltage.	Preheating cannot be activated.	Check cable harness between the control unit and the component. Check the relay.	Volvo TWD1240VE: D794/2:36  Volvo TAD1250VE: D794/B:25	ENGINE, menu 5
626/4	5.4	PID45/ 4	Preheating relay, cable short-circuited to ground.	Preheating is always activated.	Check cable harness between the control unit and the component. Check the relay.	Volvo TWD1240VE: D794/2:36  Volvo TAD1250VE: D794/B:25	ENGINE, menu 5
626/5	5.4	PID45/ 5	Preheating relay open circuit on cable or defective component.	Preheating cannot be activated.	Check cable harness between the control unit and the component. Check the relay.	Volvo TWD1240VE: D794/2:36  Volvo TAD1250VE: D794/B:25	ENGINE, menu 5
629/ FMI	9.9	SID254 /FMI	Control unit engine (D794) internal error.	Engine doesn't start. Engine runs rough.	Change the control unit.	-	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
630/ FMI	9.9	SID253 /FMI	Control unit engine (D794) memory error.	Engine doesn't start.	Re-program the control unit.	-	-
636/3	2.5	SID21/ 3	Sensor rpm camshaft, no signal.	Engine takes longer time to start than normal. Engine runs normally when it has started.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:7, 1:18 Volvo TAD1250VE: D794/B:45, B:46	-
636/8	2.5	SID21/ 8	Sensor engine rpm, camshaft, abnormal frequency.	Engine takes longer time to start than normal. Engine runs normally when it has started.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:7, 1:18 Volvo TAD1250VE: D794/B:45, B:46	-
637/2	2.4	SID22/ 2	Sensor engine rpm, flywheel, irregular signal.	Engine is extremely difficult to start and runs rough, if it starts.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:30, 1:31 Volvo TAD1250VE: D794/B:37, B:38	ENGINE, menu 2
637/3	2.4	SID22/ 3	Sensor engine rpm, flywheel, abnormal frequency.	Engine is extremely difficult to start and runs rough, if it starts.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TWD1240VE: D794/1:30, 1:31 Volvo TAD1250VE: D794/B:37, B:38	ENGINE, menu 2

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
637/8	2.4	SID22/8	Sensor engine rpm, flywheel, abnormal frequency.	Engine is extremely difficult to start and runs rough, if it starts.	Check cable harness between the control unit and the component.  Check that the sensor is correctly connected.	Volvo TWD1240VE: D794/1:30, 1:31  Volvo TAD1250VE: D794/B:37, B:38	ENGINE, menu 2
639/FMI 2017/FMI	6.5	SID231/FMI PSID201/FMI	Communication error with Engine control unit (D794), configuration error.	Engine off: engine cannot be started.  Engine on: engine goes to idle and can only be stopped by using the emergency stop.	Use diagnostic menu to find incorrect segment.  Check cable harness between the control unit and the component.  Check the control unit.	Volvo TWD1240VE: D794/2:1, 2:2  Volvo TAD1250VE: D794/B:51, B:55	CAN/POWER, menu 3
639/FMI	6.4	SID231/FMI	Communication error with Engine control unit (D794), configuration error.	Instruments and controls do not work.	Use diagnostic menu to find incorrect segment.  Check cable harness between the control unit and the component.  Check the control unit.	-	CAN/POWER, menu 3
639/FMI	9.9	SID240/FMI	Memory error engine control unit.	It may not be possible to start the engine.	Re-program the control unit.	-	-
651/2	7.1	SID1/2	Electric failure, injector cylinder 1.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component.  Check the injector.	Volvo TWD1240VE: D794/1:11, 1:12  Volvo TAD1250VE: D794/A:20, A:24	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
651/3	7.1	SID1/3	Electric failure, injector cylinder 1.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:11, 1:12 Volvo TAD1250VE: D794/A:20, A:24	-
651/4	7.1	SID1/4	Electric failure, injector cylinder 1.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:11, 1:12 Volvo TAD1250VE: D794/A:20, A:24	-
651/5	7.1	SID1/5	Electric failure, injector cylinder 1.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:11, 1:12 Volvo TAD1250VE: D794/A:20, A:24	-
651/7	7.1	SID1/7	Incorrect compression or defective injector cylinder 1.	Runs rough at low rpms and low load.	Check fuel pressure. Check valve clearance. Check cable harness between the control unit and the component. Check the injector. Perform compression test and check cylinder 1.	Volvo TWD1240VE: D794/1:11, 1:12 Volvo TAD1250VE: D794/A:20, A:24	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
651/11	7.1	SID1/11	Electric failure, injector cylinder 1.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:11, 1:12 Volvo TAD1250VE: D794/A:20, A:24	-
652/2	7.2	SID2/2	Electric failure, injector cylinder 1.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:22, 1:12 Volvo TAD1250VE: D794/A:20, A:24	-
652/3	7.2	SID2/3	Electric failure, injector cylinder 1.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:22, 1:12 Volvo TAD1250VE: D794/A:12, A:16	-
652/4	7.2	SID2/4	Electric failure, injector cylinder 1.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:22, 1:12 Volvo TAD1250VE: D794/A:12, A:16	-
652/5	7.2	SID2/5	Electric failure, injector cylinder 1.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:22, 1:12 Volvo TAD1250VE: D794/A:12, A:16	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
652/7	7.2	SID2/7	Incorrect compression or defective injector cylinder 2.	Runs rough at low rpms and low load.	<p>Check fuel pressure.</p> <p>Check valve clearance.</p> <p>Check cable harness between the control unit and the component.</p> <p>Check the injector.</p> <p>Perform compression test and check cylinder 2.</p>	<p>Volvo TWD1240VE: D794/1:22, 1:12</p> <p>Volvo TAD1250VE: D794/A:12, A:16</p>	-
652/11	123 DTC 7.2	SID2/11	Electric failure, injector cylinder 2.	Engine runs on 5 cylinders, sounds rough and has reduced power.	<p>Check cable harness between the control unit and the component.</p> <p>Check the injector.</p>	<p>Volvo TWD1240VE: D794/1:22, 1:12</p> <p>Volvo TAD1250VE: D794/A:12, A:16</p>	-
653/2	7.3	SID3/2	Electric failure, injector cylinder 3.	Engine runs on 5 cylinders, sounds rough and has reduced power.	<p>Check cable harness between the control unit and the component.</p> <p>Check the injector.</p>	<p>Volvo TWD1240VE: D794/1:23, 1:12</p> <p>Volvo TAD1250VE: D794/A:28, A:32</p>	-
653/3	7.3	SID3/3	Electric failure, injector cylinder 3.	Engine runs on 5 cylinders, sounds rough and has reduced power.	<p>Check cable harness between the control unit and the component.</p> <p>Check the injector.</p>	<p>Volvo TWD1240VE: D794/1:23, 1:12</p> <p>Volvo TAD1250VE: D794/A:28, A:32</p>	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
653/4	7.3	SID3/4	Electric failure, injector cylinder 3.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:23, 1:12 Volvo TAD1250VE: D794/A:28, A:32	-
653/5	7.3	SID3/5	Electric failure, injector cylinder 3.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:23, 1:12 Volvo TAD1250VE: D794/A:28, A:32	-
653/7	7.3	SID3/7	Incorrect compression or defective injector cylinder 3.	Runs rough at low rpms and low load.	Check fuel pressure. Check valve clearance. Check cable harness between the control unit and the component. Check the injector. Perform compression test and check cylinder 3.	Volvo TWD1240VE: D794/1:23, 1:12 Volvo TAD1250VE: D794/A:28, A:32	-
653/11	7.3	SID3/11	Electric failure, injector cylinder 3.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:23, 1:12 Volvo TAD1250VE: D794/A:28, A:32	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
654/2	140 DTC 7.4	SID4/2	Electric failure, injector cylinder 4.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:34, 1:24 Volvo TAD1250VE: D794/A:52, A:56	-
654/3	7.4	SID4/3	Electric failure, injector cylinder 4.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:34, 1:24 Volvo TAD1250VE: D794/A:52, A:56	-
654/4	7.4	SID4/4	Electric failure, injector cylinder 4.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:34, 1:24 Volvo TAD1250VE: D794/A:52, A:56	-
654/5	7.4	SID4/5	Electric failure, injector cylinder 4.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:34, 1:24 Volvo TAD1250VE: D794/A:52, A:56	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
654/7	7.4	SID4/7	Incorrect compression or defective injector cylinder 4.	Runs rough at low rpms and low load.	<p>Check fuel pressure.</p> <p>Check valve clearance.</p> <p>Check cable harness between the control unit and the component.</p> <p>Check the injector.</p> <p>Perform compression test and check cylinder 4.</p>	<p>Volvo TWD1240VE: D794/1:34, 1:24</p> <p>Volvo TAD1250VE: D794/A:52, A:56</p>	-
654/11	7.4	SID4/11	Electric failure, injector cylinder 4.	Engine runs on 5 cylinders, sounds rough and has reduced power.	<p>Check cable harness between the control unit and the component.</p> <p>Check the injector.</p>	<p>Volvo TWD1240VE: D794/1:34, 1:24</p> <p>Volvo TAD1250VE: D794/A:52, A:56</p>	-
655/2	7.5	SID5/2	Electric failure, injector cylinder 5.	Engine runs on 5 cylinders, sounds rough and has reduced power.	<p>Check cable harness between the control unit and the component.</p> <p>Check the injector.</p>	<p>Volvo TWD1240VE: D794/1:35, 1:24</p> <p>Volvo TAD1250VE: D794/A:44, A:48</p>	-
655/3	7.5	SID5/3	Electric failure, injector cylinder 5.	Engine runs on 5 cylinders, sounds rough and has reduced power.	<p>Check cable harness between the control unit and the component.</p> <p>Check the injector.</p>	<p>Volvo TWD1240VE: D794/1:35, 1:24</p> <p>Volvo TAD1250VE: D794/A:44, A:48</p>	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
655/4	7.5	SID5/4	Electric failure, injector cylinder 5.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:35, 1:24 Volvo TAD1250VE: D794/A:44, A:48	-
655/5	7.5	SID5/5	Electric failure, injector cylinder 5.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:35, 1:24 Volvo TAD1250VE: D794/A:44, A:48	-
655/7	7.5	SID5/7	Incorrect compression or defective injector cylinder 5.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check that cabling to the injectors is not damaged. Check cable harness between the control unit and the component. Check the injector. Perform compression test and check cylinder 5.	Volvo TWD1240VE: D794/1:35, 1:24 Volvo TAD1250VE: D794/A:44, A:48	-
655/11	7.5	SID5/11	Electric failure, injector cylinder 5.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:35, 1:24 Volvo TAD1250VE: D794/A:44, A:48	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
656/2	7.6	SID6/2	Electric failure, injector cylinder 6.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component.  Check the component.	Volvo TWD1240VE: D794/1:36, 1:24  Volvo TAD1250VE: D794/A:36, A:40	-
656/3	7.6	SID6/3	Electric failure, injector cylinder 6.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component.  Check the injector.	Volvo TWD1240VE: D794/1:36, 1:24  Volvo TAD1250VE: D794/A:36, A:40	-
656/4	7.6	SID6/4	Electric failure, injector cylinder 6.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component.  Check the injector.	Volvo TWD1240VE: D794/1:36, 1:24  Volvo TAD1250VE: D794/A:36, A:40	-
656/5	7.6	SID6/5	Electric failure, injector cylinder 6.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component.  Check the injector.	Volvo TWD1240VE: D794/1:36, 1:24  Volvo TAD1250VE: D794/A:36, A:40	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
656/7	7.6	SID6/7	Incorrect compression or defective injector cylinder 6.	Runs rough at low rpms and low load.	Check fuel pressure. Check valve clearance. Check cable harness between the control unit and the component. Check the injector. Perform compression test and check cylinder 6.	Volvo TWD1240VE: D794/1:36, 1:24 Volvo TAD1250VE: D794/A:36, A:40	-
656/11	7.6	SID6/11	Electric failure, injector cylinder 6.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	Volvo TWD1240VE: D794/1:36, 1:24 Volvo TAD1250VED 794/A:36, A:40	-
677/ FMI	6.3	PPID3/ FMI SID39/ FMI	Starter motor relay, short-circuiting to voltage ground.	Engine doesn't start. Engine starts immediately when ignition is turned on.	Check cable harness between the control unit and the component. Check the motor.	Volvo TWD1240VE: D794/2:31 Volvo TAD1250VED 794/B:29	ENGINE, menu 5
1485/3	5.1	PPID5/ 3	Main relay, cable short-circuited to voltage.	Instrument panel loses voltage when ignition key is turned to start position. Engine doesn't start.	Check cable harness between the control unit and the component. Check the relay.	Volvo TWD1240VE: D794/1:32 Volvo TAD1250VE: D794/A:8	-
2791/ FMI	-	PPID1 9/FMI	Internal EGR, electric problem or mechanical problem.	No limitation.	Check sensor boost pressure. Check the component. (IEGR) Contact Volvo Penta workshop for more information.	Volvo TAD1250VE: D794/B:30	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
52019 2/FMI	6.8	PPID8/ FMI	Sensor piston cooling pressure short-circuiting to voltage, ground, or open circuit.	No limitation.	Check cable harness between the control unit and the component. Check the sensor.	Volvo TAD1250VE: D794/B:14	-
52019 2/FMI	6.7	PPID8/ FMI	Low piston cooling pressure.	No limitation.	Check that engine's oil pressure is higher than 175 kPa.	-	-
52019 5/FMI	4.8	PPID4/ FMI	Stop input on control unit short-circuits to ground or open circuit.	Engine cannot be shut off.	Check cable harness between the control unit and the component.	Volvo TWD1240VE: D794/2:6  Volvo TAD1250VE: D794/B:27	-

## Error codes engine (engine alternative Cummins QSM11)

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
84/2	241	PID08 4/2	Electric problem sensor speed, data invalid.	Engine rpm restricted to max. rpm without gear.	Check cable harness between the control unit and the component. Check the sensor.	-	-
84/10	242	PID08 4/10	Electric problem sensor speed, manipulation of signal detected.	Engine rpm restricted to max. rpm without gear.	Check cable harness between the control unit and the component. Check the sensor.	-	-
91/3	131	PID09 1/3	Electric problem throttle pedal, cable short-circuited to voltage.	Engine does not respond to throttle.	Check cable harness between the control unit and the component. Check the component.	-	-
91/4	132	PID09 1/4	Electric problem throttle pedal, cable short-circuited to ground.	Engine does not respond to throttle.	Check cable harness between the control unit and the component. Check the component.	-	-
91/8	147	PID09 1/8	Electric problem throttle pedal, frequency too low.	Engine does not respond to throttle.	Check cable harness between the control unit and the component. Check the component.	-	-
91/8	148	PID09 1/8	Electric problem throttle pedal, frequency too high.	Engine does not respond to throttle.	Check cable harness between the control unit and the component. Check the component.	-	-
91/19	287	SID09 1/2	Communication error with Cab control unit (D790-1), electric problem throttle pedal.	Engine only runs on idle.	Use diagnostic menu to localise incorrect segment.	-	CAN/POWER, menu 3
97/3	428	PID09 7/3	Electric problem sensor water in fuel, cable short-circuited to voltage.	No limitation.	Check cable harness between the control unit and the component. Check the component.	D794/Sensor:09	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
97/4	429	PID09 7/4	Electric problem sensor water in fuel, cable short-circuited to ground.	No limitation.	Check cable harness between the control unit and the component. Check the component.	D794/Sensor:09	-
97/15	418	PID09 7/15	Water in fuel.	Risk of white exhaust smoke and reduced engine power.	Drain water from the fuel filter.	-	-
100/1	415	PID10 0/1	Low engine oil pressure.	Engine power drops gradually, after 30 seconds the engine is shut off.	Check oil level in the engine, top up as needed.	-	ENGINE, menu 6
100/2	435	PID10 0/2	Sensor oil pressure, data error.	No warning for low oil pressure engine.	Check the sensor.	D794/Sensor:44	ENGINE, menu 6
100/3	135	PID10 0/3	Sensor oil pressure cable short-circuited to voltage.	No warning for low oil pressure engine.	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor:44	ENGINE, menu 6
100/4	141	PID10 0/4	Sensor oil pressure, open circuit, or short-circuiting to ground.	No warning for low oil pressure engine.	Check cable harness between the control unit and the component. Check the sensor.	D794/Black:14	ENGINE, menu 6
100/18	143	PID10 0/1	Low engine oil pressure.	No limitation.	Check oil level in the engine, top up as needed. Check the sensor.	-	ENGINE, menu 6
102/2	433	PID10 2/2	Sensor boost pressure indicates high boost pressure but other engine data indicate that pressure should be normal.	Reduced engine power.	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor:39	ENGINE, menu 7
102/3	122	PID10 2/3	Sensor boost pressure, cable short-circuited to voltage.	Reduced engine power.	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor:39	ENGINE, menu 7

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
102/4	123	PID10 2/4	Sensor boost pressure, cable short-circuited to ground or open circuit.	Reduced engine power.	Check cabling between control unit and component. Check sensor boost pressure.	D794/Black:3	ENGINE, menu 7
103/16	595	PID10 3/0	Overspeed protection turbo.	Reduced engine power.	Check the component.	-	-
105/0	155	PID10 5/0	Inlet air too warm.	Engine power drops gradually, after 30 seconds the engine is shut off.	Check the coolant level in the engine, top up as needed. Check that the charge-air cooler is clean, clean as needed. Check that the fan belts are intact. Check sensor inlet air temperature.	-	ENGINE, menu 7
105/3	153	PID10 5/3	Sensor charge-air temperature, cable short-circuited to voltage or open circuit.	Risk of white exhaust smoke. No warning for high coolant temperature.	Check cabling between control unit and component. Check that sensor charge-air temperature is installed correctly and connected. Check sensor charge-air temperature.	D794/Sensor:38	ENGINE, menu 7
105/4	154	PID10 5/4	Sensor charge-air temperature, cable short-circuited to ground or open circuit.	Risk of white exhaust smoke. No warning for high coolant temperature.	Check cable harness between the control unit and the component. Check that sensor is installed correctly and connected. Check the sensor.	D794/Sensor:38	ENGINE, menu 7
108/2	295	PID10 8/2	Electric problem sensor air pressure, data error.	Reduced engine power.	Check the sensor.	-	-
108/3	221	PID10 8/3	Electric problem air pressure, cable short-circuited to voltage.	Reduced engine power.	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor:06	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
108/4	222	PID108/4	Electric problem air pressure, cable short-circuited to ground.	Reduced engine power.	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor:06	-
110/0	151	PID110/0	High coolant temperature.	Engine power drops gradually, after 30 seconds the engine is shut off.	Check coolant level. Check that radiator is clean. Check if there's air in coolant system. Check the cap on the expansion tank. Check the sensor. Check thermostat.	-	ENGINE, menu 7
110/3	144	PID110/3	Sensor coolant temperature, cable short-circuited to voltage or open circuit.	No display of engine temperature.	Check cable harness between the control unit and the component.	D794/Sensor:02	ENGINE, menu 7
110/4	145	PID110/4	Sensor coolant temperature, cable short-circuited to ground.	No display of engine temperature.	Check cable harness between the control unit and the component. Check that the sensor is correctly connected. Check the sensor.	D794/Sensor:02	ENGINE, menu 7
111/1	235	PID111/1	Low coolant level.	Engine power drops gradually, after 30 seconds the engine is shut off.	Check the coolant level, top up if needed. Check the sensor.	-	-
111/2	422	PID111/2	Electric problem sensor coolant level, data error.	No warning for low coolant level.	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor:09	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
166/2	951	PID11 6/2	Power imbalance between cylinders.	Rough idling.	Check the fuel quality. If the fuel system has been opened so that air may have entered the system, the error code may be generated. Troubleshoot the engine.	-	-
167/1	598	PID16 7/1	Low battery voltage.	Warning active until voltage is correct.	Check batteries and alternator.	D794/ OEM:7, 8, 17, 18, 28	-
167/ 16	596	PID16 7/0	Low battery voltage.	Warning active until voltage is correct.	Check fuses. Check batteries and alternator.	D794/ OEM:7, 8, 17, 18, 28	-
167/ 18	597	PID16 7/1	High battery voltage.	Warning active until voltage is correct, engine runs at high idle to increase voltage.	Check batteries and alternator.	D794/ OEM:7, 8, 17, 18, 28	-
168/ 16	442	PID16 8/0	Voltage feed to control unit high.	No limitation.	Check fuses. Check batteries and alternator.	D794/ OEM:7, 8, 17, 18, 28	-
168/ 18	441	PID16 8/1	Voltage feed to control unit low.	Rough idling.	Check fuses. Check batteries and alternator.	D794/ OEM:7, 8, 17, 18, 28	-
175/0	214	PID17 5/0	High engine oil temperature.	Engine power drops gradually, after 30 seconds the engine is shut off.	Check coolant level and oil level in engine, top up as needed.  Check that the oil cooler is clean, clean as needed.  Check that the fan belts are intact.  Check the sensor.	-	ENGINE, menu 7
175/3	212	PID17 5/3	Sensor oil temperature, cable short-circuited to voltage or open circuit.	No display of oil temperature engine.	Check cable harness between the control unit and the component.  Check that the sensor is correctly connected.	D794/Sen- sor:42	ENGINE, menu 7

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
175/4	213	PID17 5/4	Sensor oil temperature, cable short-circuited to ground.	No display of oil temperature engine.	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor:42	ENGINE, menu 7
188/4	466	SID03 2/4	Electric problem solenoid valve wastegate 1 short-circuiting to ground.	Reduced engine power.	Check cable harness between the control unit and the component. Check the solenoid valve.	D794/Actuator: 24	
190/0	234	PID19 0/0	Engine rpm too high.	Fuel feed is restricted until engine rpm is below permitted rpm.	Ease off throttle or select higher gear.	-	-
190/2	115	PID19 0/2	Electric problem sensor rpm/ignition position, no signal from any of the sensors.	Engine stops and cannot be started.	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor:47, 50	-
190/10	121	PID19 0/10	Electric problem sensor rpm/ignition position, on of two signals is missing.	No limitation.	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor: 47, 50	-
191/16	349	PID19 1/0	Speed limitation activated.	Speed is reduced.	Ease off throttle.	-	-
191/18	489	PID19 1/1	Speed warning for low speed.	Engine only runs on idle.	Increase throttle.	-	-
251/2	319	PID25 1/2	Internal error Control unit engine.	-	-	-	-
441/3	293	PID44 1/3	Extra sensor temperature short-circuited to ground.	No warning at high temperature Control unit engine (D794).	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor: 12	
441/4	294	PID44 1/4	Extra sensor temperature short-circuited to voltage.	No warning at high temperature Control unit engine (D794).	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor: 12	

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
558/2	431	SID23 0/2	Electric problem sensor throttle pedal, idle switch data error.	No limitation.	Check cable between control unit and component. Check component.	D794/ OEM: 03, 13	-
558/4	551	SID23 0/4	Electric problem sensor throttle pedal, idle switch cable short-circuited to ground.	Engine does not respond to throttle.	Check cable between control unit and component. Check component.	D794/ OEM: 03, 13	-
558/13	432	SID23 0/13	Electric problem sensor throttle pedal, idle switch calibration error.	Engine only runs on idle.	Check cable between control unit and component. Check component.	D794/ OEM: 13	-
608/2	412	SID25 0/2	Communication error with Control unit engine (D794).	No limitation.	Check the control unit.	D794/ OEM: 26, 27, 36, 37, 46	
608/9	414	SID25 0/9	Communication error with Control unit engine (D794).	No limitation.	Check the control unit.	D794/ OEM: 26, 27, 36, 37, 46	
620/3 1080/3	227	SID23 2/3	Electric problem reference voltage to sensor short-circuited to voltage.	Reduced engine power. No warning low oil pressure or low coolant level.	Check cable harness between the control unit and the component. Check the control unit.	D794/Sensor: 18, 25, 45	-
620/4 1081/4	187	SID23 2/4	Electric problem reference voltage to sensor short-circuited to ground.	Reduced engine power. No warning low oil pressure or low coolant level.	Check cable harness between the control unit and the component. Check the component.	D794/Sensor: 18, 25, 45	-
626/11	381	SID23 7/11	Electric problem to control of relay preheating.	Preheating does not work. Risk of white smoke	Check cable harness between the control unit and the component. Check the component.	D794/Actuator: 34	ENGINE, menu 5
627/2	434	SID25 1/2	Voltage feed to control unit disappears without engine off.	Reduced engine power. Engine difficult to start or engine stops.	Check fuses. Check batteries and alternator.	D794/ OEM: 7, 8, 17, 18, 28	-
629/12	111	SID25 4/12	Internal error Control unit engine.	Engine doesn't start.	Check the control unit.	-	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
629/12	343	SID254/12	Internal error Control unit engine.	No limitation.	Check the control unit.	-	-
630/2	341	SID253/2	Software error control unit, engine (D794).	Reduced engine power. Engine difficult to start or engine stops.	Re-program the software in Control unit engine (D794).	-	-
632/3	255	SID017/3	Electric problem solenoid valve fuel shut-off, cable short-circuited to voltage.	No limitation.	Check cable harness between the control unit and the component. Check the solenoid valve.	D794/Actuator: 33	-
632/4	254	SID017/4	Electric problem solenoid valve fuel shut-off, cable short-circuited to ground.	Engine is shut off.	Check cable harness between the control unit and the component. Check the solenoid valve.	D794/Actuator: 33	-
639/2	426	SID231/2	Communication error with Control unit engine (D794).	Functions via CAN-bus do not work.	Use diagnostic menu to find incorrect segment.	-	CAN/POWER, menu 2
639/9	427	SID231/9	Communication error with Control unit engine (D794).	Functions via CAN-bus do not work.	Use diagnostic menu to find incorrect segment.	-	CAN/POWER, menu 2
639/9	285	SID231/9	Communication error with Engine control unit (D794), timeout error.	Functions via CAN-bus do not work.	Use diagnostic menu to find incorrect segment.	-	CAN/POWER, menu 2
639/13	286	SID231/13	Communication error with Engine control unit (D794), configuration error.	Functions via CAN-bus do not work.	Use diagnostic menu to find incorrect segment.	-	CAN/POWER, menu 2
644/2	237	SID030/2	Electric problem throttle pedal, signal outside valid range.	Engine is shut off.	Check cable harness between the control unit and the component. Check the component.	-	-
647/4	245	SID033/4	Electric problem fan connection, cable short-circuited to ground.	Cooling fan always driven.	Check cable harness between the control unit and the component. Check the component.	D794/Actuator:10, Actuator: 9	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
651/5	322	SID00 1/5	Electric problem injector cylinder 1, open circuit on cable.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	D794/Actuator:10, Actuator: 9	-
651/6	311	SID00 1/7	Electric problem injector cylinder 1, cable short-circuited to ground.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	D794/Actuator:10, Actuator: 9	-
652/5	331	SID00 2/5	Electric problem injector cylinder 2, open circuit on cable.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	D794/Actuator: 7, 8	-
652/6	315	SID00 2/6	Electric problem injector cylinder 2, cable short-circuited to ground.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	D794/Actuator:7, 8	-
653/5	324	SID00 3/5	Electric problem injector cylinder 3, open circuit on cable.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	D794/Actuator:6, 16	-
653/6	313	SID00 3/6	Electric problem injector cylinder 3, cable short-circuited to ground.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable between control unit and component. Check component.	D794/Actuator:6, 16	-
654/5	332	SID00 4/5	Electric problem injector cylinder 4, open circuit on cable.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	D794/Actuator:26, 36	-
654/6	321	SID00 4/6	Electric problem injector cylinder 4, cable short-circuited to ground.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	D794/Actuator:26, 36	-

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
655/5	323	SID005/5	Electric problem injector cylinder 5, open circuit on cable.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	D794/Actuator: 3, 4	-
655/6	312	SID005/6	Electric problem injector cylinder 5, cable short-circuited to ground.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable between control unit and component. Check component.	D794/Actuator: 3, 4	-
656/5	325	SID006/5	Electric problem injector cylinder 6, open circuit on cable.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable between control unit and component. Check component.	D794/Actuator: 1, 2	-
656/6	314	SID006/6	Electric problem injector cylinder 6, cable short-circuited to ground.	Engine runs on 5 cylinders, sounds rough and has reduced power.	Check cable harness between the control unit and the component. Check the injector.	D794/Actuator: 1, 2	-
702/3	527	SID040/3 PID154/3	Electric problem extra output 2, cable short-circuited to voltage	No limitation.	Check cable harness between the control unit and the component. Check the component.	D794/Actuator: 14	-
703/3	529	SID051/3	Electric problem extra output 2, cable short-circuited to voltage	No limitation.	Check cable harness between the control unit and the component. Check the component.	D794/Actuator: 45	-
974/3	133	SID029/3	Electric problem extra throttle pedal, cable short-circuited to voltage.	Engine does not respond to throttle.	Check cable harness between the control unit and the component. Check the component.	D794/OEM: 21	-
974/4	134	SID029/4	Electric problem extra throttle pedal, cable short-circuited to ground.	Engine does not respond to throttle.	Check cable harness between the control unit and the component. Check the component.	D794/OEM: 21	-
974/19	288	SID029/2	Communication error with Cab control unit (D790-1), electric problem throttle pedal.	Engine does not respond to throttle.	Use diagnostic menu to find incorrect segment.	-	CAN/POWER, menu 2

			Description	Limitation	Action	Connection and component	Diagnostic menu
Code	Flash	J1587					
1043/3	387	PID22 1/3	Electric problem throttle pedal reference voltage, cable short-circuited to voltage.	Engine only runs on idle.	Check cable harness between the control unit and the component. Check the component.	D794/OEM: 48	-
1043/4	443	PID22 1/4	Electric problem throttle pedal reference voltage, cable short-circuited to ground.	Engine only runs on idle.	Check cable harness between the control unit and the component. Check the component.	D794/OEM: 48	-
1072/11	388	SID07 0/11	Electric problem solenoid valve engine brake 2.	Engine brake 1 cannot be activated.	Check cable harness between the control unit and the component. Check the solenoid valve.	D794/Actuator: 44	-
1073/11	392	SID02 9/11	Electric problem solenoid valve engine brake 2.	Engine brake 2 cannot be activated.	Check cable harness between the control unit and the component. Check the solenoid valve.	D794/Actuator: 44	-
1079/3	386	SID23 2/3	Electric problem reference voltage to sensor short-circuited to voltage.	Reduced engine power.	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor: 17, 37	-
1079/4	352	SID23 2/4	Electric problem reference voltage to sensor short-circuited to ground.	Reduced engine power.	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor: 17, 37	-
1188/3	465	SID03 2/3	Electric problem solenoid valve wastegate 1 short-circuited to voltage.	Reduced engine power.	Check cable harness between the control unit and the component. Check the solenoid valve.	D794/Actuator: 24	-
1189/3	491	SID08 8/3	Electric problem solenoid valve wastegate 2 short-circuited to voltage.	Reduced engine power.	Check cable harness between the control unit and the component. Check the solenoid valve.	D794/Actuator: 23	-

			Description	Limitation	Action	Conne- tion and compo- nent	Diag- nostic menu
Code	Flash	J1587					
1189/ 4	492	SID88/ 4	Electric problem solenoid valve wastegate 2 short-circuited to ground.	Reduced engine power.	Check cable harness between the control unit and the component. Check the solenoid valve.	D794/Actuator: 23	
1265/ 4	223	SID08 5/4	Electric problem solenoid valve oil-burn, cable short-circuited to ground.	No limitation.	Check cable harness between the control unit and the component. Check the solenoid valve.	-	-
1319/ 2	419	PID10 2/2	Electric problem sensor boost pressure.	Reduced engine power.	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor: 9	-
1380/ 1	219	PID01 7/1	Low oil level engine.	No limitation.	Check oil level in the engine, top up as needed.	-	-
1383/ 31	611	SID15 1/11	Engine shut off in another way than with start key means loading.	No limitation.	Shut off the engine with the start key.	-	-
1384/ 31	299	SID02 9/14	Engine shut off in another way than with start key means loading.	No limitation.	Shut off the engine with the start key.	-	-
1387/ 3	297	PID22 3/3	Electric problem extra sensor pressure, cable short-circuited to voltage.	No protection for pressure (customer-specific option).	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor: 19	-
1387/ 4	298	PID22 3/4	Electric problem extra sensor pressure, cable short-circuited to ground.	No protection for pressure (customer-specific option).	Check cable harness between the control unit and the component. Check the sensor.	D794/Sensor: 19	-
1484/ 31	211	SID21 6/11	Error codes in other control units.	No limitation.	Check error codes for the other control units on the machine, primarily Control unit cab (D790-1) and Control unit transmission (D793).	-	-

## 2 Transmission

### Error codes transmission (transmission alternative TE32000)

Control unit transmission can generate two modes with reduced functionality to protect the transmission in case of serious malfunctions:

- "Limp home", indicated in display with "LH".

In this mode only 1-2 gear in both directions can be used. If the malfunction occurs in a higher gear then downshifting has to be performed manually to 1st gear or 2nd.

- "Shutdown", indicated in display with "Sd".

In this mode, the transmission is in permanent neutral position as there is no oil pressure to enable selection of a gear.

	Description	Limitation	Action	Connection and component	Diagnostic menu
Code					
00/50	Memory error in control unit transmission.	Transmission locked in neutral (Shutdown).	-	-	-
00/51	Memory error in control unit transmission.	Transmission locked in neutral (Shutdown).	-	-	-
00/52	Memory error in control unit transmission.	Transmission locked in neutral (Shutdown).	-	-	-
00/53	Memory error in control unit transmission.	Transmission locked in neutral (Shutdown).	-	-	-
20/60	Sensor oil pressure (B253) indicates low oil pressure when there should be pressure.	Transmission locked in neutral (Shutdown).	Check cable harness between the control unit and the component.  Check the solenoid valve.	D793/A:2 - B253	TRANSM , menu 10
20/61	Sensor oil pressure (B253) indicates low oil pressure when there should be pressure.	Transmission locked in neutral (Shutdown).	Check cable harness between the control unit and the component.  Check the solenoid valve.	D793/A:2 - B253	TRANSM , menu 10
21/02	Solenoid valves VFS short-circuiting to voltage, ground, or open circuit.	Transmission locked in neutral (Shutdown).	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D793/D1 - Y6069, D793/F2 - Y6075	TRANSM , menu 7

	Description	Limitation	Action	Connection and component	Diagnostic menu
Code					
30/04	Low battery voltage.	Control unit saves stored information to flash memory and restarts to clear memory.	Check cabling to control unit. Check alternator, battery and cabling between battery and alternator.	-	CAN/POWER, menu 15
30/05	High battery voltage.	Control unit receives reduced proportional control precision depending on reduced PWM work cycle.	Check voltage feed. If auxiliary start equipment is connected, disconnect it.	-	CAN/POWER, menu 15
31/00	Reference voltage sensor 8 V, too low.	Control unit receives reduced sensor signals.	Check voltage feed. Check the control unit.	-	CAN/POWER, menu 15
31/01	Reference voltage sensor 8 V, too high.	Control unit receives reduced sensor signals.	Check voltage feed. Check the control unit.	-	CAN/POWER, menu 15
40/06	Incorrect direction from gear selector.	Control unit locks transmission in neutral.	Check cabling to gear selector with regards to forward and reverse signal.	-	TRANSM, menu 2
41/06	Incorrect gear selection from gear selector.	Control unit doesn't allow change of range, however, operation of machine is possible.	Check cabling to gear selector with regards to signal range.	-	TRANSM, menu 2
42/04	Actual gear ratio too low.	Control unit indicates that one or several clutches are slipping.	Check transmission with purpose to understand if and, if that is the case, which clutch is slipping. Check the set gear ratio for the control unit.	-	TRANSM, menu 6
42/05	Actual gear ratio too high.	Control unit indicates that one or several clutches are slipping.	Check transmission with purpose to understand if and, if that is the case, which clutch is slipping. Check the set gear ratio for the control unit.	-	TRANSM, menu 6
43/03	Signal from Sensor engine rpm and oil temperature transmission (B758/766) outside valid interval.	Control unit indicates the error.	Check cable harness between the control unit and the component. Check the sensor.	D793/H3-B758/766	TRANSM, menu 10

	Description	Limitation	Action	Connection and component	Diagnostic menu
Code					
43/07	Torque converter's temperature exceeds 100 °C.	Control unit indicates the error to make operator aware of the warning's level.	Check transmission oil cooler, clean as needed. Check the thermostat in the transmission oil cooler.	D793/H3-B758/766	TRANSM, menu 10
43/08	Torque converter's temperature exceeds 125 °C.	The control unit protects the transmission and does not allow the temperature in the torque converter to exceed the limit value. The control unit locks the transmission in neutral position, the engine is restricted to 50% of max. rpm.	Check transmission oil cooler, clean as needed. Check the thermostat in the transmission oil cooler.	D793/H3-B758/766	TRANSM, menu 10
44/10	Incorrect signal for throttle pedal position from Control unit engine (D794)	-	Use diagnostic menu to find incorrect segment.	-	CAN/POWER, menu 3
45/05	Max. torque for inching has been exceeded.	-	-	-	-
50/00	Sensor oil pressure (B253), short-circuited to ground.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the sensor.	D793/A:2 - B253	TRANSM, menu 10
50/01	Sensor oil pressure (B253), not connected or open circuit.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the sensor.	D793/A:2 - B253	TRANSM, menu 10
51/00	Sensor engine rpm and oil temperature transmission (B758/766) short-circuited to ground.	The control unit limits the transmission's temperature measurement to the lowest value in its settings, which results in poor temperature compensation.	Check cable harness between the control unit and the component. Check the sensor.	D793/H3-B758/766	TRANSM, menu 10

	Description	Limitation	Action	Connection and component	Diagnostic menu
Code					
51/01	Sensor engine rpm and oil temperature transmission (B758/766) not connected or open circuit.	The control unit limits the transmission's temperature measurement to the highest value in its settings, which results in poor temperature compensation.	Check cable harness between the control unit and the component. Check the sensor.	D793/H3-B758/766	TRANSM, menu 10
52/00	Sensor oil temperature (S221) short-circuited to ground.	The control unit limits the transmission's temperature measurement to the highest value in its settings, which results in poor temperature compensation.	Check cable harness between the control unit and the component. Check the sensor.	D793/J3-S221	TRANSM, menu 10
52/01	Sensor oil temperature (S221) open circuit.	The control unit limits the transmission's temperature measurement to the highest value in its settings, which results in poor temperature compensation.	Check cable harness between the control unit and the component. Check the sensor.	D793/J3-S221	TRANSM, menu 10
54/00	Reference voltage sensor 5 V short-circuiting to frame ground.	-	Check cable harness between the control unit and the component. Check the sensor.	-	CAN/POWER, menu 15
54/01	Reference voltage sensor 5 V open circuit.	-	Check cable harness between the control unit and the component. Check the sensor.	-	CAN/POWER, menu 15
60/00	Sensor rpm drum (B752) short-circuited to ground.	When only one rpm signal that is not the engine rpm signal is incorrect, the control unit calculates the missing rpm.  If several rpm signals or if the engine rpm signal are defective, the control unit activates Limp-home.	Check cable between control unit and component. Check component.	D793/C3-B752	TRANSM, menu 6

	Description	Limitation	Action	Connection and component	Diagnostic menu
Code					
60/01	Sensor rpm drum (B752) not connected.	When only one rpm signal that is not the engine rpm signal is incorrect, the control unit calculates the missing rpm.  If several rpm signals or if the engine rpm signal are defective, the control unit activates Limp-home.	Check cable between control unit and component.  Check component.	D793/C3-B752	TRANSM , menu 6
61/00	Sensor rpm output shaft (B758) short-circuited to ground.	When only one rpm signal that is not the engine rpm signal is incorrect, the control unit calculates the missing rpm.  If several rpm signals or if the engine rpm signal are defective, the control unit activates Limp-home.	Check cable between control unit and component.  Check component.	D793/D3-B758	TRANSM , menu 6
61/01	Sensor rpm output shaft (B758) not connected.	When only one rpm signal that is not the engine rpm signal is incorrect, the control unit calculates the missing rpm.  If several rpm signals or if the engine rpm signal are defective, the control unit activates Limp-home.	Check cable between control unit and component.  Check component.	D793/D3-B758	TRANSM , menu 6
62/00	Sensor engine rpm (B758/766), short-circuited to ground.	When only one rpm signal that is not the engine rpm signal is incorrect, the control unit calculates the missing rpm.  If several rpm signals or if the engine rpm signal are defective, the control unit activates Limp-home.	Check cable between control unit and component.  Check component.	D793/F3-B758/766	TRANSM , menu 6

	Description	Limitation	Action	Connection and component	Diagnostic menu
Code					
62/01	Sensor engine rpm (B758/766), not connected or has open circuit.	<p>When only one rpm signal that is not the engine rpm signal is incorrect, the control unit calculates the missing rpm.</p> <p>If several rpm signals or if the engine rpm signal are defective, the control unit activates Limp-home.</p>	<p>Check cable between control unit and component.</p> <p>Check component.</p>	D793/F3 - B758/766	TRANSM , menu 6
63/00	Sensor rpm turbine (B751) short-circuited to ground.	<p>When only one rpm signal that is not the engine rpm signal is incorrect, the control unit calculates the missing rpm.</p> <p>If several rpm signals or if the engine rpm signal are defective, the control unit activates Limp-home.</p>	<p>Check cable between control unit and component.</p> <p>Check component.</p>	D793/R2 - B751	TRANSM , menu 6
63/01	Sensor rpm turbine (B751) not connected.	<p>When only one rpm signal that is not the engine rpm signal is incorrect, the control unit calculates the missing rpm.</p> <p>If several rpm signals or if the engine rpm signal are defective, the control unit activates Limp-home.</p>	<p>Check cable between control unit and component.</p> <p>Check component.</p>	D793/R2 - B751	TRANSM , menu 6
70/00	Solenoid valve VFS front (Y630), short-circuited to each other, signal cable short-circuited to voltage, or plus-cable short-circuited to frame ground.	Transmission in Limp-Home.	<p>Check cable harness between the control unit and the component.</p> <p>Check the solenoid valve.</p>	D793/B1 - Y630, C1 - Y630	TRANSM , menu 8
70/01	Solenoid valve VFS forward (Y630) open circuit or short-circuited voltage.	Transmission in Limp-Home.	<p>Check cable harness between the control unit and the component.</p> <p>Check the solenoid valve.</p>	D793/B1 - Y630, C1 - Y630	TRANSM , menu 8

	Description	Limitation	Action	Connection and component	Diagnostic menu
Code					
70/02	Solenoid valve VFS forward (Y630), control current higher than 1400 mA.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/B1 - Y630, C1 - Y630	TRANSM , menu 9
70/03	Solenoid valve VFS forward (Y630), control current outside approved interval. Incorrect impedance.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/B1 - Y630, C1 - Y630	TRANSM , menu 9
71/00	Solenoid valve VFS 2/4 (Y6069), short-circuited to each other, signal cable short-circuited to voltage, or plus-cable short-circuited to frame ground.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/D1 - Y6069, E1 - Y6069	TRANSM , menu 8
71/01	Solenoid valve VFS 2/4 (Y6069) open circuit or short-circuited voltage.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/D1 - Y6069, E1 - Y6069	TRANSM , menu 8
71/02	Solenoid valve VFS 2/4 (Y6069), control current higher than 1400 mA.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/D1 - Y6069, E1 - Y6069	TRANSM , menu 9
71/03	Solenoid valve VFS 2/4 (Y6069), control current outside approved interval (incorrect impedance).	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/D1 - Y6069, E1 - Y6069	TRANSM , menu 9
72/00	Solenoid valve VFS reverse (Y631), cables short-circuited to each other, signal cable short-circuited to voltage, or plus-cable short-circuited to frame ground.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/F1 - Y631, G1 - Y631	TRANSM , menu 8

	Description	Limitation	Action	Connection and component	Diagnostic menu
Code					
72/01	Solenoid valve VFS reverse (Y631) open circuit or short-circuited voltage.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/F1 - Y631, G1 - Y631	TRANSM , menu 8
72/02	Solenoid valve VFS reverse (Y631), control current higher than 1400 mA.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/F1 - Y631, G1 - Y631	TRANSM , menu 9
72/03	Solenoid valve VFS reverse (Y631), control current outside approved interval (incorrect impedance).	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/F1 - Y631, G1 - Y631	TRANSM , menu 9
73/00	Solenoid valve VFS 1/3 (Y6067), cables short-circuited to each other, signal cable short-circuited to voltage, or plus-cable short-circuited to frame ground.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/H1 - Y6067, J1 - Y6067	TRANSM , menu 8
73/01	Solenoid valve VFS 1/3 (Y6067) open circuit or short-circuited voltage.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/H1 - Y6067, J1 - Y6067	TRANSM , menu 8
73/02	Solenoid valve VFS 1/3 (Y6067), control current higher than 1400 mA.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/H1 - Y6067, J1 - Y6067	TRANSM , menu 9
73/03	Solenoid valve VFS 1/3 (Y6067), control current outside approved interval (incorrect impedance).	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/H1 - Y6067, J1 - Y6067	TRANSM , menu 9
77/02	All gear packs disengaged.	Transmission locked in neutral (Shutdown).	-	-	-

	Description	Limitation	Action	Connection and component	Diagnostic menu
Code					
80/00	Solenoid valve RSP Drive (Y6066), cable short-circuited to frame ground.	Transmission locked in neutral (Shutdown).	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/K1 - Y6066	TRANSM , menu 7
80/01	Solenoid valve RSP Drive (Y6066), cable is not connected or short-circuited to voltage.	Transmission locked in neutral (Shutdown).	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/K1 - Y6066	TRANSM , menu 7
81/00	Solenoid valve VFS 2/4 (Y6074), cable short-circuited to frame ground.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/E2 - Y6074	TRANSM , menu 7
81/01	Solenoid valve VSF 2/4 (Y6074), cable is not connected or short-circuited to voltage.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/E2 - Y6074	TRANSM , menu 7
82/00	Solenoid valve VFS 1/3 (Y6075), cable short-circuited to frame ground.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/F2 - Y6075	TRANSM , menu 7
82/01	Solenoid valve VSF 1/3 (Y6075), cable is not connected or short-circuited to voltage.	Transmission in Limp-Home.	Check cable harness between the control unit and the component. Check the solenoid valve.	D793/F2 - Y6075	TRANSM , menu 7
83/00	Solenoid valve RSP Drive (Y6066), cable short-circuited to frame ground.	Transmission locked in neutral (Shutdown).	Check cabling to solenoid valve drive Check solenoid valve drive.	D793/K2 - Y6066	TRANSM , menu 7
83/01	Solenoid valve RSP Drive (Y6066), cable is not connected or short-circuited to voltage.	Transmission locked in neutral (Shutdown).	Check cabling to solenoid valve drive Check solenoid valve drive.	D793/K2 - Y6066	TRANSM , menu 7

	Description	Limitation	Action	Connection and component	Diagnostic menu
Code					
90/xx - 99/xx	System error.	Transmission locked in neutral (Shutdown).	-	D793/A:20	-
95/71	Control unit cannot interpret input data.	-	-		
99/90	Incorrect software in control unit transmission.	-	-		

## 8 Control and monitoring system

### Error codes machine

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
1	Communication error with Control unit attachment (D791-1).	Attachment functions not working.	Use diagnostic menu to find incorrect segment.	D791-1	CAN/ POWER, menu 2	11.6.2 Redundant CAN-bus
2	Communication error with Control unit attachment option (D791-2).	Levelling, tilt, overheight extension not working.	Use diagnostic menu to find incorrect segment.	D791-2	CAN/ POWER, menu 2	11.6.2 Redundant CAN-bus
3	Communication error with Control unit attachment left legs (D791-3).	Left side of bottom lift not working.	Use diagnostic menu to find incorrect segment.	D791-3	CAN/ POWER, menu 2	11.6.2 Redundant CAN-bus
4	Communication error with Control unit attachment right leg pair (D791-4).	Right side of bottom lift not working.	Use diagnostic menu to find incorrect segment.	D791-4	CAN/ POWER, menu 2	11.6.2 Redundant CAN-bus
5	Communication error with Control unit frame rear (D797-R).	Lighting rear, hydraulic oil cooling, overload system, extension not working.	Use diagnostic menu to find incorrect segment.	D797-R	CAN/ POWER, menu 2	11.6.2 Redundant CAN-bus
6	Communication error with Control unit frame front (D797-F).	Front lighting, lift, extension, brake light, brake cooling not working.	Use diagnostic menu to find incorrect segment.	D797-F	CAN/ POWER, menu 2	11.6.2 Redundant CAN-bus
7	Communication error with Control unit frame option (D797-O).	Sliding cab, support jacks, joystick steering mini-wheel, cab lift and cab tilt not working.	Use diagnostic menu to find incorrect segment.	D797-O	CAN/ POWER, menu 2	11.6.2 Redundant CAN-bus
8	Communication error with Control unit KID (D795).	Controls in steering wheel panel and display not working.	Use diagnostic menu to find incorrect segment.	D795	CAN/ POWER, menu 2	11.6.2 Redundant CAN-bus

<b>Code</b>	<b>Description</b>	<b>Limitation</b>	<b>Action</b>	<b>Connection and component</b>	<b>Diagnostic menu</b>	<b>Group</b>
9	Communication error with Control unit cab option (D790-3).	Mini-wheel or joystick steering not working	Use diagnostic menu to find incorrect segment.	D790-3	CAN/ POWER, menu 2	11.6.2 Redundant CAN-bus
11	Cable defect CAN-net segment 1.	No limitation.	Use diagnostic menu to find incorrect segment.	Varies depending on machine configuration.	CAN/ POWER, menu 1 and 21	11.6.2 Redundant CAN-bus
12	Cable defect CAN-net segment 2.	No limitation.	Use diagnostic menu to find incorrect segment.	Varies depending on machine configuration.	CAN/ POWER, menu 1 and 21	11.6.2 Redundant CAN-bus
13	Cable defect CAN-net segment 3.	No limitation.	Use diagnostic menu to find incorrect segment.	Varies depending on machine configuration.	CAN/ POWER, menu 1 and 21	11.6.2 Redundant CAN-bus
14	Cable defect CAN-net segment 4.	No limitation.	Use diagnostic menu to find incorrect segment.	Varies depending on machine configuration.	CAN/ POWER, menu 1 and 21	11.6.2 Redundant CAN-bus
15	Cable defect CAN-net segment 5.	No limitation.	Use diagnostic menu to find incorrect segment.	Varies depending on machine configuration.	CAN/ POWER, menu 1 and 21	11.6.2 Redundant CAN-bus
16	Cable defect CAN-net segment 6.	No limitation.	Use diagnostic menu to find incorrect segment.	Varies depending on machine configuration.	CAN/ POWER, menu 1 and 21	11.6.2 Redundant CAN-bus
17	Cable defect CAN-net segment 7.	No limitation.	Use diagnostic menu to find incorrect segment.	Varies depending on machine configuration.	CAN/ POWER, menu 1 and 21	11.6.2 Redundant CAN-bus
18	Cable defect CAN-net segment 8.	No limitation.	Use diagnostic menu to find incorrect segment.	Varies depending on machine configuration.	CAN/ POWER, menu 1 and 21	11.6.2 Redundant CAN-bus

Code	Description	Limitation	Action	Con- nection and compo- nent	Diag- nostic menu	Group
20	Accelerator pedal (B690) not calibrated.	Poor sensitivity in accelerator pedal.	Calibrate the accelerator pedal, see tab 8 <i>Control system</i> , group 8.5.2.3 <i>Calibrate DRIVE-TRAIN</i> .	D790-1/ K6:11 – B690	CALIBRA- TION: DRIVE- TRAIN, menu 1 and 2	1. Engine
21	Communication error with Control unit transmission (D793).	Gear selection not working.	Use diagnostic menu to check communication.  Check cable harness between Control unit cab (D790-1) and Control unit transmission (D793).	D790-1/ K13:1 – D793/M2  D790-1/ K13:2 – D793/L2	CAN/ POWER, menu 3	11.6.3 CAN-bus drivetrain
22	Communication error with Control unit engine (D794).	Engine does not react to commands from cab.	Use diagnostic menu to check communication.  Check cable harness between Control unit cab (D790-1) and Control unit engine (D794).	Volvo: D790-1/ K13:1, K13:2 – D794/2, 1  Cummins: D790-1/ K13:1, K13:2 – D794/46, 37	CAN/ POWER, menu 3	11.6.3 CAN-bus drivetrain
23	The setup file cannot be read in Control unit cab (D790-1).	No controls working in cab.	Contact Kalmar Industries AB.	D790-1	-	11.5.3.1 Control unit cab
24	Electric power feed to cab fan less than 18 V.	Cab fan not working.	Check fuse F58-5/3.	D790-1/ K2:8 – 58- 5/3:2	-	9.4.3 Cab fan
25	Interference during software download. Buffer for error codes from Control unit engine (D794), active error code when downloading.	Error code is stored in Control unit engine (D794).	Turn the ignition off and on.  Repeat software download.	D794	ENGINE, menu 8	11.5.3.10 Control unit engine
26						
27						
28						
29						
30						

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
31	Incorrect electric power feed to Control unit cab (D790-1). Voltage lower than 18 V or higher than 32 V.	Control in cab not working.	Check fuse F58-5/1. Check cable harness between the control unit and the component with diagnostic menu. Check the control unit.	D790-1/ K1:2, K1:3, K1:4 – F58-5/1:1, 1:2	CAN/ POWER, menu 6	11.5.1.3 Ignition voltage (15)
32	Incorrect 5 V reference voltage to analogue controls in the cab. Voltage lower than 4.9 V or higher than 5.1 V.	Analogue controls in the cab not working (mini-wheel/joy-stick, control lever and controls for air conditioning).	Check cable harness between the control unit and the component with diagnostic menu. Check the component.	D790-1/ K4:5, K 5:11, K5:13, K7:2, K 9:7, K10:3	CAN/ POWER, menu 6	11.5.3.1 Control unit cab
33	No feedback signal for control breaker voltage from Relay control breaker voltage (K3009-1).	Control breaker cannot be disengaged. All hydraulic functions are blocked.	Check fuse F58-3/8. Check cable harness between the control unit and the component with diagnostic menu.	D790-1/ K11:13 – K3009-1/ 87	CAN/ POWER, menu 5	11.5.1.4 Control breaker voltage (15E)
34	Incorrect signal from Switch parking brake (S107), indicates released and applied at same time or not at all.	Parking brake cannot be released.	Check cable harness between the control unit and the component with diagnostic menu. Check the switch.	D791-1/ K8:5 – S107/7  D791-1/ K8:13 – S107/1	HYD, menu 5	4.5 Parking brake
35	Interference during software download. Buffer for error codes from Control unit transmission (D793), active error code when downloading.	Error code is stored in Control unit transmission (D793).	Turn the ignition off and on.  Repeat software download.	D793	TRANSM, menu 13	11.5.3.9 Control unit transmission
36						
37						
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39						
40						
41	The transistor has been triggered due to short-circuiting in the circuit to Wiper motor, rear (M650-2).	Windshield wiper rear not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the motor.	D790-1/ K2:4 – M650-2/53	CAB, menu 3	9.5.7 Wiper motor rear

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
42	The transistor has been triggered due to short-circuiting in the circuit to Rotating beacon (H428).	Rotating beacon not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the component.	D790-1/ K2:5 – H428	LIGHTS, menu 9	9.6.8 Rotating beacon
43	The transistor has been triggered due to short-circuiting in the circuit to Work light cab left (E404-1L).	Work light cab left not working.	Check the light. Check cable harness between the control unit and the component with diagnostic menu.	D790-1/ K2:6 – E404-1L	LIGHTS, menu 1	9.6.9 Work lights cab
44	The transistor has been triggered due to short-circuiting in the circuit to Work light cab right (E404-1R).	Work light cab right not working.	Check the light. Check cable harness between the control unit and the component with diagnostic menu.	D790-1/ K2:7 – E404-1R	LIGHTS, menu 1	9.6.9 Work lights cab
45	The transistor has been triggered due to short-circuiting in the circuit to Wiper motor, front (M650-1).	Windshield wiper front not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the motor.	D790-1/ K2:1 – M650-1/53	CAB, menu 2	9.5.1 Wiper front
46	The transistor has been triggered due to short-circuiting in the circuit to Fan motor (M657-1).	Cab fan not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the motor.	D790-1/ K2:2 – M657-1/2	CLIMATE, menu 6	9.4.3 Cab fan
47	The transistor has been triggered due to short-circuiting in the circuit to Actuator recirculation (M612).	The recirculation damper for ventilation is not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the motor.	D790-1/ K2:3 – M612/3	CLIMATE, menu 6	9.4.2 Fresh air and recirculation damper
48	The transistor has been triggered due to short-circuiting in the circuit to Water valve (Y673).	Heat in cab cannot be adjusted.	Check cable harness between the control unit and the component with diagnostic menu. Check the motor.	D790-1/ K4:1 – Y673/5	CLIMATE, menu 7	9.4.5 Water valve
49	The transistor has been triggered due to short-circuiting in the circuit to Water valve (Y673).	Heat in cab cannot be adjusted.	Check cable harness between the control unit and the component with diagnostic menu. Check the motor.	D790-1/ K4:2 – Y673/6	CLIMATE, menu 7	9.4.5 Water valve

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
50	The transistor has been triggered due to short-circuiting in the circuit to Damper motor (Y672)	Air distribution in cab cannot be adjusted.	Check cable harness between the control unit and the component with diagnostic menu. Check the motor.	D790-1/ K4:3 – Y672/5	CLIMATE, menu 8	9.4.14 Air distributor
51	The transistor has been triggered due to short-circuiting in the circuit to Damper motor (Y672).	Air distribution in cab cannot be adjusted.	Check cable harness between the control unit and the component with diagnostic menu. Check the motor.	D790-1/ K4:4 – Y672/6	CLIMATE, menu 8	9.4.14 Air distributor
53	The transistor has been triggered due to short-circuiting in the circuit to Washer motor roof and rear (M651-2).	Windshield washer rear and roof not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the motor.	D790-1/ K5:4 – M651-2	CAB, menu 1	9.5.4 Washer motor and reservoir
54	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Switch flashing hazard lights (S109).	Flashing hazard lights not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the switch.	D790-1/ K5:5 – S109/	LIGHTS, menu 7	9.6.7 Flashing hazard lights
55	The transistor has been triggered due to short-circuiting in the circuit to background lighting in switches and instruments.	Reduced or no background lighting in switches and instruments	Check bulbs for background lighting, change if needed. Check cable harness to background lighting.	D7901/ K6:1, K 8:15, K9:2, K 10:5, all inputs type A Digital in	LIGHTS, menu 13	9.1 Controls and instruments
56	The transistor has been triggered due to short-circuiting or open circuit in the circuit to LED-indication for tilt lock in control lever (S815).	Indication for tilt lock in control lever is not illuminated.	Check cable harness between the control unit and the component with diagnostic menu. Check the switch.	D790-1/ K7:8 – S815/5	-	7.1.1 Control lever
57	The transistor has been triggered due to short-circuiting or open circuit in the circuit to LED-indication for levelling lock in control lever (S815).	Indication for levelling lock in control lever is not illuminated.	Check cable harness between the control unit and the component with diagnostic menu. Check the switch.	D790-1/ K7:9 – S815/7	-	7.1.1 Control lever

Code	Description	Limitation	Action	Con- nection and compo- nent	Diag- nostic menu	Group
60	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Relay seat heater (K383).	Seat heater not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the component.	D790-1/ K10:7 – K383/86	CAB, menu 8	9.3.3 Heat- ing coils
61	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Relay extra work light boom (K304).	Extra work light boom not work- ing.	Check cable harness between the control unit and the component with diagnostic menu.  Check the component.	D790-1/ K10:8 – K304/86	LIGHTS, menu 3	9.6.10 Work light boom
62	The transistor has been triggered due to short-circuiting or open circuit in the circuit to simulat- ed D+ feed to hour meter (P708) and Relay compressor air-sus- pended seat (K358).	Hour meter and air-suspended seat not work- ing.	Check cable harness between the control unit and the component with diagnostic menu.  Check the component.	D790-1/ K10:9 – P708, K358/86	CAN/ POWER, menu 7	9.3.5 Air suspension
63	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Relay ig- nition voltage (K315-1).	No ignition volt- age to the ma- chine's Control units.	Check cable harness between the control unit and the component with diagnostic menu.  Check the component.	D790-1/ K10:10 – K315-1/86	CAN/ POWER, menu 4	11.5.1.3 Ig- nition volt- age (15)
64	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Relay control breaker voltage (K3009-1).	No control breaker voltage to the machine's Control units.	Check cable harness between the control unit and the component with diagnostic menu.  Check the component.	D790-1/ K10:11 – K3009-1/ 86	CAN/ POWER, menu 5	11.5.1.4 Control breaker voltage
65	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Relay control breaker voltage (K3009-2).	No control breaker voltage to the machine's Control units.	Check cable harness between the control unit and the component with diagnostic menu.  Check the component.	D790-1/ K10:11 – K3009-1/ 86	CAN/ POWER, menu 5	11.5.1.4 Control breaker voltage
66	The transistor has been triggered due to short-circuiting in the circuit to Washer motor wind- shield (M651-1).	Windshield washer not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the component.	D790-1/ K10:13 – M651-1	CAB, menu 1	9.5.4 Washer motor and reservoir

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
67	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Wiper motor, roof (M650-3).	Wiper roof not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the motor.	D790-1/ K10:14 – M650-3/53	CAB, menu 4	9.5.6 Wiper motor roof
68	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Circulation pump pause heater (M667).	Pause heater not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the motor.	D790-1/ K10:15 – M667	-	9.4 Heating, ventilation and air conditioning
69	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Relay ignition voltage drivetrain (K315-2).	No voltage feed to engine and transmission.	Check cable harness between the control unit and the component with diagnostic menu. Check the component.	D790-1/ K10:16 – K315-2/86	CAN/ POWER, menu 4	11.5.1.3 Ignition voltage (15)
71	The transistor has been triggered due to short-circuiting in the circuit to Interior lighting cab (E434-1).	Interior lighting in cab not working.	Check the light. Check cable harness between the control unit and the component with diagnostic menu.	D790-1/ K11:6 – E434-1	LIGHTS, menu 12	9.6.12 Interior lighting cab
74	The transistor has been triggered due to short-circuiting in the circuit to Horn (H850) or Relay compressed air horn (K3016)	Horn / compressed air horn not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the component.	D790-1/ K11:11 – H850/1, K3016/86	CAB, menu 5	9.7.1 Horn
75	Relay ignition voltage (K315-1) has jammed in position on.	Control unit cab (D790-1) is still supplied with voltage and thus active.	Check cable harness between the control unit and the component with diagnostic menu. Check the component.	-	CAN/ POWER, menu 4	11.5.1.3 Ignition voltage
80	No signal from Pressure switch air conditioning (S246), despite the AC compressor being activated.	Air conditioning not working.	Check drive belt for air conditioning compressor. Check that compressor for air conditioning is activated. Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K1:37 – S246	CLIMATE, menu 3	9.4.10 Pressure monitor

Code	Description	Limitation	Action	Con- nection and compo- nent	Diag- nostic menu	Group
81	Incorrect signal from-Damper motor (Y672). Signal voltage lower than 0.2 V or higher than 4.8 V.	Air distribution cannot be changed.	Check cable harness between the control unit and the component with diagnostic menu. Check the motor.	D790-1/ K4:7 – Y672/9	CLI- MATE, menu 4	9.4.6 Fresh air and re-circulation damper
85	Incorrect signal from ac-celerator pedal (R690). Signal voltage lower than 0.2 V or higher than 4.8 V.	Engine rpm limited to idle.	Check cable harness between the control unit and the component with diagnostic menu. Check the component.	D790-1/ K6:11 – R690/2	ENGINE, menu 1	1 Engine
87	Incorrect signal from Control lever (S815-P1) for lift and lower. Signal voltage lower than 0.2 V or higher than 4.8 V.	Lift and lower not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the switch.	D790-1/ K7:3 – S815-P1/8	BOOM, menu 1	7.1.1 Con- trol lever
88	Incorrect signal from Control lever (S815-P2) for extension. Signal voltage lower than 0.2 V or higher than 4.8 V.	Extension not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the switch.	D790-1/ K7:4 – S815-P2/4	BOOM, menu 1	7.1.1 Con- trol lever
89	Incorrect signal from Control lever (S815-P3) for rotation. Signal voltage lower than 0.2 V or higher than 4.8 V.	Rotation not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the switch.	D790-1/ K7:5 – S815-P3/ 11	ATTACH, menu 1	7.1.1 Con- trol lever
90	Incorrect signal from Control lever (S815-P4) for tilt. Signal voltage lower than 0.2 V or higher than 4.8 V.	Controllable tilt not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the switch.	D790-1/ K7:6 – S815-P4/1	ATTACH, menu 1	7.1.1 Con- trol lever
92	Incorrect signal from Joystick (R825-1) or Mini-wheel (R825-1). Signal voltage lower than 0.2 V or higher than 4.8 V.	Joystick steering or mini-wheel not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the switch.	D790-1/ K9:8 – R825-1/P2	STEER- ING, menu 1	5.1.2 Mini- wheel 5.1.3 Joy- stick
93	Incorrect signal from Mini-wheel (R825-2). Signal voltage lower than 0.2 V or higher than 4.8 V.	Joystick steering or mini-wheel not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the switch.	D790-1/ K9:9 – R825-2/H2	STEER- ING, menu 1	5.1.2 Mini- wheel

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
94	Incorrect signal from Water valve cab heat (Y673). Signal voltage lower than 0.2 V or higher than 4.8 V.	Cab heat cannot be adjusted.	Check cable harness between the control unit and the component with diagnostic menu. Check the motor.	D790-1/ K10:4 – Y673/9	CLIMATE, menu 4	9.4.5 Water valve
96	Incorrect signal from Sensor cab temperature (B775-1). The sensor indicates temperature below -43 °C or above 105 °C.	Air conditioning not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D790-1/ K4:8 – B775-1/2	CLIMATE, menu 1	9.4.17 Sensor cab temperature
97	Incorrect signal from Sensor outdoor temperature (B774). Temperature signal above 105 °C.	Air conditioning not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D790-1/ K4:9 – B774/2	CLIMATE, menu 2	9.4.18 Sensor outdoor temperature
98	Incorrect signal from Sensor temperature outlet fan (B775-2). The sensor indicates temperature below -43 °C or above 105 °C.	Air conditioning not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D790-1/ K4:10 – B775-2/2	CLIMATE, menu 2	9.4.16 Sensor temperature outlet fan
99	Incorrect signal from Sensor temperature refrigerant (B775-3). The sensor indicates temperature below -43 °C or above 105 °C.	Air conditioning not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D790-1/ K4:11 – B775-3/2	CLIMATE, menu 2	9.4.12 Sensor temperature refrigerant
101	Redundant voltage feed left to Control unit frame front (D797-F) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu. Check the control unit.	D797-F/ K2:7	CAN/ POWER, menu 8	11.5.1.2 Redundant voltage feed of Control units
102	Redundant voltage feed right to Control unit frame front (D797-F) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu. Check the control unit.	D797-F/ K2:8	CAN/ POWER, menu 8	11.5.1.2 Redundant voltage feed of Control units

Code	Description	Limitation	Action	Con- nection and compo- nent	Diag- nostic menu	Group
103	Incorrect electric power feed to Control unit frame front (D797-F). Voltage lower than 18 V or higher than 32 V.	No electric power feed to components.	Check fuse F58-2/1, change if needed. Check cable harness between the control unit and the component with diagnostic menu.	D797-F/ K2:1, K2:9, K2:10 – F58-2/1:1, 1:2	CAN/ POWER, menu 8	11.5.1.3 Ig- nition volt- age (15)
104	Incorrect control breaker voltage to Control unit frame front (D797-F).	Functions supplied with control breaker voltage have no feed. All hydraulic functions are blocked.	Check fuse F58-3/2, change if needed. Check cable harness between the control unit and the component with diagnostic menu.	D797-F/ K2:11 – F58-3/2:1	CAN/ POWER, menu 8	11.5.1.4 Control breaker voltage
105	Incorrect 5 V reference voltage to pressure sensor. Voltage lower than 4.9 V or higher than 5.1 V.	Regeneration lift, weight indicator and overload system not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D797-F/ K1:8 – B768-R1/1, B768-R2/1, B768-L1/1, B768-L2/1	CAN/ POWER, menu 9	8.2.1.7 Sensor hy- draulic pressure lift cylinder
106	The transistor has been triggered due to short-circuiting in the circuit to Cooling fan, brake oil (M674).	Cooling fan brake oil not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the motor.	D797-F/ K1:14 – M674/1	HYD, menu 2	4.8.8 Cool- ing fan
107	The transistor has been triggered due to short-circuiting or open circuit in the circuit to High beam light left (E402L).	Left high beam not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D797-F/ K1:1 – E402L/1	LIGHTS, menu 6	9.6.1 Headlights
108	The transistor has been triggered due to short-circuiting or open circuit in the circuit to High beam light right (E402R).	Right high beam not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D797-F/ K1:15 – E402R/1	LIGHTS, menu 6	9.6.1 Headlights
110	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Low beam light (E400L/ E400R).	Low beams not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D797-F/ K1:42 – E400L/1, E400R/1	LIGHTS, menu 6	9.6.1 Headlights

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
111	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve boom up (Y6005).	Lift not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-F/ K1:2 – Y6005/1	BOOM, menu 4	7.2.5 Control valve lift, lower and extension
112	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve boom down (Y6004).	Lower not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-F/ K1:3 – Y6004/1	BOOM, menu 5	7.2.5 Control valve lift, lower and extension
113	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve boom out (Y6006).	Extension out not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-F/ K1:4 – Y6006/1	BOOM, menu 7	7.3.5 Control valve lift, lower and extension
114	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve boom in (Y6007).	Extension in not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-F/ K1:5 – Y6007/1	BOOM, menu 6	7.3.5 Control valve lift, lower and extension
115	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve blocking lift left (Y6002).	Lift and lower not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-F/ K1:30 – Y6002/1	BOOM, menu 2	7.2.7 Valve block lift cylinder
116	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve blocking lift right (Y6001).	Lift and lower not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-F/ K1:31 – Y6001/1	BOOM, menu 2	7.2.7 Valve block lift cylinder
117	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve regeneration lift right (Y6051).	Regenerating lift not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-F/ K1:32 – Y6051/1	BOOM, menu 3	7.2.7 Valve block lift cylinder

Code	Description	Limitation	Action	Con- nection and compo- nent	Diag- nostic menu	Group
118	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve regeneration lift left (Y6052).	Regenerating lift not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D797-F/ K1:33 – Y6052/1	BOOM, menu 3	7.2.7 Valve block lift cylinder
119	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve parking brake (Y642).	Parking brake cannot be released.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D797-F/ K1:7 – Y642/1	HYD, menu 5	4.5.3 Solenoid valve parking brake
120	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb direction indicator left front (H422).	Direction indicator left front not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D797-F/ K1:9 – H422/1	LIGHTS, menu 8	9.6.6 Direc- tion indica- tors
121	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb direction indicator right front (H423).	Direction indica- tor right front not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D797-F/ K1:10 – H423/1	LIGHTS, menu 8	9.6.6 Direc- tion indica- tors
122	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb running light left front H416-1).	Running light left front not work- ing.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D797-F/ K1:25 – H416-1/1	LIGHTS, menu 5	9.6.2 Run- ning lights
123	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb running light right front (H417-1).	Running light right front not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D797-F/ K1:29 – H417-1/1	LIGHTS, menu 5	9.6.2 Run- ning lights

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
124	Incorrect 24 V reference voltage to Break-contact parking brake (S200), Break-contact low brake pressure (S204), Make-contact brake lights (S216) and Break-contact declutch (S220-2).	Indicator light parking brake and warning for low brake pressure do not go off. Brake lights and declutch not working. Gear cannot be engaged since the signal for released parking brake is not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D797-F/ K1:39 – S200/1, S204/1, S216/1, S220/1	CAN/ POWER, menu 9	4.5.5 Break-contact parking brake  4.3.8 Make-contact brake lights  4.3.7 Break-contact brake pressure
133	Incorrect signal from Sensor hydraulic pressure lift cylinder left (B768-L1). Signal voltage lower than 0.2 V or higher than 4.8 V.	Overload system not working. All lift functions operate with reduced speed. Error code 150 is activated.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D797-F/ K1:21 – B768-L1/3	OP, menu 3 [V] HYD, menu 6 [bar]	7.2.9 Sensor hydraulic pressure lift cylinder
134	Incorrect signal from Sensor hydraulic pressure lift cylinder left (B768-L2). Signal voltage lower than 0.2 V or higher than 4.8 V.	Overload system not working. All lift functions operate with reduced speed. Error code 150 is activated.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D797-F/ K1:22 – B768-L2/3	OP, menu 3 [V] HYD, menu 6 [bar]	7.2.9 Sensor hydraulic pressure lift cylinder
135	Incorrect signal from Sensor hydraulic pressure lift cylinder right (B768-R1). Signal voltage lower than 0.2 V or higher than 4.8 V.	Overload system not working. All lift functions operate with reduced speed. Error code 150 is activated.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D797-F/ K1:23 – B768-R1/3	OP, menu 3 [V] HYD, menu 6 [bar]	7.2.9 Sensor hydraulic pressure lift cylinder
136	Incorrect signal from Sensor hydraulic pressure lift cylinder right (B768-R2). Signal voltage lower than 0.2 V or higher than 4.8 V.	Overload system not working. All lift functions operate with reduced speed. Error code 150 is activated.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D797-F/ K1:24 – B768-R2/3	OP, menu 3 [V] HYD, menu 6 [bar]	7.2.9 Sensor hydraulic pressure lift cylinder

Code	Description	Limitation	Action	Con- nection and compo- nent	Diag- nostic menu	Group
137	Incorrect signal from Solenoid valve boom up (Y6005). The return current does not match the control current.	Lift not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D797-F/ K1:16 – Y6005/2	BOOM, menu 4	7.2.5 Con- trol valve lift, lower and exten- sion
138	Incorrect signal from Solenoid valve boom down (Y6004). The return current does not match the control current.	Lower not work- ing.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D797-F/ K1:17 – Y6004/2	BOOM, menu 5	7.2.5 Con- trol valve lift, lower and exten- sion
139	Incorrect signal from Solenoid valve boom out (Y6006). The return current does not match the control current.	Extension out not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D797-F/ K1:18 – Y6006/2	BOOM, menu 7	7.3.5 Con- trol valve lift, lower and exten- sion
140	Incorrect signal from Solenoid valve boom in (Y6007). The return current does not match the control current.	Extension in not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D797-F/ K1:19 – Y6007/2	BOOM, menu 6	7.3.5 Con- trol valve lift, lower and exten- sion
145	Incorrect signal from Sensor boom angle (B771). Logic error, signal does not change when lift or lower is activated.	Overload sys- tem not working. All lift functions operate with re- duced speed. Error code 150 is activated.	Check sensor arm's at- tachment.  Check the sensor.  Check cable harness between the control unit and the component with diagnostic menu.	-	OP, menu 4	8.2.1.5 Sensor boom an- gle
146	Incorrect signal from Sensor boom length (B777). Logic error, signal does not change when extension is activated.	Overload sys- tem not working. All lift functions operate with re- duced speed. Error code 150 is activated.	Check the line to the sensor.  Check the sensor.  Check cable harness between the control unit and the component with diagnostic menu.	-	OP, menu 4	8.2.1.6 Sensor boom length

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
147	High brake oil temperature.	Reduced braking capacity.	Check that cooling fan is working. Check that cooler isn't clogged. Check the sensor.	D797-F/ K2:13 – B762/1	HYD, menu 2	4.8 Temperature control, cleaning and brake oil
148	Incorrect signal from Sensor brake oil temperature (B762). Signal voltage lower than 0.2 V or higher than 4.8 V.	-	Check the sensor. Check cable harness between the control unit and the component with diagnostic menu.	D797-F/ K2:13 – B762/1	HYD, menu 2	4.8.10 Sensor brake oil temperature
149	Incorrect load curve or load curve missing.	Lift, lower and extension not working.	Contact Kalmar Industries AB.	-	-	7.2 Lift and lower. 7.3 Extension
150	Defective overload protection. This error code cannot be removed with Reset.	Overload system not working. All lift functions operate with reduced speed.	Check if there are error codes for sensors in the overload system.	-	OP, menu 1 - 5	8.2.1 Overload system
151	Redundant voltage feed left to Control unit frame rear (D797-R) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu. Check the control unit.	D797-R/ K2:7	CAN/ POWER, menu 10	11.5.1.2 Redundant voltage feed of Control units
152	Redundant voltage feed right to Control unit frame rear (D797-R) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu. Check the control unit.	D797-R/ K2:8	CAN/ POWER, menu 10	11.5.1.2 Redundant voltage feed of Control units
153	Incorrect electric power feed to Control unit frame rear (D797-R). Voltage lower than 18 V or higher than 32 V.	-	Check fuse F58-2/3, change if needed. Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K2:1, K2:9, K2:10 – F58-2/3:1	CAN/ POWER, menu 10	11.5.1.3 Ignition voltage (15)
154	Incorrect electric power feed to Control unit frame rear (D797-R).	-	Check fuse F58-2/3, change if needed. Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K2:11 – F58-2/3:2	CAN/ POWER, menu 10	11.5.1.4 Control breaker voltage

Code	Description	Limitation	Action	Con- nection and compo- nent	Diag- nostic menu	Group
155	Incorrect 5 V reference voltage to analogue sensor. Voltage lower than 4.9 V or higher than 5.1 V.	Overload system and weight indicator not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the sensor.	D797-R/ K1:8 – B771/1, B777/1	CAN/ POWER, menu 11	8.2.1.5 Sensor boom an- gle  8.2.1.6 Sensor boom length (an- alogue sensor)
156	The transistor has been triggered due to short-circuiting in the circuit to Cooling fan hydraulic oil (M668).	Cooling fan hy- draulic oil not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the motor.	D797-R/ K1:14 – M668/1	HYD, menu 1	10.6.3 Cooling fan
157	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb work light boom left (E404-3L).	Work light boom left not working.	Check the light.  Check the bulb holder.  Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K1:1 – E404-3L	LIGHTS, menu 3	9.6.10 Work light boom
158	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb work light boom right (E404-3R).	Work light boom right not work- ing.	Check the light.  Check the bulb holder.  Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K1:15 – E404-3R	LIGHTS, menu 3	9.6.10 Work light boom
159	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb back-up light left (E405L).	Back-up light left not working.	Check the light.  Check the bulb holder.  Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K1:28 – E405L	LIGHTS, menu 11	9.6.5 Back- up light
160	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb back-up light right (E405R).	Back-up light right not work- ing.	Check the light.  Check the bulb holder.  Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K1:42 – E405R	LIGHTS, menu 11	9.6.5 Back- up light

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
161	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Sensor steering axle load (B7221L and b7221R).	Overload system indicates overload.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D797-R/ K1:2 – B7221L/A, B7221R/A	OP, menu 1	8.2.1.4 Sensor steering axle load
162	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Sensor position sensor boom length	Damping in/out/ 1.5m not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D797-R/ K1:2 – B777/A, B769-3/A, B769-4/A	OP, menu 1 BOOM, menu 8	8.2.1.6 Sensor boom length description (position sensor)
163	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve regeneration extension (Y6046).	Regeneration extension not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-R/ K1:4 – Y6046/1	BOOM, menu 3	7.3.7 Valve block extension cylinder
164	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve blocking extension (Y6050).	Extension not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-R/ K1:5 – Y6050/1	BOOM, menu 2	7.3.7 Valve block extension cylinder
165	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Back-up warning (H965).	Back-up alarm not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the component.	D797-R/ K1:30 – H965/1	LIGHTS, menu 11	9.7.5 Back-up alarm
166	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve top hydraulics (Y6003).	Attachment functions not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-R/ K1:31 – Y6003/1	HYD, menu 6	7.4.2 Valve block top lift hydraulics
167	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb brake light left (H411L).	Brake light left not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K1:32 – H411L/1	LIGHTS, menu 11	9.6.4 Brake lights

Code	Description	Limitation	Action	Con- nection and compo- nent	Diag- nostic menu	Group
168	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb brake light right (H411R).	Brake light right not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K1:33 – H411R/1	LIGHTS, menu 11	9.6.4 Brake lights
169	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb running light left (H416-2).	Running light left rear not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K1:7 – H416-2/1	LIGHTS, menu 5	9.6.2 Run- ning lights
170	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb running light right (H417-2).	Running light right rear not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K1:9 – H417-2/1	LIGHTS, menu 5	9.6.2 Run- ning lights
171	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb rear light left (H421L).	Rear light left not working.	Check the light. Check the bulb holder. Check the bulb holder.	D797-R/ K1:10 – H412L/1	LIGHTS, menu 5	9.6.3 Rear lights
172	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb rear light right (H421R).	Rear light left not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K1:25 – H412R/1	LIGHTS, menu 5	9.6.3 Rear lights
173	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb direction indicator left rear (H426).	Direction indica- tor left rear not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K1:29 – H426/1	LIGHTS, menu 8	9.6.6 Direc- tion indica- tors

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
174	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb direction indicator right rear (H426).	Direction indicator right rear not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K1:39 – H427/1	LIGHTS, menu 8	9.6.6 Direction indicators
175	Different signal from Sensor steering axle load (B7221L and B722R) for more than 10 seconds.	Overload system indicates overload.	Check sensor's adjustment. Check the sensor.	D797-R/ K1:11 – B7221L/C D797-R/ K1:12 – B7221R/C	OP, menu 1	8.2.1.4 Sensor steering axle load
178	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve pump unloading (Y6062).	Unloading of hydraulic oil pumps at boom in not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-R/ K1:40 – Y6062/1	BOOM, menu 2	7.3.8 Valve block pump unloading
183	Incorrect signal from Sensor boom angle (771). Signal voltage lower than 0.2 V or higher than 4.8 V.	Overload system not working. All lift functions operate with reduced speed. Error code 150 is activated.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D797-R/ K1:21 – B771/3	OP, menu 4	8.2.1.5 Sensor boom angle
184	Incorrect signal from Sensor length (777). Signal voltage lower than 0.2 V or higher than 4.8 V.	Overload system not working. All lift functions operate with reduced speed. Error code 150 is activated.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D797-R/ K1:22 – B777/3	OP, menu 4	8.2.1.6 Sensor boom length
191	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Magnetic clutch on AC compressor (M677).	Air conditioning not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the component.	D797-R/ K1:11 – M645/1	CLIMATE, menu 6	9.4.8 Compressor
192	<b>NOTE!</b> Error code 191 and 192 here go to the same user.			D797-R/ K1:26 – M645/1		

Code	Description	Limitation	Action	Con- nection and compo- nent	Diag- nostic menu	Group
193	Only engine alternative Cummins QSM11: The transistor has been triggered due to short-circuiting or open circuit in the circuit to Relay starter motor (K360).	Starter motor not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the component.	D797-R/ K1:36 – K360/86	ENGINE, menu 5	1 Engine
197	High temperature hydraulic oil.	No limitation.	Check that cooling fan is working. Check that cooler isn't clogged. Check the sensor.	D797-R/ K2:13 – B776/1	HYD, menu 1	10.6 Tem- perature control, cleaning and hy- draulic oil
198	Incorrect signal from-Sensor hydraulic oil temperature (B776).	Incorrect tem- perature display.	Check the sensor. Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K2:13 – B776/1	HYD, menu 1	10.6.4 Sen- sor hydrau- lic oil tem- pera- ture
199	Incorrect signal from Sensor fuel level (B757). Resistance higher than 180 Ω.	Incorrect dis- play of fuel amount (empty or full).	Check the sensor. Check cable harness between the control unit and the component with diagnostic menu.	D797-R/ K2:15 – B757	CAB, menu 7	1.2.2 Sen- sor fuel lev- el
201	Redundant voltage feed left to Control unit frame option (D797-O) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu. Check the control unit.	D797-O/ K2:7	CAN/ POWER, menu 12	11.5.1.2 Redundant voltage feed of Control units
202	Redundant voltage feed right to Control unit frame option (D797-O) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu. Check the control unit.	D797-O/ K2:8	CAN/ POWER, menu 12	11.5.1.2 Redundant voltage feed of Control units
203	Incorrect electric power feed to Control unit frame option (D797-O). Voltage lower than 18 V or higher than 32 V.	-	Check fuse F58-2/4, change if needed. Check cable harness between the control unit and the component with diagnostic menu.	D797-O/ K2:10 – F58-2/4:1	CAN/ POWER, menu 12	11.5.1.3 Ig- nition volt- age (15)

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
204	Incorrect control breaker voltage to Control unit frame option (D797-O).	Functions supplied with control breaker voltage have no feed. All hydraulic functions are blocked.	Check fuse F58-3/4, change if needed. Check cable harness between the control unit and the component with diagnostic menu.	D797-O/ K2:11 – F58-3/4:1	CAN/ POWER, menu 12	11.5.1.4 Control breaker voltage
211	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve cab front/up (Y6016).	Hydraulic sliding cab or cab lift not working	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-O/ K1:2 – Y6016/1	SLIDING CAB, menu 3	9.10.4.3 Control valve op- tion frame  9.10.5.2 Control valve op- tion frame
212	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve cab rear/down (Y6017).	Hydraulic sliding cab or cab lift not working	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-O/ K1:3 – Y6017/1	SLIDING CAB, menu 4	9.10.4.3 Control valve op- tion frame  9.10.5.2 Control valve op- tion frame
213	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve steering left (Y636L).	Joystick steering or mini-wheel not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-O/ K1:4 – Y636L1/1	EL- STEER- ING, menu 4	5.2.10 Control valve joy- stick steer- ing/mini- wheel
214	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve steering right (Y636R).	Joystick steering or mini-wheel not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-O/ K1:5 – Y636R1/1	EL- STEER- ING, menu 5	5.2.10 Control valve joy- stick steer- ing/mini- wheel
215	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve support jacks up (Y6053).	Support jacks not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D797-O/ K1:30 – Y6063/1	SUP- PORT JACKS, menu 3	7.10.1.2 Control valve op- tion frame

Code	Description	Limitation	Action	Conne- tion and compo- nent	Diag- nostic menu	Group
216	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve support jacks down (Y6064).	Support jacks not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D797-O/ K1:31 – Y6064/1	SUP- PORT JACKS, menu 3	7.10.1.2 Control valve op- tion frame
217	Solenoid valve cab tilt up (Y6047).	Cab tilt not work- ing.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D797-O/ K1:32 – Y6047/1	SLIDING CAB, menu 3	MISSING
218	Solenoid valve cab tilt down (Y6048).	Cab tilt not work- ing.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D797-O/ K1:33 – Y6048/1	SLIDING CAB, menu 4	MISSING
219	Solenoid valve disen- gagement of hydraulic oil pumps (Y6057).	Disengagement of hydraulic oil pump when low- ering tiltable cab not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D797-O/ K1:7 – Y6057/1	HYD, menu 6	MISSING
220	Incorrect 24 V reference voltage to Position sen- sor support jacks (B7222L, B7222R, B7223L and B7223R).	Indication sup- port jacks up not working. Gear cannot be se- lected to operate the machine.	Check cable harness between the control unit and the component with diagnostic menu.  Check the sensor.	D797-O/ K1:9 – B7222L, B7222R, B7223L, B7223R	SUP- PORT JACKS, menu 2	7.10.1.5 Sensor raised sup- port jacks  7.10.1.6 Sensor lowered support jacks
221	Incorrect 24 V reference voltage to Position sen- sor cab lift (B777-2).	Indication Low- ered cab not working. Door must be closed to allow lowering of boom. Speed limitation is acti- vated.	Check cable harness between the control unit and the component with diagnostic menu.  Check the sensor.	D797-O/ K1:10 – B777-2/1	SLIDING CAB, menu 4	9.10.5.8 Sensor lowered cab

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
237	Incorrect signal from Solenoid valve cab front/up (Y6016). The return current does not match the control current.	Hydraulic sliding cab or cab lift not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D797-O/ K1:16 – Y6016/2	SLIDING CAB, menu 3	9.10.4.3 Control valve op- tion frame  9.10.5.2 Control valve op- tion frame
238	Incorrect signal from Solenoid valve cab rear/down (Y6017). The return current does not match the control current.	Hydraulic sliding cab or cab lift not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D797-O/ K1:17 – Y6017/2	SLIDING CAB, menu 4	9.10.4.3 Control valve op- tion frame  9.10.5.2 Control valve op- tion frame
239	Incorrect signal from Solenoid valve steering left (Y636L). The return current does not match the control current.	Joystick steering or mini-wheel not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D797-O/ K1:18 – Y636L/2	EL- STEER- ING, menu 4	5.2.10 Control valve joy- stick steer- ing/mini- wheel
240	Incorrect signal from Solenoid valve steering right (Y636R). The return current does not match the control current.	Joystick steering or mini-wheel not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D797-O/ K1:19 – Y636R/2	EL- STEER- ING, menu 5	5.2.10 Control valve joy- stick steer- ing/mini- wheel
251	Redundant voltage feed left to Control unit attachment (D791-1) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu.	D791-1/ K2:7	CAN/ POWER, menu 16	11.5.1.2 Redundant voltage feed of Control units
252	Redundant voltage feed left to Control unit attachment (D791-1) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu.	D791-1/ K2:8	CAN/ POWER, menu 16	11.5.1.2 Redundant voltage feed of Control units

Code	Description	Limitation	Action	Con- nection and compo- nent	Diag- nostic menu	Group
253	Incorrect electric power feed to Control unit attachment (D791-1). Voltage lower than 18 V or higher than 32 V.	Functions supplied with control breaker voltage have no feed. No attachment functions working.	Check fuse F58-3/1, change if needed. Check fuse F52-1, change if needed. Check cable harness between the control unit and the component with diagnostic menu.	D791-1/ K2:1/9/10– F52-1 – F58-3/1:1	CAN/ POWER, menu 16	11.5.1.4 Control breaker voltage
254	Incorrect control breaker voltage to Control unit attachment (D791-1).	Functions supplied with control breaker voltage have no feed. No attachment functions working.	Check fuse F58-3/1, change if needed. Check fuse F52-1, change if needed. Check cable harness between the control unit and the component with diagnostic menu.	D791-1/ K2:11 – F58-3/1	CAN/ POWER, menu 16	11.5.1.4 Control breaker voltage
257	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb work light attachment right (E406R).	Work light attachment right not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D791-1/ K1:1 – E406R	LIGHTS, menu 2	9.6.11 Work light attachment
258	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb work light attachment left (E406L).	Work light attachment left not working.	Check bulb. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D791-1/ K1:15 – E406L	LIGHTS, menu 2	9.6.11 Work light attachment
259	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Buzzer automatic positioning 20'-40' (H4009).	Automatic positioning 20'-40' not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the component.	D791-1/ K1:28 – H9003/1	ATTACH, menu 15	7.5 Spreading
260	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Light bulb extra work light attachment (E404-4L and E404-4R).	Extra work light attachment not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D791-1/ K1:42 – E404-4L, E404-4R	LIGHTS, menu 2	9.6.11 Work light attachment

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
261	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve rotation clockwise (Y6008).	Rotation of attachment not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-1/ K1:2 – Y6008/1	ATTACH, menu 11	7.6.3 Control valve attachment
262	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve rotation counter-clockwise (Y6009)	Rotation of attachment not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-1/ K1:3 – Y6009/1	ATTACH, menu 12	7.6.3 Control valve attachment
263	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve positioning out (Y6018).	Spreading not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-1/ K1:4 – Y6018/1	ATTACH, menu 13	7.5.3 Control valve attachment
264	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve positioning in (Y6019).	Spreading not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-1/ K1:5 – Y6019/1	ATTACH, menu 14	7.5.3 Control valve attachment
265	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve sideshift right (Y6021).	Sideshift of attachment not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-1/ K1:30 – Y6021/1	ATTACH, menu 8	7.4.3 Control valve attachment
266	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve sideshift left (Y6020).	Sideshift of attachment not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-1/ K1:31 – Y6020/1	ATTACH, menu 8	7.4.3 Control valve attachment
267	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve lock twistlock (Y6040).	Twistlock not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-1/ K1:32 – Y6040/1	ATTACH, menu 9	7.9.1.3 Control valve attachment

Code	Description	Limitation	Action	Con- nec- tion and compo- nent	Diag- nostic menu	Group
268	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve open twistlock (Y6039).	Twistlock not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-1/ K1:33 – Y6039/1	ATTACH, menu 9	7.9.1.3 Control valve at- tachment
269	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve tilt lock 1 (Y6012-1).	Tilt locked, tilt damping and controllable tilt not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-1/ K1:7 – Y6012-1/1	ATTACH, menu 15	7.7.4 Lock valve tilt
270	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve tilt lock 2 (Y6012-2).	Tilt locked, tilt damping and controllable tilt not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-1/ K1:9 – Y6012-2/1	ATTACH, menu 15	7.7.4 Lock valve tilt
271	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Voltage feed Position sensor attachment.	Twistlocks, rotation stop, and positioning not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the sensor.	D791-1/ K1:10 – B769/A, B777-2/A, B7225/A, B7202R/A, B7204R/A, B7205R/A, B7203R/A, B7202L/A, B7204L/A, B7205L/A, B7203L/A, B7224/A	ATTACH, menu 5, 6, 7, 21	7.5.10 Po- sition sen- sor positioning 7.6.10 Sen- sor rotation stop 7.9.1.8 Sensor alignment 7.9.1.9 Sensor twistlocks 8.2.1.6 Sensor boom length de- scription (position sensor)

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
272	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Indicator light twistlock open (H562).	Indicator light open twistlock not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D791-1/ K1:25 – H562/1	ATTACH, menu 10	7.9.1 Twistlocks
273	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Indicator light alignment (H564).	Indicator light alignment twistlock not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D791-1/ K1:29 – H564/1	ATTACH, menu 10	7.9.1 Twistlocks
274	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Indicator light twistlock locked (H563).	Indicator light locked twistlock not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D791-1/ K1:39 – H563/1	ATTACH, menu 10	7.9.1 Twistlocks
287	Incorrect signal from Solenoid valve rotation clockwise (Y6008). The return current does not match the control current.	Rotation of attachment not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-1/ K1:16 – Y6008/2	ATTACH, menu 11	7.6.3 Control valve attachment
288	Incorrect signal from Solenoid valve rotation counter-clockwise (Y6009). The return current does not match the control current.	Rotation of attachment not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-1/ K1:17 – Y6009/2	ATTACH, menu 12	7.6.3 Control valve attachment
289	Incorrect signal from Solenoid valve positioning out (Y6018). The return current does not match the control current.	Spreading not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-1/ K1:18 – Y6018/2	ATTACH, menu 13	7.5.3 Control valve attachment

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
290	Incorrect signal from Solenoid valve positioning in (Y6019). The return current does not match the control current.	Spreading not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-1/ K1:19 – Y6019/2	ATTACH, menu 14	7.5.3 Control valve attachment
298	Sensor twistlock indicates that left twistlock is between open and locked position.	Lift and extension not working.	Check that Sensors twistlock are clean and correctly adjusted.  Check cable harness between the control unit and the component with diagnostic menu.	-	ATTACH, menu 7	7.9.1.9 Sensor twistlocks
299	Sensor twistlock indicates that right twistlock is between open and locked position.	Lift and extension not working.	Check that Sensors twistlock are clean and correctly adjusted.  Check cable harness between the control unit and the component with diagnostic menu.	-	ATTACH, menu 7	7.9.1.9 Sensor twistlocks
300	Sensor alignment indicates unreasonable condition.	Twistlock not working.	Check that Sensors alignment are clean and correctly adjusted.  Check that contact pin runs freely.  Check cable harness between the control unit and the component with diagnostic menu.	-	ATTACH, menu 6	7.9.1.8 Sensor alignment
301	Redundant voltage feed left to Control unit attachment option (D791-2) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu.  Check the control unit.	D791-2/ K2:7	CAN/ POWER, menu 17	11.5.1.2 Redundant voltage feed of Control units
302	Redundant voltage feed left to Control unit attachment option (D791-2) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu.  Check the control unit.	D791-2/ K2:8	CAN/ POWER, menu 17	11.5.1.2 Redundant voltage feed of Control units

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
303	Incorrect electric power feed to Control unit attachment option (D791-2). Voltage lower than 18 V or higher than 32 V.	Levelling, tilt and special function not working.	Check fuse F58-3/1 and F52-1, change if needed. Check cable harness between the control unit and the component with diagnostic menu.	D791-2/ K2:1, K2:9, K2:10 – F52-1 – F58-3/1	CAN/ POWER, menu 17	11.5.1.4 Control breaker voltage
304	Incorrect control breaker voltage to Control unit attachment option (D791-2).	Functions supplied with control breaker voltage have no feed. Levelling, tilt and special function not working.	Check fuse F58-3/1 and F52-1, change if needed. Check cable harness between the control unit and the component with diagnostic menu.	D791-2/ K2:11 – F52-1 – F58-3/1	CAN/ POWER, menu 17	11.5.1.4 Control breaker voltage
311	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve levelling right (Y6035).	Levelling not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-2/ K1:2 – Y6035/1	ATTACH, menu 19	7.8.3 Con- trol valve attachment
312	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve levelling left (Y6036).	Levelling not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-2/ K1:3 – Y6036/1	ATTACH, menu 20	7.8.3 Con- trol valve attachment
313	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve tilt out (Y6010).	Controllable tilt not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-2/ K1:4 – Y6010/1	ATTACH, menu 16	7.7.5 Con- trol valve attachment
314	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve tilt in (Y6011).	Controllable tilt not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-2/ K1:5 – Y6011/1	ATTACH, menu 17	7.7.5 Con- trol valve attachment

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
315	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve levelling lock (Y6034-1).	Levelling is locked, controllable levelling and float mode not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-2/ K1:30 – Y6034-1/1	ATTACH, menu 18	7.8.6 Valve block levelling cylinders
316	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve levelling lock (Y6034-2).	Levelling is locked, controllable levelling and float mode not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-2/ K1:31 – Y6034-2/1	ATTACH, menu 18	7.8.6 Valve block levelling cylinders
317	Incorrect output signal special function.		WARNING	D791-2/ K1:32		
318	Incorrect output signal special function.		WARNING	D791-2/ K1:33		
319	Incorrect output signal special function.		WARNING	D791-2/ K1:7		
320	Incorrect output signal special function.		WARNING	D791-2/ K1:9		
321	Incorrect output signal special function.		WARNING	D791-2/ K1:10		
322	Incorrect output signal special function.		WARNING	D791-2/ K1:25		
337	Incorrect signal from Solenoid valve levelling right (Y6035). The return current does not match the control current.	Levelling not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-2/ K1:16 – Y6035/2	ATTACH, menu 17	7.8.3 Control valve attachment
338	Incorrect signal from Solenoid valve levelling left (Y6036). The return current does not match the control current.	Levelling not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-2/ K1:17 – Y6036/2	ATTACH, menu 18	7.8.3 Control valve attachment

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
339	Incorrect signal from Solenoid valve tilt out (Y6010). The return current does not match the control current.	Controllable tilt not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-2/ K1:18 – Y6010/2	ATTACH, menu 14	7.7.5 Control valve attachment
340	Incorrect signal from Solenoid valve tilt in (Y6011). The return current does not match the control current.	Controllable tilt not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-2/ K1:19 – Y6011/2	ATTACH, menu 15	7.7.5 Control valve attachment
351	Redundant voltage feed left to Control unit attachment left legs (D791-3) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu.  Check the control unit.	D791-3/ K2:7	CAN/ POWER, menu 18	11.5.1.2 Redundant voltage feed of Control units
352	Redundant voltage feed right to Control unit attachment left legs (D791-3) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu.  Check the control unit.	D791-3/ K2:8	CAN/ POWER, menu 18	11.5.1.2 Redundant voltage feed of Control units
353	Incorrect electric power feed to Control unit attachment left legs (D791-3). Voltage lower than 18 V or higher than 32 V.	Left lift leg not working.	Check fuse F58-3/1 and F52-2, change if needed.  Check cable harness between the control unit and the component with diagnostic menu.	D791-3/ K2:1 – F52-2 – F58-3/1	CAN/ POWER, menu 18	11.5.1.4 Control breaker voltage
354	Incorrect control breaker voltage to Control unit attachment left legs (D791-3).	Functions supplied with control breaker voltage have no feed. Left lift leg not working.	Check fuse F58-3/1 and F52-2, change if needed.  Check cable harness between the control unit and the component with diagnostic menu.	D791-3/ K2:11 – F52-2 – F58-3/1	CAN/ POWER, menu 18	11.5.1.4 Control breaker voltage

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
357	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Work light left lift leg (E404-6L).	Work light left lift leg not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D791-3/ K1:1 – E404-6L/1	-	9.6.11 Work light attachment
358	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve levelling lock (Y6034-1) and Solenoid valve levelling lock (Y6034-2).	Levelling is locked, controllable levelling and float mode not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-3/ K1:15 – Y6034-1/1, Y6034-2/1	ATTACH, menu 18	7.8.6 Valve block levelling cylinders
360	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve operating position (Y6053L).	Left lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-3/ K1:42 – Y6053L/1	COMBI, menu 16	7.9.2.5 Valve operating position
361	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve levelling right (Y6035).	Levelling not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-3/ K1:2 – Y6035/1	ATTACH, menu 19	7.8.3 Control valve attachment
362	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve levelling left (Y6036).	Levelling not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-3/ K1:3 – Y6036/1	ATTACH, menu 20	7.8.3 Control valve attachment
363	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve front knee in (Y6057L).	Left lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-3/ K1:4 – Y6057L/1	COMBI, menu 11	7.9.2.3 Control valve lift legs

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
364	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve front knee out (Y6056L).	Left lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-3/ K1:5 – Y6056L/1	COMBI, menu 10	7.9.2.3 Control valve lift legs
365	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve rear knee in (Y6059L).	Left lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-3/ K1:30 – Y6059L/1	COMBI, menu 13	7.9.2.3 Control valve lift legs
366	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve rear knee out (Y6058L).	Left lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-3/ K1:31 – Y6058L/1	COMBI, menu 12	7.9.2.3 Control valve lift legs
367	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve lowering front leg (Y6013L).	Left lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-3/ K1:32 – Y6013L/1	COMBI, menu 10	7.9.2.3 Control valve lift legs
368	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve front leg up (Y6060L).	Left lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-3/ K1:33 – Y6060L/1	COMBI, menu 11	7.9.2.3 Control valve lift legs
369	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve lowering rear leg (Y6014L).	Left lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-3/ K1:7 – Y6014L/1	COMBI, menu 12	7.9.2.3 Control valve lift legs
370	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve rear leg up (Y6061L).	Left lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-3/ K1:9 – Y6061L/1	COMBI, menu 13	7.9.2.3 Control valve lift legs

Code	Description	Limitation	Action	Con- nection and compo- nent	Diag- nostic menu	Group
371	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Indicator light (H566R).	Indicator light alignment lift leg right front not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D791-3/ K1:10 – H566R/1	COMBI, menu 7	7.9.2 Lift legs
372	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Indicator light (H567R).	Indicator light alignment lift leg right rear not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D791-3/ K1:25 – H567R/1	COMBI, menu 7	7.9.2 Lift legs
373	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Indicator light (H556L).	Indicator light alignment lift leg left front not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D791-3/ K1:29 – H566L/1	COMBI, menu 7	7.9.2 Lift legs
374	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Indicator light (H556L).	Indicator light alignment lift leg left rear not working.	Check the light. Check the bulb holder. Check cable harness between the control unit and the component with diagnostic menu.	D791-3/ K1:39 – H567L/1	COMBI, menu 7	7.9.2 Lift legs
375	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve clamp shut (Y6054L).	Left lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-3/ K1:11 – Y6054L/1	COMBI, menu 15	7.9.2.3 Control valve lift legs
376	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve clamp open (Y6055L).	Left lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-3/ K1:12 – Y6055L/1	COMBI, menu 15	7.9.2.3 Control valve lift legs

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
377	The transistor has been triggered due to short-circuiting or open circuit in the circuit to voltage feed position sensor left leg pair.	Left lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D791-3/ K1:26 – B7212L/A, B7213L/A, B7214L/A, B7215L/A, B7216L/A, B7217L/A, B7218L/A, B7219L/A, B7220L/A	COMBI, menu 2, 3, 4, 5, 6	7.9.2.9 Sensor operating position 7.9.2.10 Sensor knee 7.9.2.13 Sensor lift leg 7.9.2.15 Sensor alignment 7.9.2.16 Sensor clamping position
387	Incorrect signal from Solenoid valve levelling right (Y6035). The return current does not match the control current.	Levelling not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-3/ K1:16 – Y6035/2	ATTACH, menu 19	7.8.3 Control valve attachment
388	Incorrect signal from Solenoid valve levelling left (Y6036). The return current does not match the control current.	Levelling not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-3/ K1:17 – Y6036/2	ATTACH, menu 20	7.8.3 Control valve attachment
401	Redundant voltage feed left to Control unit attachment right leg pair (D791-4) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu. Check the control unit.	D791-4/ K2:7	CAN/ POWER, menu 19	11.5.1.2 Redundant voltage feed of Control units
402	Redundant voltage feed right to Control unit attachment right leg pair (D791-4) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu. Check the control unit.	D791-4/ K2:8	CAN/ POWER, menu 19	11.5.1.2 Redundant voltage feed of Control units

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
403	Incorrect electric power feed to Control unit attachment right leg pair (D791-4). Voltage lower than 18 V or higher than 32 V.	Right lift leg and controllable tilt not working.	Check fuse F58-3/1 and F52-2, change if needed.  Check cable harness between the control unit and the component with diagnostic menu.	D791-4/ K2:1 – F52-2 – F58-3/1	CAN/ POWER, menu 19	11.5.1.4 Control breaker voltage
404	Incorrect control breaker voltage to Control unit attachment right leg pair (D791-4).	Control breaker cannot be disengaged. Right lift leg and controllable tilt not working.	Check fuse F58-3/1 and F52-2, change if needed.  Check cable harness between the control unit and the component with diagnostic menu.	D791-4/ K2:11 – F52-2 – F58-3/1	CAN/ POWER, menu 19	11.5.1.4 Control breaker voltage
407	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Work light left lift leg (E404-6R).	Work light left lift leg not working.	Check the light.  Check the bulb holder.  Check cable harness between the control unit and the component with diagnostic menu.	D791-4/ K1:1 – E404-6R	-	9.1.11 Work light attachment
410	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve operating position (Y6053R).	Right lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-4/ K1:42 – Y6053R/1	COMBI, menu 16	7.9.2.5 Valve oper- ating posi- tion
411	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve tilt out (Y6010).	Controllable tilt not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-4/ K1:15 – Y6010/1	ATTACH, menu 16	7.7.5 Con- trol valve attachment
412	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve tilt in (Y6010).	Controllable tilt not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-4/ K1:15 – Y6011/1	ATTACH, menu 17	7.7.5 Con- trol valve attachment

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
413	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve front knee in (Y6057R).	Right lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-4/ K1:4 – Y6057R/1	COMBI, menu 11	7.9.2.3 Control valve lift legs
414	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve front knee out (Y6056R).	Right lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-4/ K1:5 – Y6056R/1	COMBI, menu 10	7.9.2.3 Control valve lift legs
415	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve rear knee in (Y6059R).	Right lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-4/ K1:30 – Y6059R/1	COMBI, menu 13	7.9.2.3 Control valve lift legs
416	The transistor has been triggered due to short-circuiting in the circuit to Solenoid valve rear knee out (Y6058L).	Right lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-4/ K1:31 – Y6058R/1	COMBI, menu 12	7.9.2.3 Control valve lift legs
417	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve lowering front leg (Y6013R).	Right lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-4/ K1:32 – Y6013R/1	COMBI, menu 10	7.9.2.3 Control valve lift legs
418	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve front leg up (Y6060R).	Right lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-4/ K1:33 – Y6060R/1	COMBI, menu 11	7.9.2.3 Control valve lift legs
419	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve lowering rear leg (Y6014R).	Right lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-4/ K1:7 – Y6014R/1	COMBI, menu 12	7.9.2.3 Control valve lift legs

Code	Description	Limitation	Action	Con- nection and compo- nent	Diag- nostic menu	Group
420	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve rear leg up (Y6061R).	Right lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu.  Check the solenoid valve.	D791-4/ K1:9 – Y6061R/1	COMBI, menu 13	7.9.2.3 Control valve lift legs
421	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Indicator light (H580).	Indicator light front legs raised not working.	Check the light.  Check the bulb holder.  Check cable harness between the control unit and the component with diagnostic menu.	D791-4/ K1:10 – H580/1	COMBI, menu 9	7.9.2 Lift legs
422	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Indicator light (H581).	Indicator light front legs lowered not working.	Check the light.  Check the bulb holder.  Check cable harness between the control unit and the component with diagnostic menu.	D791-4/ K1:25 – H581/1	COMBI, menu 9	7.9.2 Lift legs
423	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Indicator light (H578).	Indicator light clamping position lift legs front not working.	Check the light.  Check the bulb holder.  Check cable harness between the control unit and the component with diagnostic menu.	D791-4/ K1:29 – H578/1	COMBI, menu 8	7.9.2 Lift legs
424	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Indicator light (H579).	Indicator light clamping position lift legs rear not working.	Check the light.  Check the bulb holder.  Check cable harness between the control unit and the component with diagnostic menu.	D791-4/ K1:39 – H579/1	COMBI, menu 8	7.9.2 Lift legs
425	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve clamp shut (Y6054R).	Right lift leg not working.		D791-4/ K1:2 – Y6054R	COMBI, menu 15	7.9.2.3 Control valve lift legs
426	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Solenoid valve clamp open (Y6055R).	Right lift leg not working.		D791-4/ K1:3 – Y6055R	COMBI, menu 15	7.9.2.3 Control valve lift legs

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
427	The transistor has been triggered due to short-circuiting or open circuit in the circuit to Voltage feed position sensor right leg pair.	Right lift leg not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the sensor.	D791-4/ K1:26 – B7212R/A, B7213R/A, B7214R/A, B7215R/A, B7216R/A, B7217R/A, B7218R/A, B7219R/A, B7220R/A	COMBI, menu 2, 3, 4, 5, 6	7.9.2.9 Sensor operating position 7.9.2.10 Sensor knee 7.9.2.13 Sensor lift leg 7.9.2.15 Sensor alignment 7.9.2.16 Sensor clamping position
437	Incorrect signal from Solenoid valve tilt out (Y6010). The return current does not match the control current.	Controllable tilt not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-4/ K1:16 – Y6010/2	ATTACH, menu 16	7.7.5 Control valve attachment
438	Incorrect signal from Solenoid valve tilt in (Y6010). The return current does not match the control current.	Controllable tilt not working.	Check cable harness between the control unit and the component with diagnostic menu. Check the solenoid valve.	D791-4/ K1:17 – Y6011/2	ATTACH, menu 17	7.7.5 Control valve attachment
451	Redundant voltage feed left to Control unit KID (D795) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu.	795/K1:7	CAN/ POWER, menu 14	11.5.1.2 Redundant voltage feed of Control units
452	Redundant voltage feed right to Control unit KID (D795) does not arrive.	-	Check cable harness between the control unit and the component with diagnostic menu.	795/K1:8	CAN/ POWER, menu 14	11.5.1.2 Redundant voltage feed of Control units

Code	Description	Limitation	Action	Connection and component	Diagnostic menu	Group
460	No messages received on CAN-buffer 1.	Incorrect values in operating menus.	Use diagnostic menu to check CAN-bus	D795/ K1:10, K1:11, K1:12, K1:13	CAN/ POWER, menu 1, 2, 21	11.6.2 Redundant CAN-bus
461	No messages received on CAN-buffer 2.	Error codes from other Control units cannot be shown.	Use diagnostic menu to check CAN-bus	D795/K1:5, K1:6	CAN/ POWER, menu 1, 2, 21	11.6.2 Redundant CAN-bus
500	Time for service.	-	Check that service has been performed. If service is done according to Kalmar Industries service intervals, reset the service indicator, see tab 8 Control system, group 8.2.6 Service indicator.	-	-	8.2.6 Service indicator

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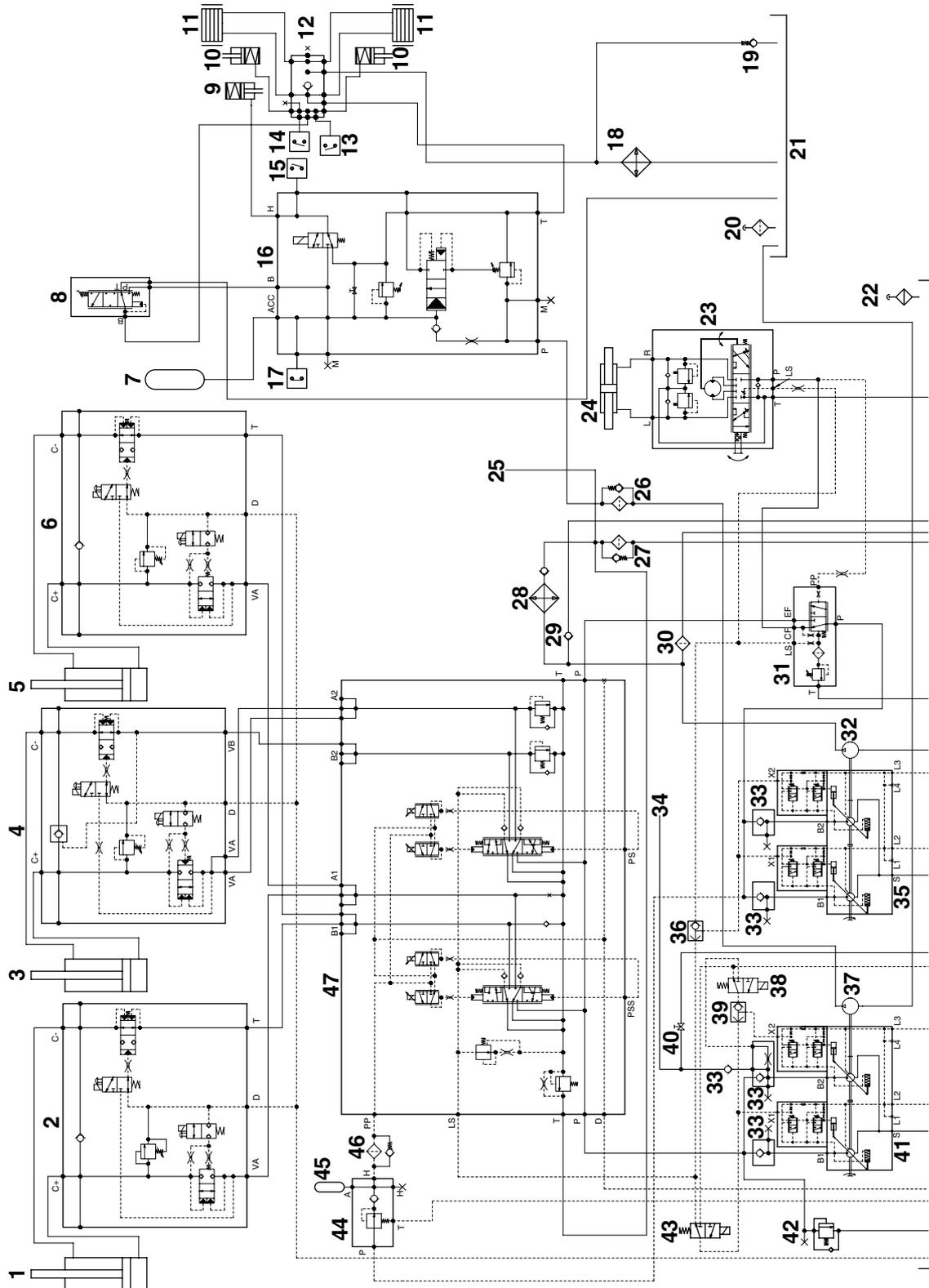


# 10 Common hydraulics

## Hydraulic diagrams, compilation

<b>Designation</b>	<b>Drawing number</b>
<i>Hydraulic diagram basic machine page 4</i>	A40740.0100
<i>Hydraulic diagram top lift page 6</i>	A40853.0100
<i>Hydraulic diagram top lift, tilt lock and controllable tilt page 8</i>	A40853.0200
<i>Hydraulic diagram top lift, tilt lock, controllable tilt and hydraulic levelling page 10</i>	A43123.0100
<i>Hydraulic diagram joystick steering page 12</i>	A48056.0100
<i>Hydraulic diagram sliding cab page 14</i>	A40855.0100
<i>Hydraulic diagram cab lift and support jacks page 16</i>	A43276.0100
<i>Hydraulic diagram sliding cab and support jacks page 18</i>	A40854.0100
<i>Hydraulic diagram combi attachment (part 1 of 3) page 20</i>	A41791.0100
<i>Hydraulic diagram combi attachment (part 2 of 3) page 22</i>	A41791.0100
<i>Hydraulic diagram combi attachment (part 3 of 3) page 24</i>	A41791.0100

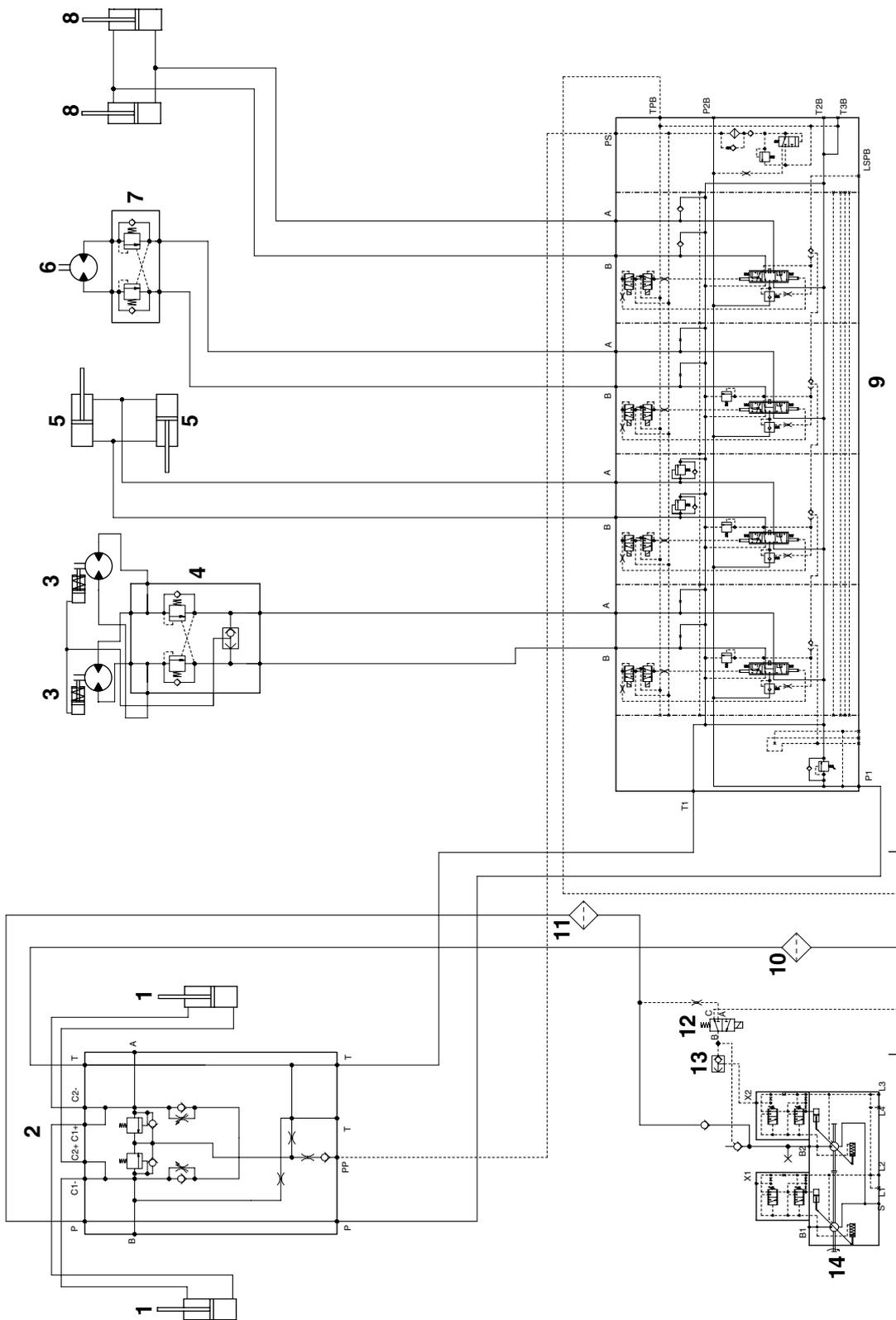
# Hydraulic diagram basic machine



003183 (A40740.0100 ver. 8)

- 
1. Lift cylinder
  2. Valve block lift cylinder
  3. Extension cylinder
  4. Valve block extension cylinder
  5. Lift cylinder
  6. Valve block lift cylinder
  7. Accumulator brake pressure
  8. Brake valve
  9. Parking brake caliper
  10. Brake cylinder
  11. Wheel brake
  12. Drive axle block
  13. Make-contact declutch
  14. Make-contact brake light
  15. Make-contact parking brake
  16. Accumulator charging valve
  17. Breaking contact brake pressure
  18. Cooler brake oil
  19. Thermal by-pass valve
  20. Breather filter brake oil tank
  21. Brake oil tank
  22. Breather filter hydraulic oil tank
  23. Steering valve
  24. Steering cylinder
  25. Oil return from attachment
  26. Brake oil filter
  27. Hydraulic oil filter
  28. Cooler hydraulic oil
  29. By-pass valve hydraulic oil cooler
  30. Fine filter hydraulic oil
  31. Priority valve
  32. Pump cooling and filtering of hydraulic oil
  33. Non-return valve
  34. Pressure feed to attachment
  35. Hydraulic oil pump 3 and 4
  36. Shuttle valve
  37. Pump brake system
  38. Valve block top lift hydraulics
  39. Shuttle valve
  40. Unloading valve attachment
  41. Hydraulic oil pump 1 and 2
  42. Pressure limiting valve
  43. Valve block pump unloading
  44. Pressure reducer
  45. Accumulator servo pressure
  46. Servo filter
  47. Control valve lift and lower as well as extension

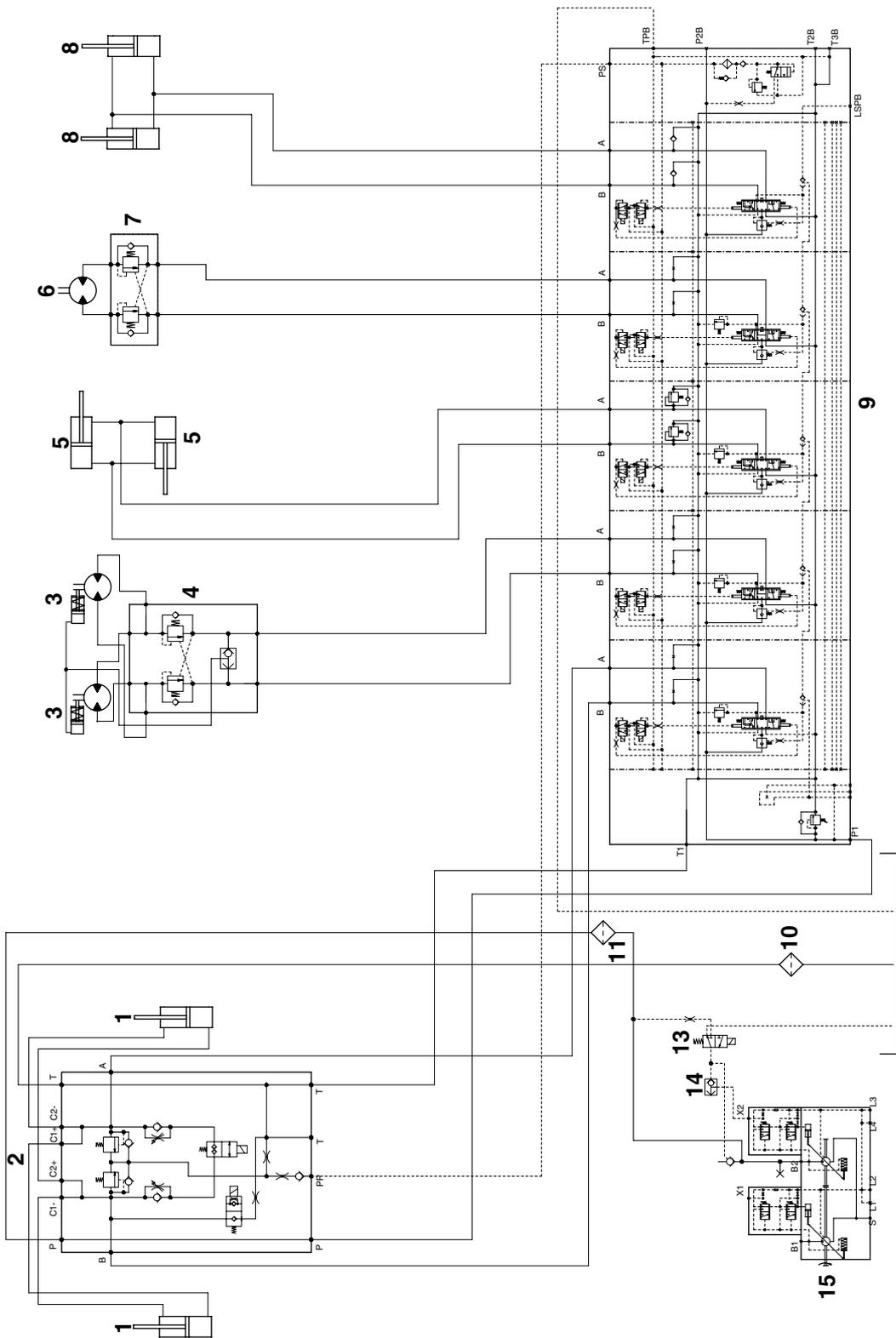
# Hydraulic diagram top lift



003184 (A40853.0100 ver. 4)

1. Tilt cylinder
2. Damping block
3. Rotation motor unit
4. Valve block rotation motor
5. Sideshift cylinders
6. Spreader motor
7. Valve block spreader motor
8. Twistlock cylinders
9. Control valve attachment
10. Filter hydraulic oil
11. Filter hydraulic oil (high pressure filter) 
12. Solenoid valve engagement hydraulic pressure
13. Shuttle valve
14. Hydraulic oil pump 1 and 2

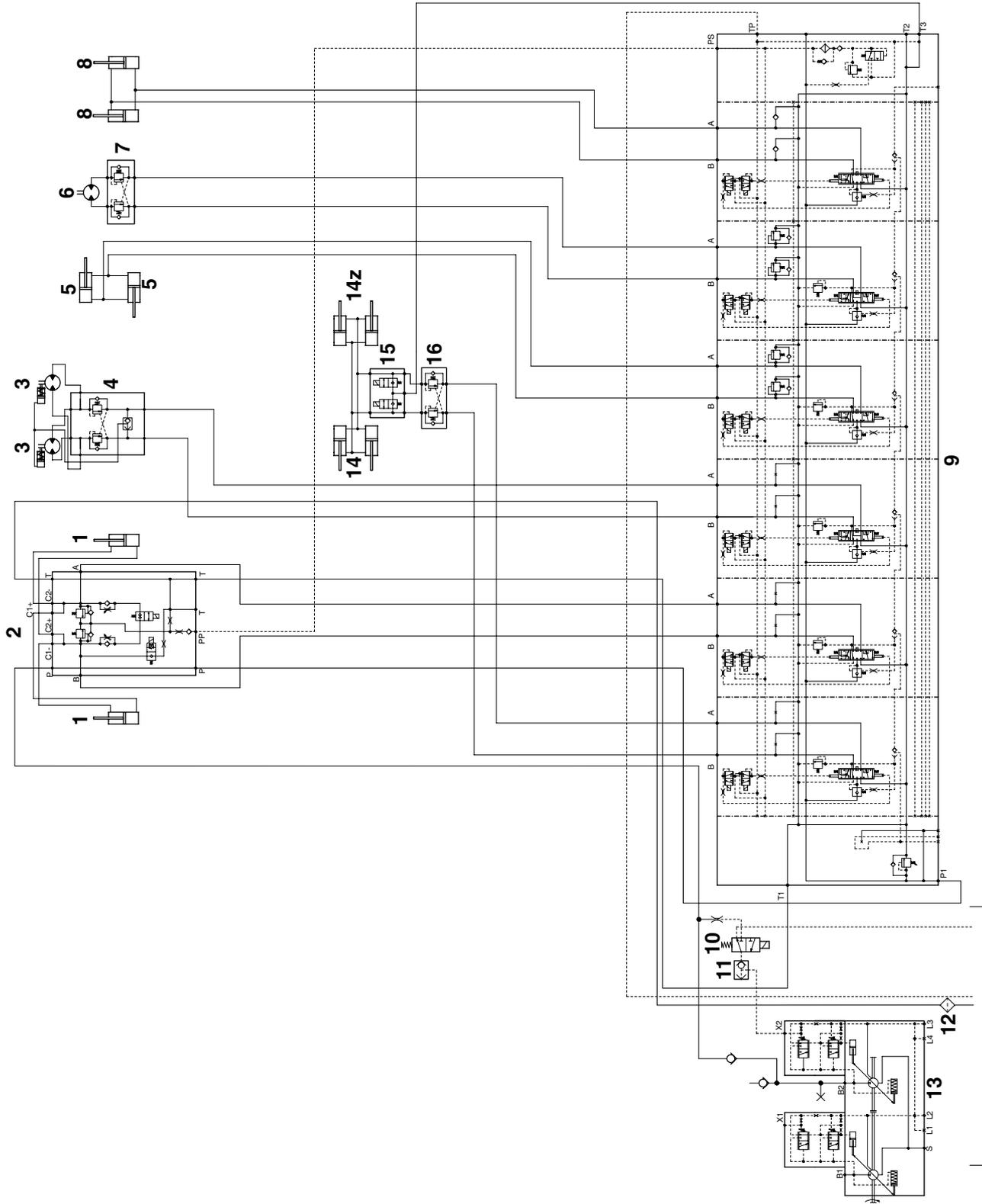
# Hydraulic diagram top lift, tilt lock and controllable tilt



003185 (A40853.0200 ver. 5)

- 
1. Tilt cylinder
  2. Damping block
  3. Rotation motor unit
  4. Valve block rotation motor
  5. Sideshift cylinders
  6. Spreader motor
  7. Valve block spreader motor
  8. Twistlock cylinders
  9. Control valve attachment
  10. Filter hydraulic oil
  11. Filter hydraulic oil (high pressure filter) 
  12. Solenoid valve engagement hydraulic pressure
  13. Shuttle valve
  14. Hydraulic oil pump 1 and 2

# Hydraulic diagram top lift, tilt lock, controllable tilt and hydraulic levelling



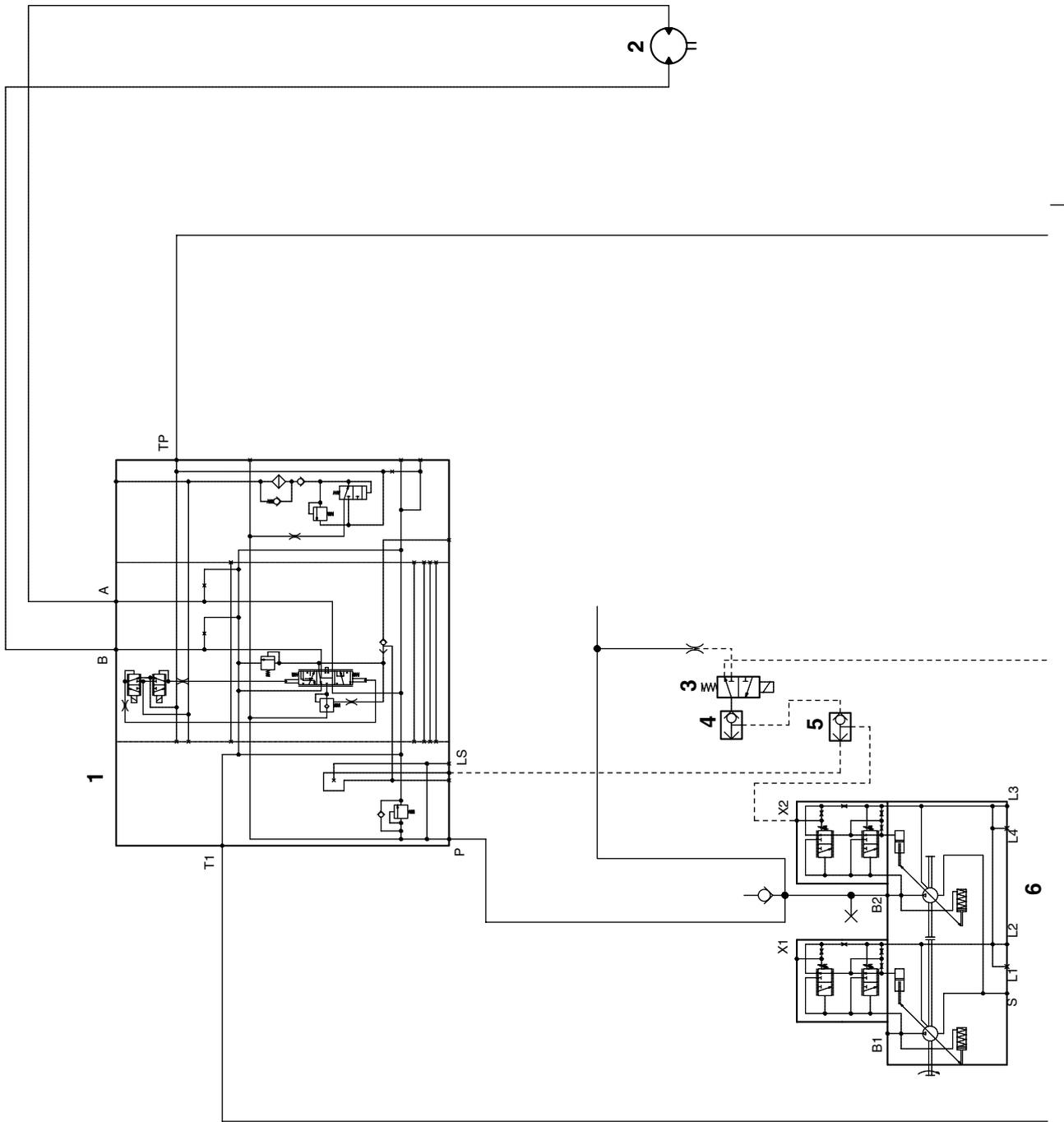
003186 (A431213.0100 ver. 3)

1. Tilt cylinder
2. Damping block
3. Rotation motor unit
4. Valve block rotation motor
5. Sideshift cylinders
6. Spreader motor
7. Valve block spreader motor
8. Twistlock cylinders
9. Control valve attachment
10. Solenoid valve engagement hydraulic pressure
11. Shuttle valve
12. Hydraulic oil filter
13. Hydraulic oil pump 1 and 2
14. Levelling cylinders
15. Valve block levelling cylinders
16. Over-centre valve levelling



1. Control valve option frame
2. Steering cylinder
3. Steering valve
4. Priority valve
5. Shuttle valve
6. Shuttle valve joystick steering
7. Hydraulic oil pumps 3 and 4

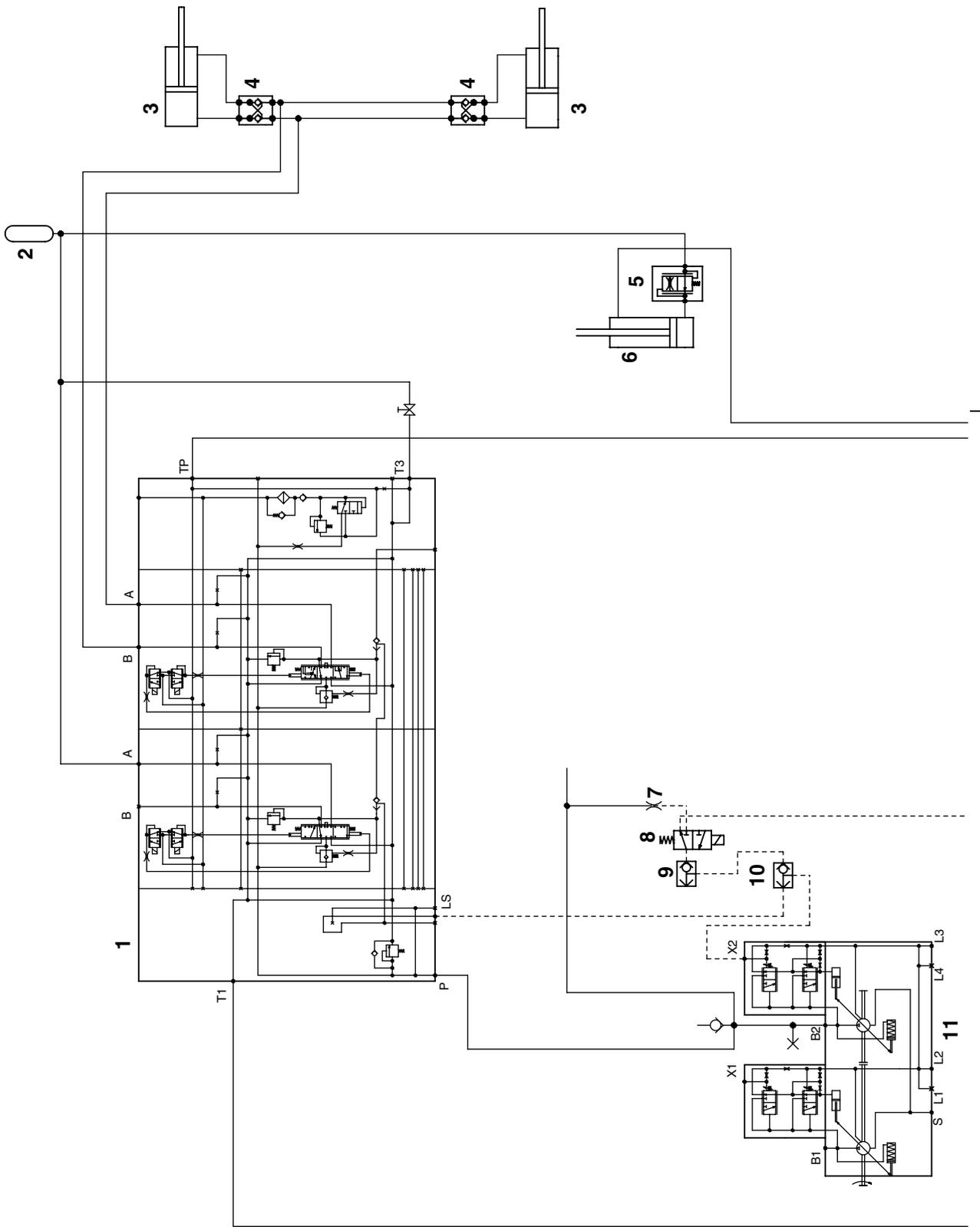
# Hydraulic diagram sliding cab



002394 (A40855.0100 ver.1)

1. Control valve option frame
2. Hydraulic motor sliding cab
3. Solenoid valve engagement hydraulic pressure
4. Shuttle valve
5. Shuttle valve option
6. Hydraulic oil pump 1 and 2

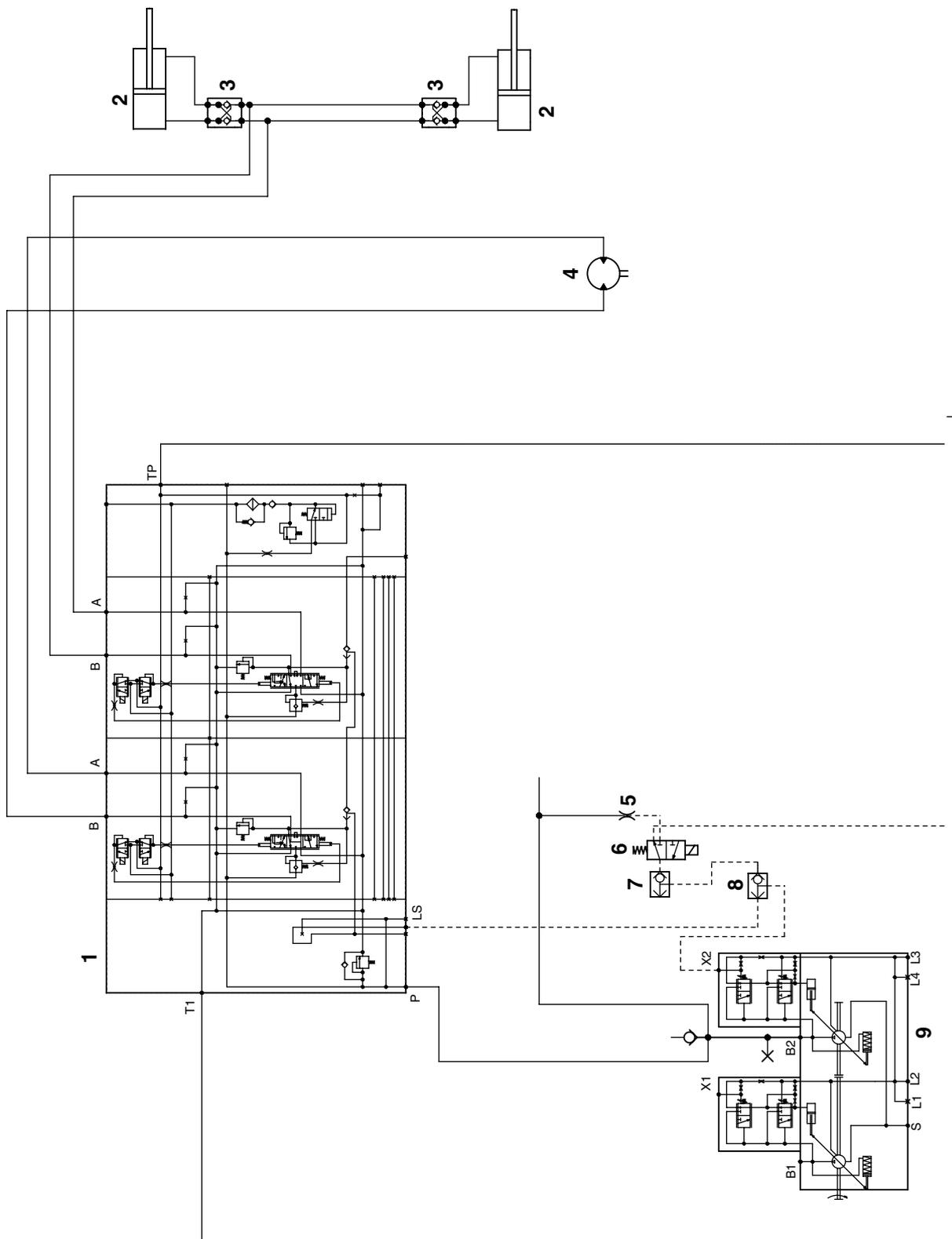
# Hydraulic diagram cab lift and support jacks



001987 (A43276.0100 ver. 1)

1. Control valve option frame
2. Accumulator
3. Hydraulic cylinder support jacks
4. Valve block support jacks
5. Load control valve
6. Hydraulic cylinder cab lift/lowering
7. Restriction
8. Valve block top lift hydraulics
9. Shuttle valve
10. Shuttle valve option frame
11. Hydraulic oil pump 1 and 2

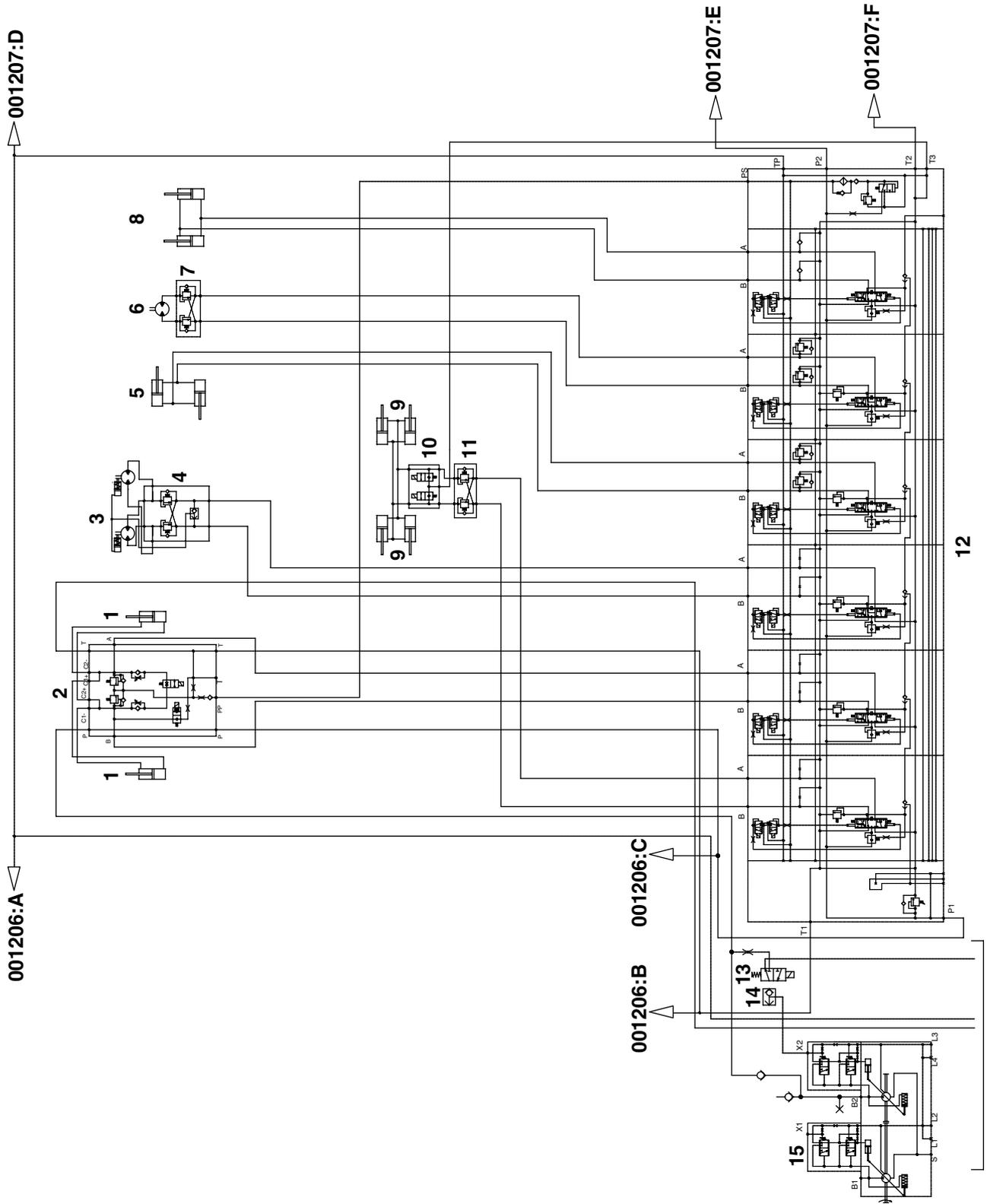
# Hydraulic diagram sliding cab and support jacks



001985 (A40854.0100 ver.1)

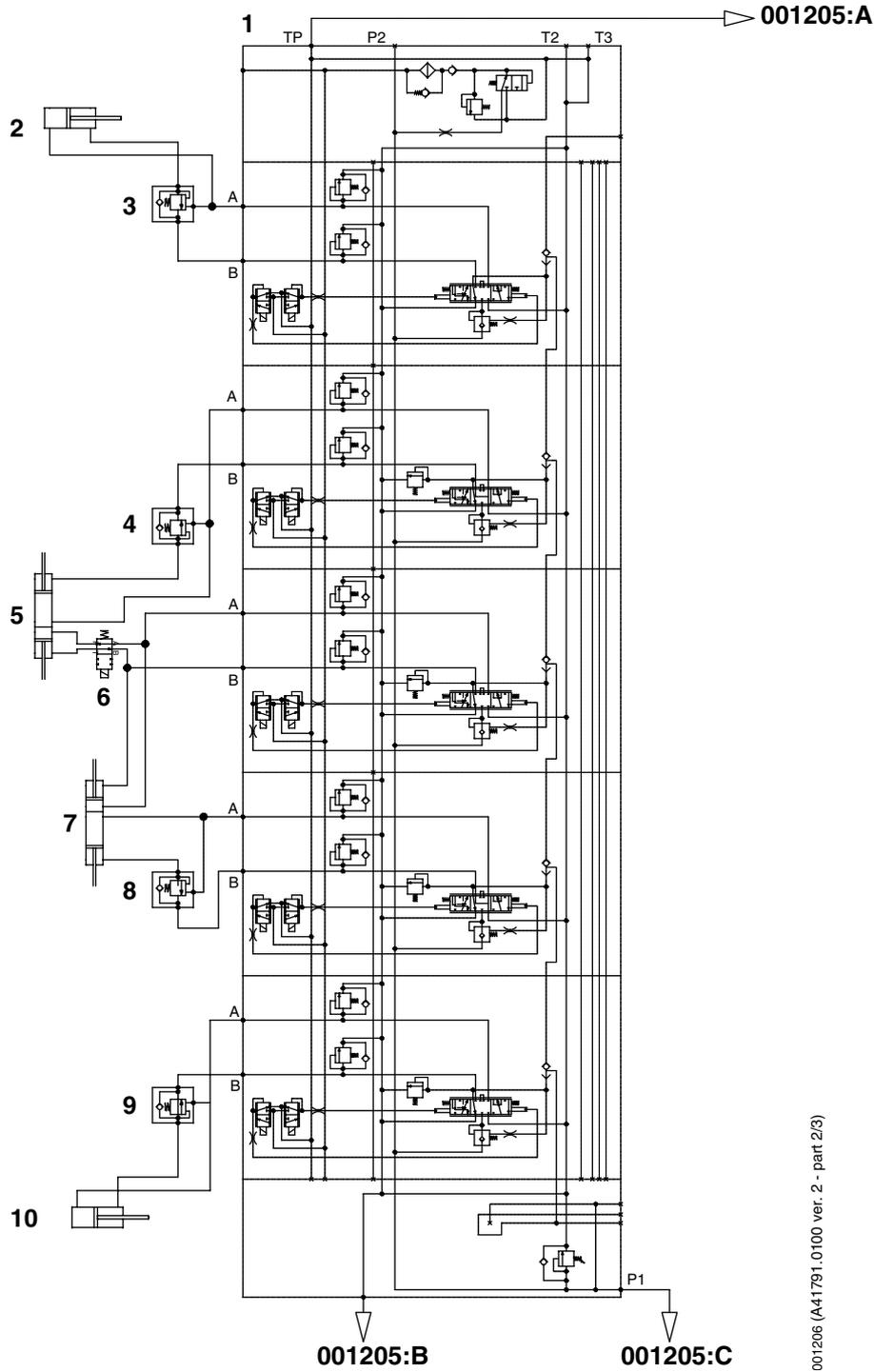
1. Control valve option frame
2. Hydraulic cylinder support jacks
3. Over-centre valve support jacks
4. Hydraulic motor sliding cab
5. Restriction
6. Solenoid valve engagement hydraulic pressure
7. Shuttle valve
8. Shuttle valve option
9. Hydraulic oil pump 1 and 2

# Hydraulic diagram combi attachment (part 1 of 3)



1. Tilt cylinder
2. Damping block
3. Rotation motor unit
4. Valve block rotation motor
5. Sideshift cylinders
6. Spreader motor
7. Valve block spreader motor
8. Twistlock cylinders
9. Valve block levelling cylinders
10. Over-centre valve levelling
11. Levelling cylinders
12. Control valve attachment
13. Solenoid valve engagement hydraulic pressure
14. Shuttle valve
15. Hydraulic oil pump 1 and 2

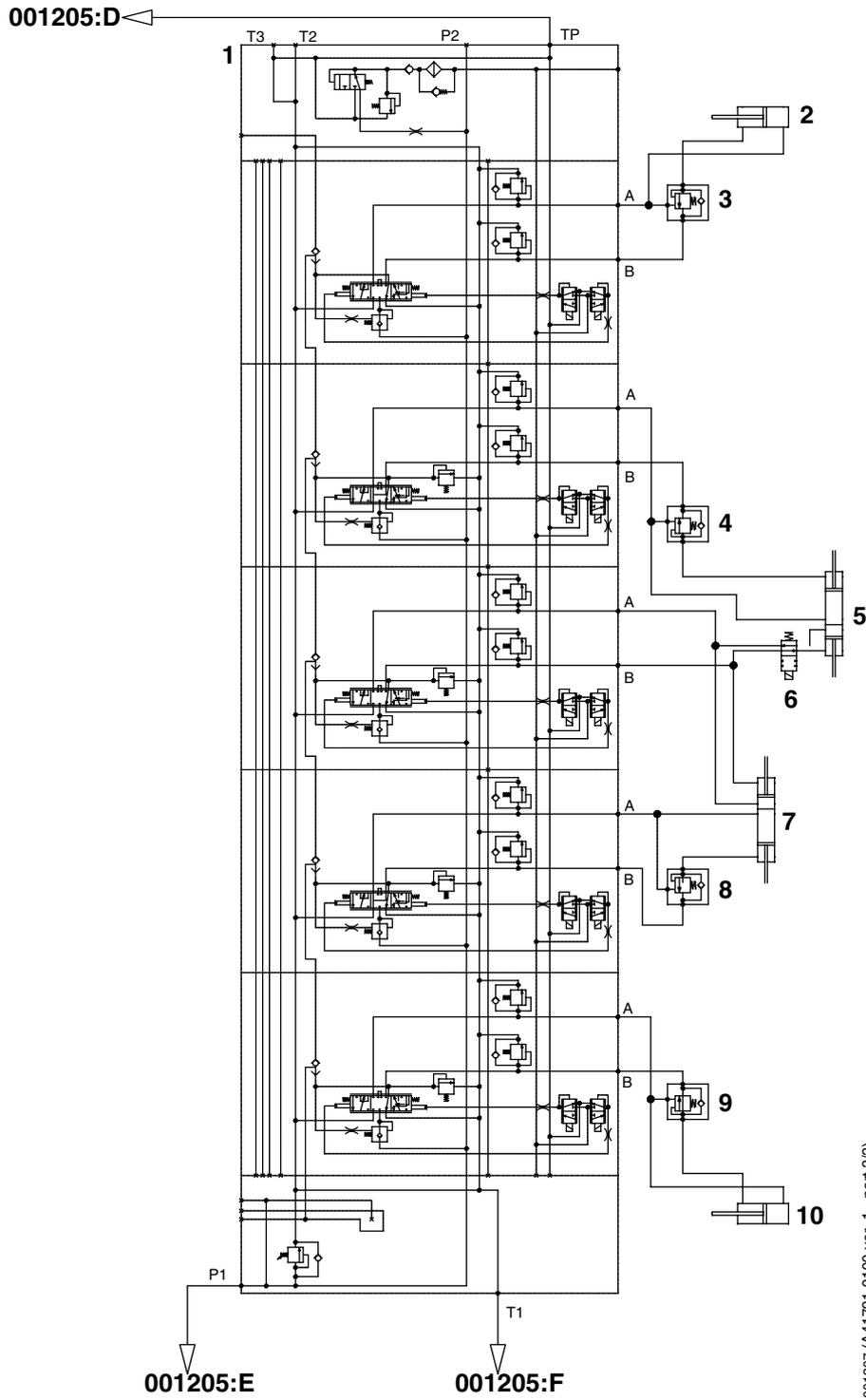
# Hydraulic diagram combi attachment (part 2 of 3)



001206 (A41791.0100 ver. 2 - part 2/3)

1. Control valve lift leg left
2. Lowering cylinder front lift leg
3. Valve block lowering front lift leg
4. Valve block lowering front lift leg
5. Clamping cylinder front lift leg
6. Valve block operating position front lift leg
7. Clamping cylinder rear lift leg
8. Valve block lowering rear lift leg
9. Valve block lowering rear lift leg
10. Lowering cylinder rear lift leg

# Hydraulic diagram combi attachment (part 3 of 3)



1. Control valve lift leg right
2. Lowering cylinder front lift leg
3. Valve block lowering front lift leg
4. Valve block lowering front lift leg
5. Clamping cylinder front lift leg
6. Valve block operating position front lift leg
7. Clamping cylinder rear lift leg
8. Valve block lowering rear lift leg
9. Valve block lowering rear lift leg
10. Lowering cylinder rear lift leg

# 11 Common electric

## Wiring diagrams, description

A wiring diagram is divided into circuit name(drawing number) and consists of a number of pages.

The following is an explanation of the symbols used in circuit diagrams:

- X is connection terminal (followed by number)
- Designation 353-2  
353 is component designation (see *Component designations page 27* for description of respective component). 2 indicates that it is the second component of this type in the specific diagram.
- Sensors, etc. are drawn in resting position on circuit, powerless mode
- Colour cable harness:  
White cable = ground signal  
Grey cable = Other cable harness
- Fuse box, e.g., F58, means fuse box with 8 fuses
- An arrow symbol means a reference to another circuit diagram
- 20015.0001 wiring diagrams-item designations K-standard.  
K-standard 1: norms, rules  
K-standard 2: cable harness, general physical  
K-standard 5: Designation and marking systems, item designations wiring diagrams
- Ground connection:  
1: X37-A is ground connection in the electrical distribution box. A connection terminal for ground. Frame ground connection - connection terminal to chassis.  
2: Zero reference found in control units.

## Component designations

The components in circuit diagrams have a prefix and number, the prefix describes the type of component, the number which component.

Component list with component number, prefix and designation is provided as an appendix after the circuit diagrams.

Prefix	Description
B	Converter from non-electric to electric signals or vice versa. Example: inductive sensor.
D	Binary element, delay unit, memory. Example: control unit.
E	White light. Example: work lights.
F	Protective device. Example: fuse.
G	Alternator, power supply device. Example: battery.
H	Signal device. Example horn, brake lights.
K	Relay, contactor. Example: power relay ignition.
M	Motor. Example: electric motor.
P	Measuring instrument, testing equipment. Example: operating hour gauge.
R	Resistor. Example: potentiometer.
S	Electric switch for control circuit, selector. Example: switch.
X	Outlet/socket, connecting device: Example: connection terminal
Y	Electrically controlled mechanical device: Example: solenoid valve, hydraulic valve.

## Circuit diagrams, compilation

Circuit diagrams are provided as an appendix in the following order.

Sheet	Designation
0.0-1	Circuit Cross-references
0.0-2	Circuit Cross-references
0.0-3	Circuit Cross-references Opt.
0.0-4	Circuit Cross-references Attch.
0.0-5	Circuit Cross-references Attch.
0.0-6	Circuit Cross-references Combi attch.
1.0-1	Circuit Engine 1240&1250
1.0-2	Circuit Engine Cummins
1.0-3	Circuit Engine Cummins
1.1-1	Circuit Drivetrain
2.0-1	Circuit Dana TE 32000
2.0-2	Circuit Dana TE 32000
2.0-3	Circuit Dana TE 32000
2.1-1	Circuit Drivetrain
4.0-1	Circuit Brake system
4.0-2	Circuit Brake system
5.2-1	Circuit Steering joystick/mini-wheel
5.2-2	Circuit Steering joystick/mini-wheel
5.2-3	Circuit Steering joystick/mini-wheel and Combi attch.
5.2-4	Circuit Steering joystick/mini-wheel and Combi attch.
7.1-1	Circuit Joystick
7.2-1	Circuit Boom Up/Down
7.3-1	Circuit Boom In/Out
7.5-1	Circuit Spreading Valves
7.5-2	Circuit Spreading Auto
7.5-3	Circuit Spreading Sensors
7.6-1	Circuit Rotation
7.7-1	Circuit Tilt lock
7.7-2	Circuit Tilt + Levelling
7.7-3	Circuit Tilt + Levelling
7.9-1	Circuit Twistlocks

<b>Sheet</b>	<b>Designation</b>
7.9-2	Circuit Twistlocks
7.9-3	Circuit Combi Attch.
7.9-4	Circuit Combi Attch.
7.9-5	Circuit Combi Attch.
7.9-6	Circuit Combi Attch.
7.9-7	Circuit Combi Attch.
7.9-8	Circuit Combi Attch.
7.9-9	Circuit Combi Attch.
7.9-10	Circuit Combi Attch.
7.9-11	Circuit Combi Attch.
7.9-12	Circuit Combi Attch.
7.9-13	Circuit Combi Attch.
7.9-14	Circuit Combi Attch.
7.9-15	Circuit Overheight
7.9-16	Circuit Overheight
7.9-17	Circuit Combi Attch.
7.10-1	Circuit Hyd Support Jacks
7.10-2	Circuit Hyd Support Jacks
7.10-3	Circuit Printer
8.2-1	Circuit OP + Scales
8.2-2	Circuit OP + Scales
8.2-3	Circuit By-passing
8.2-4	Circuit RMI
9.1-1	Circuit Extra Sensor Instr.
9.1-2	Circuit Optional Equipment
9.1-3	Circuit Optional Equipment
9.1-4	Circuit Sensor Instr.
9.1-5	Circuit Option Cab
9.3-1	Circuit Cab Operator's Seat
9.3-2	Circuit Cab Operator's Seat
9.4-1	Circuit Climate System
9.4-2	Circuit Climate System
9.5-1	Circuit Wipers
9.6-1	Circuit Work Lights

<b>Sheet</b>	<b>Designation</b>
9.6-2	Circuit Extra Work Lights Attch.
9.6-3	Circuit Extra Work Lights Boom
9.6-5	Circuit Lighting
9.6-6	Circuit Lighting
9.6-7	Circuit Lighting
9.6-8	Circuit Lighting
9.6-9	Circuit Courtesy lighting
9.6-10	Circuit Extra Work Lights Frame
9.7-1	Circuit Alarms, Audible signals
9.7-2	Circuit Alarms, Audible signals
9.7-3	Circuit Direction Indicators, Flashing Hazard Lights
9.7-4	Circuit Back-up Alarm
9.8-1	Circuit Radio
9.9-9	Circuit Camera
9.10-1	Circuit Sliding/Vertical adjustable Cab
9.10-2	Circuit Cab Tilt
9.14	Circuit Central Lubrication
10.0-1	Circuit Hydraulics
11.5-1	Circuit Current
11.5-2	Circuit Current
11.5-3	Circuit Current
11.5-4	Circuit Current
11.5-5	Circuit Current Attch.
11.5-6	Circuit Current KDU OPT
11.5-7	Circuit 24 V
11.5-8	Circuit 12 V + Com. Radio
11.5-9	Circuit Current Attch.
11.6-3	Circuit CAN-BUS opt. Frame KDU
11.6-4	Circuit CAN-BUS AGG
11.6-5	Circuit CAN-BUS AGG
11.6-6	Circuit CAN-BUS AGG



**KDU FRONT**

+CHASSIS -D797-F

Pin Number	Drawing	Function	Type
11	/115_4,B5	Power	6A
12	/116_3,D8	CAN	1.5A
2.6		Temperature input	1.5A
2.11	/115_4,A5	Emergency stop	1.5A
2.13	/A0_1,E1	Temperature input	0V Ref
2.15		TEMP BRAKE OIL	Analog In 0.5V
2.16		Recall In	1.5A
		D+	1.5A

**KDU REAR**

+CHASSIS -D797-R

Pin Number	Drawing	Function	Type
11	/115_4,B1	WORKING LIGHT BOOM	6A
12	+CHASSIS72_1,E2	SENSOR STEERING AXLE	1.5A
13	+CHASSIS72_1,B2	POWER SUPPLY SENSORS	1.5A
14	/73_1,C2	POWER SUPPLY SENSORS	1.5A
15	/73_1,C2	BLOCKING PROJECTING	1.5A
16	+CHASSIS62_2,D8	SENSORS	0V Ref
17	/A0_2,A1	SIDE POSITION LEFT REAR	Analog Ref 5V
18	+CHASSIS62_2,D1	PARKING BRAKE	1.5A
19	/67_3,D1	DIRECTION RIGHT FRONT	1.5A
110	/67_3,D1	OPTION FRONT	1.5A
111	/61_3,B1	OPTION FRONT	Dig In /1.5A
112	/61_3,B1	BRAKE LIGHTS	Dig In /1.5A
113	/96_6,E8	COOLER FAN BRAKE	Analog In 0.5V
114	/A0_2,B1	HEAD LIGHT RIGHT	10A
115	/66_6,B1	BOOM LIGHT	6A
116	+CHASSIS72_1,E8	BOOM LOWER	PWM
117	+CHASSIS72_1,B8	BOOM OUT	PWM
118	/73_1,C8	BOOM IN	PWM
119	/73_1,C8	BOOM IN	PWM
120	/A0_1,D8	PRESSURE ACCUMULATOR TANK	Analog In 0.5V

**KDU contact K1**

+CHASSIS62\_2,E8

Pin Number	Drawing	Function	Type
121	+CHASSIS62_2,E8	BOOM ANGLE	Analog In 0.5V
122	+CHASSIS62_2,E8	BOOM POSITION	Analog In 0.5V
123	+CHASSIS62_2,E8	DAMPING BOOM OUT	Analog In 0.5V
124	+CHASSIS62_2,E8	REAR LIGHT RIGHT	1.5A
125	/66_6,C1	DAMPING BOOM IN	Dig In /1.5A
126	/61_3,A1	REVERSING LIGHT LEFT REAR	Analog In 0.5V
127	/A0_1,C8	REVERSING LIGHT RIGHT REAR	6A
128	/914,C2	REVERSING ALARM	2.5A
129	+CHASSIS72_1,D2	ACTIVATION OF TOPLIFT HYDRAULICS	1.5A
130	+CHASSIS72_1,C2	BRAKE LIGHT LEFT REAR	1.5A
131	+CHASSIS72_1,C2	BRAKE LIGHT RIGHT REAR	1.5A
132	+CHASSIS72_1,E2	MAGNETIC CLUTCH COMPRESSOR	1.5A
133	+CHASSIS72_1,F2	Relay starting solenoid	Dig In /1.5A
134		PRESSURE REFRIERANT	Dig In /1.5A
135		SENSOR STEERING AXLE	0V Ref
136		DIRECTION RIGHT REAR	1.5A
137		INTERRUPTION PUMP	Dig In /1.5A
138		OPTION REAR	Analog In 0.5V
139		REVERSING LIGHT RIGHT REAR	6A
140			
141			
142			

**KDU contact K2**

+CHASSIS115\_1,F7

Pin Number	Drawing	Function	Type
115_4,C5		HYDRAULIC TEMPERATURE	
116_3,F1		FUEL LEVEL	
115_4,B5		ALTERNATOR	
100_1,B2			
61_4,D8			

**KDU contact K1**

+CHASSIS62\_2,C7

Pin Number	Drawing	Function	Type
121	+CHASSIS62_2,C7	BOOM ANGLE	Analog In 0.5V
122	+CHASSIS62_2,C7	BOOM POSITION	Analog In 0.5V
123	/73_1,B8	DAMPING BOOM OUT	Analog In 0.5V
124		REAR LIGHT RIGHT	Dig In /1.5A
125	/66_7,C1	DAMPING BOOM IN	Analog In 0.5V
126	/73_1,A8	REVERSING LIGHT LEFT REAR	6A
127	/61_3,D8	REVERSING LIGHT RIGHT REAR	1.5A
128	/66_7,A1	REVERSING ALARM	2.5A
129	/67_3,E1	ACTIVATION OF TOPLIFT HYDRAULICS	1.5A
130	/67_4,B1	BRAKE LIGHT LEFT REAR	1.5A
131	/76_1,D1	BRAKE LIGHT RIGHT REAR	1.5A
132	/66_7,B1	MAGNETIC CLUTCH COMPRESSOR	1.5A
133	/66_7,C1	Relay starting solenoid	Dig In /1.5A
134	+CAB94_2,F1	PRESSURE REFRIERANT	Dig In /1.5A
135	/21_1,E2	SENSOR STEERING AXLE	0V Ref
136	+CAB94_1,A8	DIRECTION RIGHT REAR	1.5A
137	+CHASSIS62_2,B8	INTERRUPTION PUMP	Dig In /1.5A
138	/67_3,E1	OPTION REAR	Analog In 0.5V
139	/73_1,D2	REVERSING LIGHT RIGHT REAR	6A
140			
141			
142			

**KDU contact K1**

+CHASSIS62\_2,C7

Pin Number	Drawing	Function	Type
121	+CHASSIS62_2,C7	BOOM ANGLE	Analog In 0.5V
122	+CHASSIS62_2,C7	BOOM POSITION	Analog In 0.5V
123	/73_1,B8	DAMPING BOOM OUT	Analog In 0.5V
124		REAR LIGHT RIGHT	Dig In /1.5A
125	/66_7,C1	DAMPING BOOM IN	Analog In 0.5V
126	/73_1,A8	REVERSING LIGHT LEFT REAR	6A
127	/61_3,D8	REVERSING LIGHT RIGHT REAR	1.5A
128	/66_7,A1	REVERSING ALARM	2.5A
129	/67_3,E1	ACTIVATION OF TOPLIFT HYDRAULICS	1.5A
130	/67_4,B1	BRAKE LIGHT LEFT REAR	1.5A
131	/76_1,D1	BRAKE LIGHT RIGHT REAR	1.5A
132	/66_7,B1	MAGNETIC CLUTCH COMPRESSOR	1.5A
133	/66_7,C1	Relay starting solenoid	Dig In /1.5A
134	+CAB94_2,F1	PRESSURE REFRIERANT	Dig In /1.5A
135	/21_1,E2	SENSOR STEERING AXLE	0V Ref
136	+CAB94_1,A8	DIRECTION RIGHT REAR	1.5A
137	+CHASSIS62_2,B8	INTERRUPTION PUMP	Dig In /1.5A
138	/67_3,E1	OPTION REAR	Analog In 0.5V
139	/73_1,D2	REVERSING LIGHT RIGHT REAR	6A
140			
141			
142			

**KDU contact K1**

+CHASSIS62\_2,C7

Pin Number	Drawing	Function	Type
121	+CHASSIS62_2,C7	BOOM ANGLE	Analog In 0.5V
122	+CHASSIS62_2,C7	BOOM POSITION	Analog In 0.5V
123	/73_1,B8	DAMPING BOOM OUT	Analog In 0.5V
124		REAR LIGHT RIGHT	Dig In /1.5A
125	/66_7,C1	DAMPING BOOM IN	Analog In 0.5V
126	/73_1,A8	REVERSING LIGHT LEFT REAR	6A
127	/61_3,D8	REVERSING LIGHT RIGHT REAR	1.5A
128	/66_7,A1	REVERSING ALARM	2.5A
129	/67_3,E1	ACTIVATION OF TOPLIFT HYDRAULICS	1.5A
130	/67_4,B1	BRAKE LIGHT LEFT REAR	1.5A
131	/76_1,D1	BRAKE LIGHT RIGHT REAR	1.5A
132	/66_7,B1	MAGNETIC CLUTCH COMPRESSOR	1.5A
133	/66_7,C1	Relay starting solenoid	Dig In /1.5A
134	+CAB94_2,F1	PRESSURE REFRIERANT	Dig In /1.5A
135	/21_1,E2	SENSOR STEERING AXLE	0V Ref
136	+CAB94_1,A8	DIRECTION RIGHT REAR	1.5A
137	+CHASSIS62_2,B8	INTERRUPTION PUMP	Dig In /1.5A
138	/67_3,E1	OPTION REAR	Analog In 0.5V
139	/73_1,D2	REVERSING LIGHT RIGHT REAR	6A
140			
141			
142			

**KDU contact K1**

+CHASSIS62\_2,C7

Pin Number	Drawing	Function	Type
121	+CHASSIS62_2,C7	BOOM ANGLE	Analog In 0.5V
122	+CHASSIS62_2,C7	BOOM POSITION	Analog In 0.5V
123	/73_1,B8	DAMPING BOOM OUT	Analog In 0.5V
124		REAR LIGHT RIGHT	Dig In /1.5A
125	/66_7,C1	DAMPING BOOM IN	Analog In 0.5V
126	/73_1,A8	REVERSING LIGHT LEFT REAR	6A
127	/61_3,D8	REVERSING LIGHT RIGHT REAR	1.5A
128	/66_7,A1	REVERSING ALARM	2.5A
129	/67_3,E1	ACTIVATION OF TOPLIFT HYDRAULICS	1.5A
130	/67_4,B1	BRAKE LIGHT LEFT REAR	1.5A
131	/76_1,D1	BRAKE LIGHT RIGHT REAR	1.5A
132	/66_7,B1	MAGNETIC CLUTCH COMPRESSOR	1.5A
133	/66_7,C1	Relay starting solenoid	Dig In /1.5A
134	+CAB94_2,F1	PRESSURE REFRIERANT	Dig In /1.5A
135	/21_1,E2	SENSOR STEERING AXLE	0V Ref
136	+CAB94_1,A8	DIRECTION RIGHT REAR	1.5A
137	+CHASSIS62_2,B8	INTERRUPTION PUMP	Dig In /1.5A
138	/67_3,E1	OPTION REAR	Analog In 0.5V
139	/73_1,D2	REVERSING LIGHT RIGHT REAR	6A
140			
141			
142			

**KDU contact K1**

+CHASSIS62\_2,C7

Pin Number	Drawing	Function	Type
121	+CHASSIS62_2,C7	BOOM ANGLE	Analog In 0.5V
122	+CHASSIS62_2,C7	BOOM POSITION	Analog In 0.5V
123	/73_1,B8	DAMPING BOOM OUT	Analog In 0.5V
124		REAR LIGHT RIGHT	Dig In /1.5A
125	/66_7,C1	DAMPING BOOM IN	Analog In 0.5V
126	/73_1,A8	REVERSING LIGHT LEFT REAR	6A
127	/61_3,D8	REVERSING LIGHT RIGHT REAR	1.5A
128	/66_7,A1	REVERSING ALARM	2.5A
129	/67_3,E1	ACTIVATION OF TOPLIFT HYDRAULICS	1.5A
130	/67_4,B1	BRAKE LIGHT LEFT REAR	1.5A
131	/76_1,D1	BRAKE LIGHT RIGHT REAR	1.5A
132	/66_7,B1	MAGNETIC CLUTCH COMPRESSOR	1.5A
133	/66_7,C1	Relay starting solenoid	Dig In /1.5A
134	+CAB94_2,F1	PRESSURE REFRIERANT	Dig In /1.5A
135	/21_1,E2	SENSOR STEERING AXLE	0V Ref
136	+CAB94_1,A8	DIRECTION RIGHT REAR	1.5A
137	+CHASSIS62_2,B8	INTERRUPTION PUMP	Dig In /1.5A
138	/67_3,E1	OPTION REAR	Analog In 0.5V
139	/73_1,D2	REVERSING LIGHT RIGHT REAR	6A
140			
141			
142			

**KDU contact K1**

+CHASSIS62\_2,C7

Pin Number	Drawing	Function	Type
121	+CHASSIS62_2,C7	BOOM ANGLE	Analog In 0.5V
122	+CHASSIS62_2,C7	BOOM POSITION	Analog In 0.5V
123	/73_1,B8	DAMPING BOOM OUT	Analog In 0.5V
124		REAR LIGHT RIGHT	Dig In /1.5A
125	/66_7,C1	DAMPING BOOM IN	Analog In 0.5V
126	/73_1,A8	REVERSING LIGHT LEFT REAR	6A
127	/61_3,D8	REVERSING LIGHT RIGHT REAR	1.5A
128	/66_7,A1	REVERSING ALARM	2.5A
129	/67_3,E1	ACTIVATION OF TOPLIFT HYDRAULICS	1.5A
130	/67_4,B1	BRAKE LIGHT LEFT REAR	1.5A
131	/76_1,D1	BRAKE LIGHT RIGHT REAR	1.5A
132	/66_7,B1	MAGNETIC CLUTCH COMPRESSOR	1.5A
133	/66_7,C1	Relay starting solenoid	Dig In /1.5A
134	+CAB94_2,F1	PRESSURE REFRIERANT	Dig In /1.5A
135	/21_1,E2	SENSOR STEERING AXLE	0V Ref
136	+CAB94_1,A8	DIRECTION RIGHT REAR	1.5A
137	+CHASSIS62_2,B8	INTERRUPTION PUMP	Dig In /1.5A
138	/67_3,E1	OPTION REAR	Analog In 0.5V
139	/73_1,D2	REVERSING LIGHT RIGHT REAR	6A
140			
141			
142			

**KDU contact K1**

+CHASSIS62\_2,C7

Pin Number	Drawing	Function	Type
121	+CHASSIS62_2,C7	BOOM ANGLE	Analog In 0.5V
122	+CHASSIS62_2,C7	BOOM POSITION	Analog In 0.5V
123	/73_1,B8	DAMPING BOOM OUT	Analog In 0.5V
124		REAR LIGHT RIGHT	Dig In /1.5A
125	/66_7,C1	DAMPING BOOM IN	Analog In 0.5V
126	/73_1,A8	REVERSING LIGHT LEFT REAR	6A
127	/61_3,D8	REVERSING LIGHT RIGHT REAR	1.5A
128	/66_7,A1	REVERSING ALARM	2.5A
129	/67_3,E1	ACTIVATION OF TOPLIFT HYDRAULICS	1.5A
130	/67_4,B1	BRAKE LIGHT LEFT REAR	1.5A
131	/76_1,D1	BRAKE LIGHT RIGHT REAR	1.5A
132	/66_7,B1	MAGNETIC CLUTCH COMPRESSOR	1.5A
133	/66_7,C1	Relay starting solenoid	Dig In /1.5A
134	+CAB94_2,F1	PRESSURE REFRIERANT	Dig In /1.5A
135	/21_1,E2	SENSOR STEERING AXLE	0V Ref
136	+CAB94_1,A8	DIRECTION RIGHT REAR	1.5A
137	+CHASSIS62_2,B8	INTERRUPTION PUMP	Dig In /1.5A
138	/67_3,E1	OPTION REAR	Analog In 0.5V
139	/73_1,D2	REVERSING LIGHT RIGHT REAR	6A
140			
141			
142			

**KDU contact K1**

+CHASSIS62\_2,C7

Pin Number	Drawing	Function	Type
121	+CHASSIS62_2,C7	BOOM ANGLE	Analog In 0.5V
122	+CHASSIS62_2,C7	BOOM POSITION	Analog In 0.5V
123	/73_1,B8	DAMPING BOOM OUT	Analog In 0.5V
124			

K6	K7	K8	K9	+CAB -D780-1	
				INST. ILLUMINATION SWITCH LIGHTS ATT. SWITCH LIGHTS BOOM ROT. BEACON MAIN LIGHT SEAT HEATER OPTION	PWM Input Input Input Input Input Input
61	69	81	91	+CAB79_3.A2	24V reference
62	610	82	92	+CAB96_1.B7	1.5A Input
63	611	83	93	+CAB96_1.A7	Input
64	612	84	94	/96_5.C8	Input
65	613	85	95	/96_5.B8	0V reference
66	614	86	96	+CAB93_1.B7	24V reference
67	615	87	97	/91_2.E8	24V reference
68	616	88	98	/91_2.D8	Analog Input
69	617	89	99	/91_2.B8	Analog Input
70	71	90	100	+CAB96_1.C7	24V reference
71	72	91	101	/21_1.E8	0.5A
72	73	92	102	/21_1.B7	0.5A
73	74	93	103	/21_1.C7	0.5A
74	75	94	104	/21_1.D7	0.5A
75	76	95	105	/71_1.D1	Input
76	77	96	106	/71_1.C1	Input
77	78	97	107	/71_1.A1	Input
78	79	98	108	/71_1.B1	Input
79	80	99	109	/710_1.A1	Input
80	81	100	110	/71_1.A8	Input
81	82	101	111	/71_1.A8	Input
82	83	102	112	/71_1.B8	Input
83	84	103	113	/71_1.B8	Input
84	85	104	114	/71_1.B8	Input
85	86	105	115	/71_1.B8	Input
86	87	106	116	/71_1.B8	Input
87	88	107	117	/710_1.C8	Input
88	89	108	118	/710_1.C8	Input
89	90	109	119	/710_1.C8	Input
90	91	110	120	/710_1.C8	Input
91	92	111	121	/710_1.C8	Input
92	93	112	122	/710_1.C8	Input
93	94	113	123	/710_1.C8	Input
94	95	114	124	/710_1.C8	Input
95	96	115	125	/710_1.C8	Input
96	97	116	126	/710_1.C8	Input
97	98	117	127	/710_1.C8	Input
98	99	118	128	/710_1.C8	Input
99	100	119	129	/710_1.C8	Input
100	101	120	130	/710_1.C8	Input

# KDU OPTION

\*CHASSIS  
-D797-O

Pin Number	Drawing	Function	Type
Power	/11.5_5B5		CAN-BUS
CAN	/11.6_3D8		Temperature Input
2:6			Emergency stop
2:11	/11.5_5A5		Temperature Input
2:13			Temperature Input
2:15			Reset In
2:16			D+

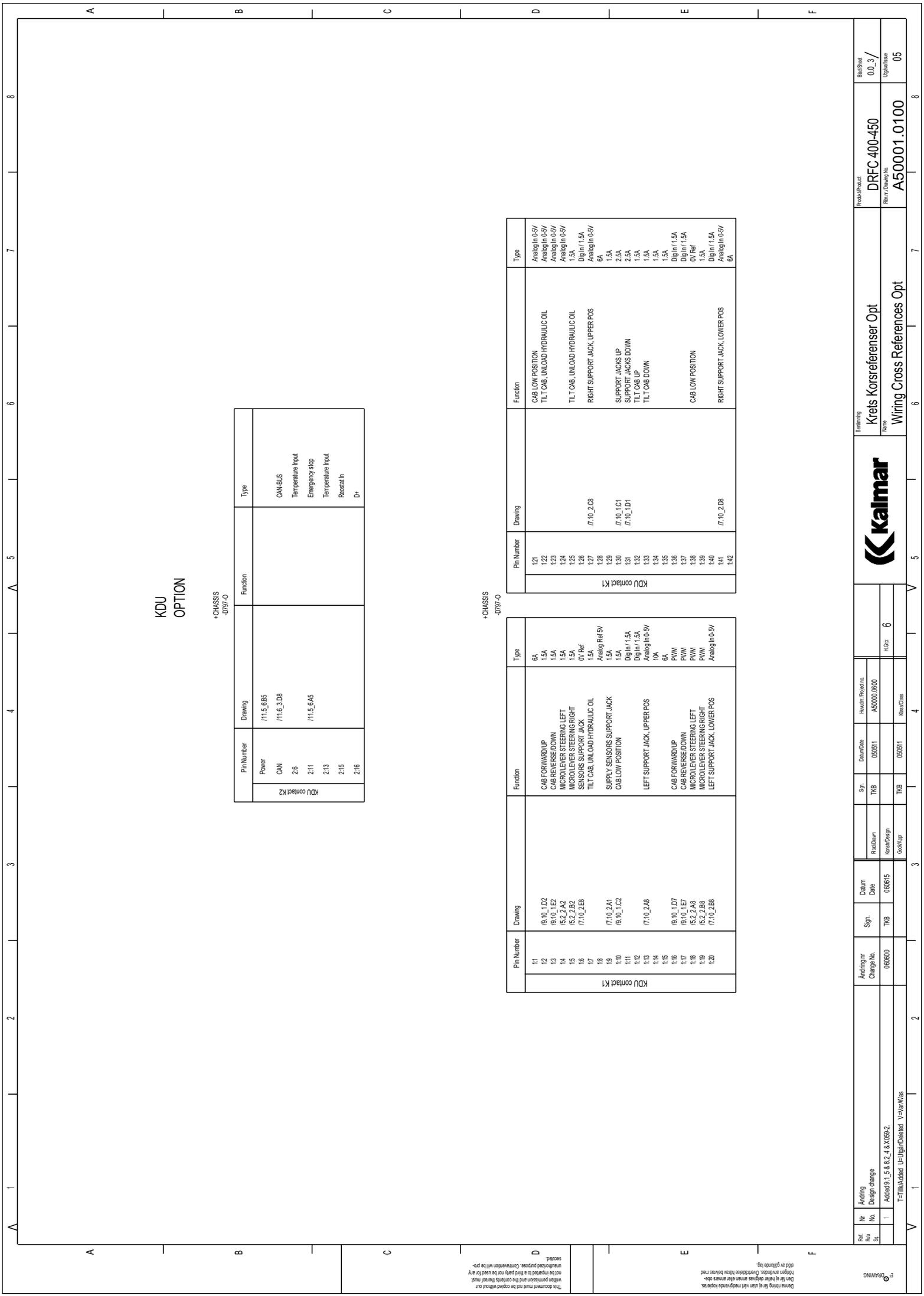
\*CHASSIS  
-D797-O

Pin Number	Drawing	Function	Type
1:1	/9.10.1D2	CAB FORWARD/UP	6A
1:2	/9.10.1E2	CAB REVERSE/DOWN	1.5A
1:3	/5.2.2A2	MICROLEVER STEERING LEFT	1.5A
1:4	/5.2.2B2	MICROLEVER STEERING RIGHT	1.5A
1:5	/7.10.2E8	SENSORS SUPPORT JACK	0V Ref
1:7		TILT CAB, UNLOAD HYDRAULIC OIL	1.5A
1:8	/7.10.2A1	SUPPLY SENSORS SUPPORT JACK	Analog Ref 5V
1:9	/9.10.1C2	CAB LOW POSITION	1.5A
1:10			1.5A
1:11	/7.10.2A8	LEFT SUPPORT JACK, UPPER POS	Dig In / 1.5A
1:12			Dig In / 1.5A
1:13			Analog in 0-5V
1:14			10A
1:15			6A
1:16	/9.10.1D7	CAB FORWARD/UP	PWM
1:17	/9.10.1E7	CAB REVERSE/DOWN	PWM
1:18	/5.2.2A8	MICROLEVER STEERING LEFT	PWM
1:19	/5.2.2B8	MICROLEVER STEERING RIGHT	PWM
1:20	/7.10.2E8	LEFT SUPPORT JACK, LOWER POS	Analog in 0-5V

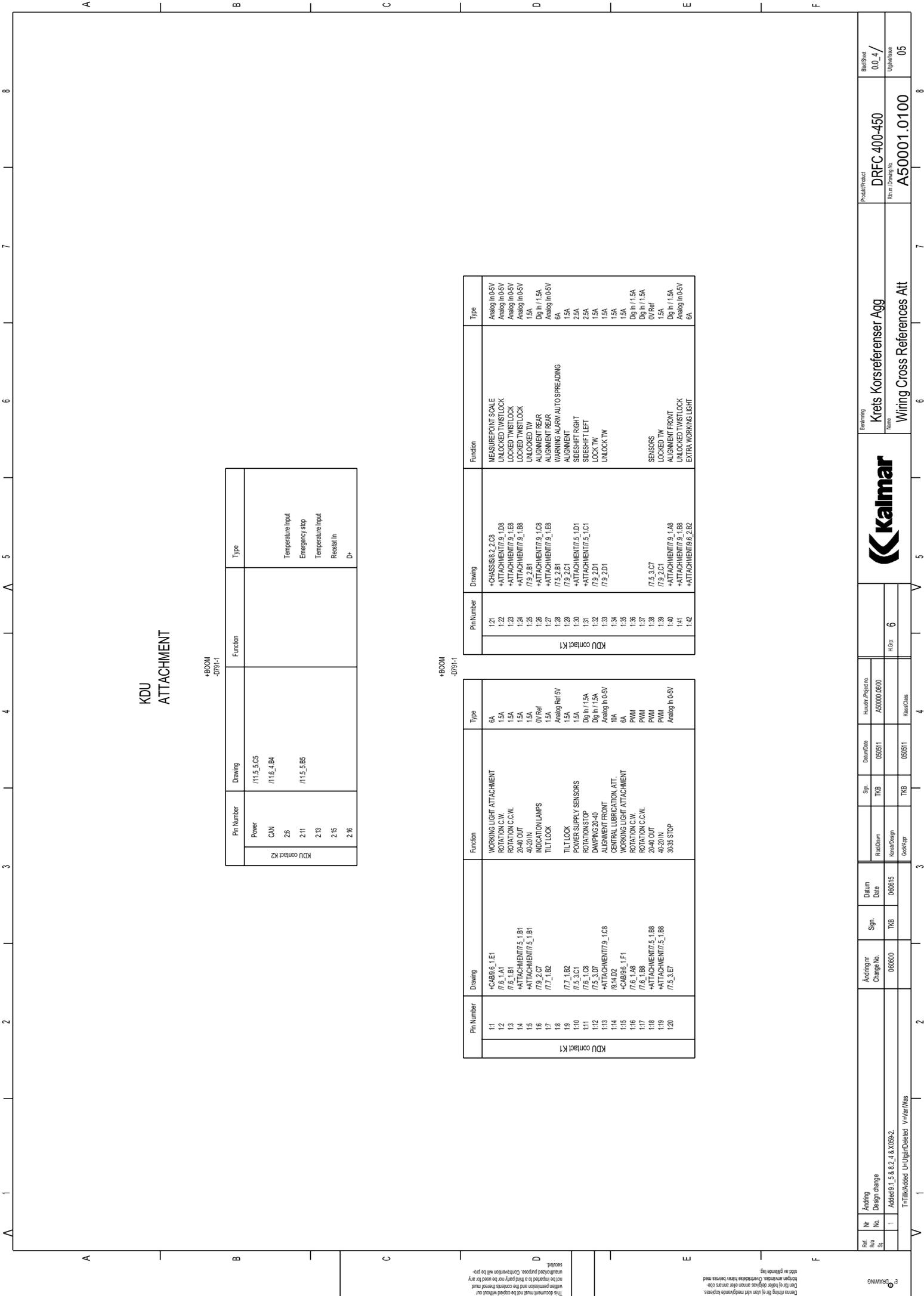
  

Pin Number	Drawing	Function	Type
121		CAB LOW POSITION	Analog in 0-5V
122		TILT CAB, UNLOAD HYDRAULIC OIL	Analog in 0-5V
123			Analog in 0-5V
124			1.5A
125		TILT CAB, UNLOAD HYDRAULIC OIL	Dig In / 1.5A
126		RIGHT SUPPORT JACK, UPPER POS	Analog in 0-5V
127	/7.10_2C8		6A
128			1.5A
129		SUPPORT JACKS UP	2.5A
130	/7.10_1C1	SUPPORT JACKS DOWN	2.5A
131	/7.10_1D1	TILT CAB UP	1.5A
132			1.5A
133		TILT CAB DOWN	1.5A
134			1.5A
135			1.5A
136			Dig In / 1.5A
137			Dig In / 1.5A
138		CAB LOW POSITION	0V Ref
139			1.5A
140			Dig In / 1.5A
141	/7.10_2D8	RIGHT SUPPORT JACK, LOWER POS	Analog in 0-5V
142			6A

Rev. No.	1	Avding nr	06800	Datum	06815	Sign.	TKG	Drawn	TKG	Drawn Date	050511	Project no.	A50000.05100	Product	DRFC 400-450	Block/Sheet	0.0_3 /				
Design change	Added 1, 5, 8, 9, 2, 4 & X0592.																				
Key	T=Title Added U=Uppig Deleted V=Var/Wies																				
										Betsättning		Krets Korsreferenser Opt		Product/Block		DRFC 400-450		Block/Sheet		0.0_3 /	
										Name		Wiring Cross References Opt		Rev. / Drawn No.		A50001.0100		Uppgavs		05	



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# KDU ATTACHMENT

+B00M  
-0791-1

Pin Number	Drawing	Function	Type
Power	/11.5_5_C5		
CAN	/11.6_4_B4		
2.6		Temperature Input	
2.11	/11.5_5_B5	Emergency stop	
2.13		Temperature Input	
2.15		Resist.in	
2.16		D+	

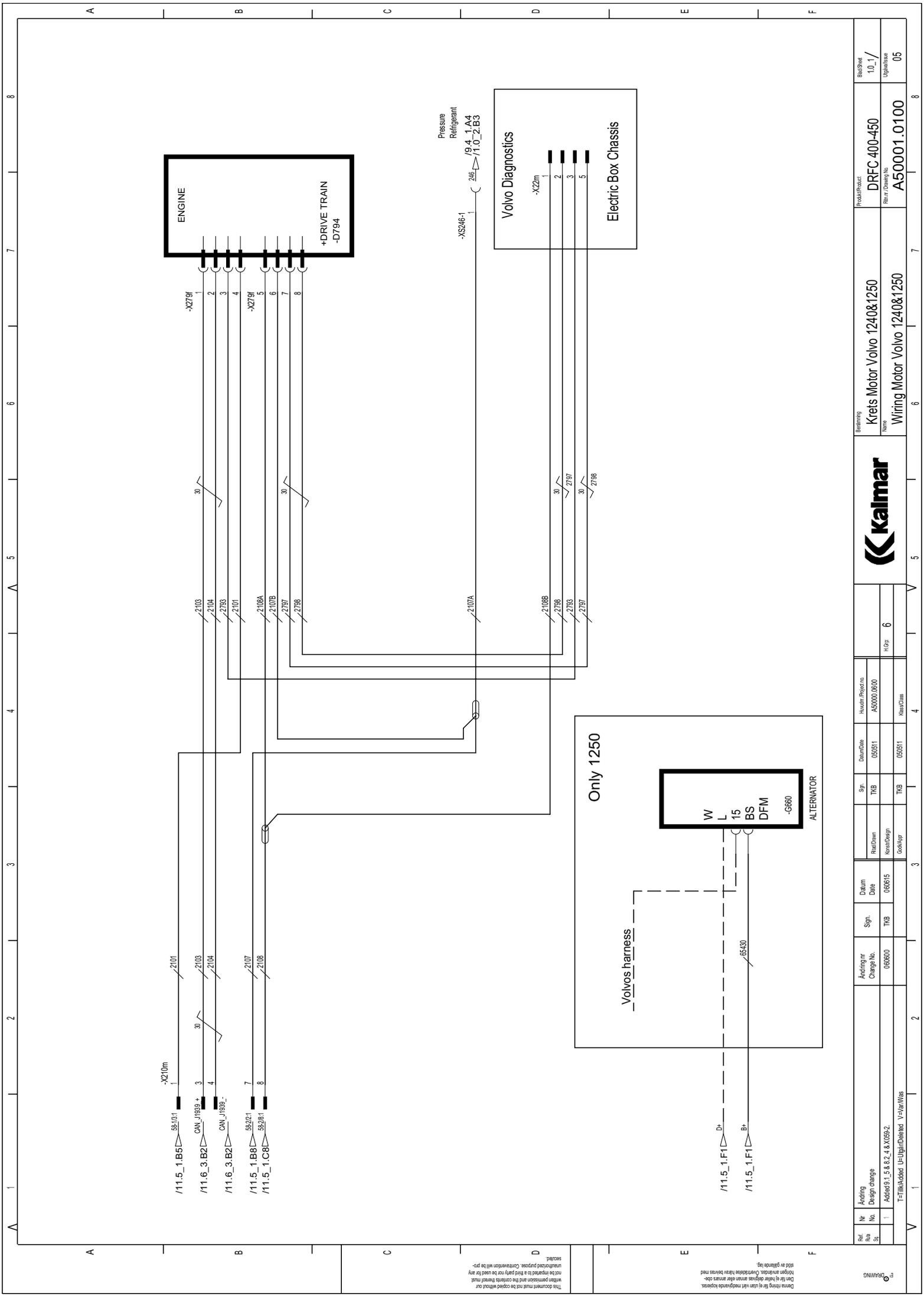
+B00M  
-0791-1

Pin Number	Drawing	Function	Type	Pin Number	Drawing	Function	Type
1.1	+CAB96_1.E1	WORKING LIGHT ATTACHMENT	6A	1.21	+CHASSIS6_2.C8	MEASUREPOINT SCALE	Analog in 0.5V
1.2	/7.2_1.A1	ROTATION C.W.	1.5A	1.22	+ATTACHMENT7.9_1.D8	UNLOCKED TWISTLOCK	Analog in 0.5V
1.3	/7.1_1.B1	ROTATION C.C.W.	1.5A	1.23	+ATTACHMENT7.9_1.E8	LOCKED TWISTLOCK	Analog in 0.5V
1.4	+ATTACHMENT7.5_1.B1	2040 OUT	1.5A	1.24	+ATTACHMENT7.9_1.B8	LOCKED TWISTLOCK	Analog in 0.5V
1.5	+ATTACHMENT7.5_1.B1	4020 IN	1.5A Ref	1.25	/7.3_2.B1	ALIGNED BEAR	1.5A
1.6	/7.3_2.C1	INDICATION LAMPS	1.5A Ref	1.26	+ATTACHMENT7.9_1.C8	ALIGNED BEAR	Dig in / 1.5A
1.7	/7.1_1.B2	TILT LOCK	1.5A	1.27	+ATTACHMENT7.9_1.E8	ALIGNED BEAR	Analog in 0.5V
1.8	/7.1_1.B2	TILT LOCK	1.5A	1.28	/7.3_2.B1	WARNING ALARM AUTO SPREADING	6A
1.9	/7.1_1.B2	TILT LOCK	1.5A	1.29	/7.3_2.C1	ALIGNED BEAR	1.5A
1.10	/7.5_3.C1	POWER SUPPLY SENSORS	1.5A	1.30	+ATTACHMENT7.5_1.D1	SPESHIFT RIGHT	2.5A
1.11	/7.5_3.C1	ROTATION STOP	Dig in / 1.5A	1.31	+ATTACHMENT7.5_1.C1	SPESHIFT LEFT	1.5A
1.12	/7.5_3.D7	DUMPING 20.40	Dig in / 1.5A	1.32	/7.9_2.D1	LOCK TW	1.5A
1.13	+ATTACHMENT7.9_1.C8	CENTRAL LUBRICATION ATT.	Analog in 0.5V	1.33	/7.9_2.D1	UNLOCK TW	1.5A
1.14	/9.14.D2	WORKING LIGHT ATTACHMENT	6A	1.34			1.5A
1.15	+CAB96_1.F1	ROTATION C.W.	PWM	1.35			1.5A
1.16	/7.6_1.A8	ROTATION C.C.W.	PWM	1.36			Dig in / 1.5A
1.17	/7.6_1.B8	2040 OUT	PWM	1.37	/7.5_3.C7	SENSORS	Dig in / 1.5A
1.18	+ATTACHMENT7.5_1.B8	4020 IN	PWM	1.38	/7.9_2.C1	LOCKED TW	Dig in / 1.5A
1.19	+ATTACHMENT7.5_1.B8	3035 STOP	PWM	1.40	+ATTACHMENT7.9_1.B8	UNLOCKED TWISTLOCK	1.5A
1.20	/7.5_3.E7		Analog in 0.5V	1.41	+ATTACHMENT6.6_2.B2	EXTRA WORKING LIGHT	Analog in 0.5V
				1.42			6A

Rel. No.	KDU	Drawing No.	06800	Sign.	TKB	Datum Date	06815	Sign.	TKB	Drawn Date	05051	Haven Project no.	AS0000.0510	Kop	6	Blad/Sheet	0.0_4 /
	A50001.0100																
													Blad/Sheet	0.0_4 /			
<b>Krets Korsreferenser Agg</b>													Blad/Sheet	0.0_4 /			
<b>Wiring Cross References Alt</b>													Blad/Sheet	0.0_4 /			



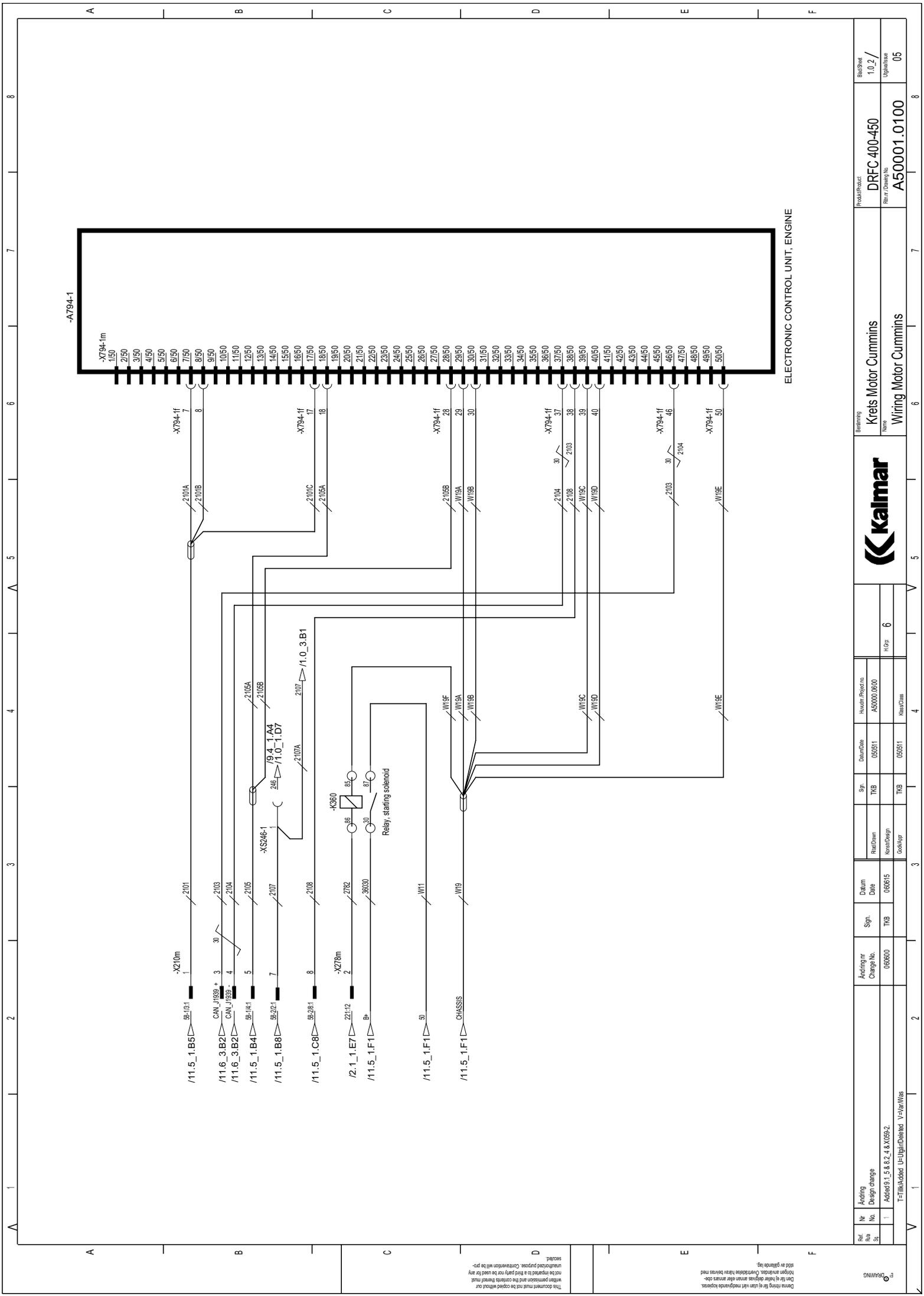




Nr	Ändring	Ändring nr	Sign.	Datum	Sign.	Datum	Rev	Projekt no.	Rev	Blad/Totalt
1	Design change	066800	TJK	066815	TJK	050511	6	A50000.05100	1.0.1 / Uppgradering	05
Additions 1, 5 & 8, 2, 4 & X2592		T=TimeAdded U=Uppgradering V=Var/Wies						Krets Motor Volvo 1240&1250		DRFC 400-450
								Wiring Motor Volvo 1240&1250		A50001.0100



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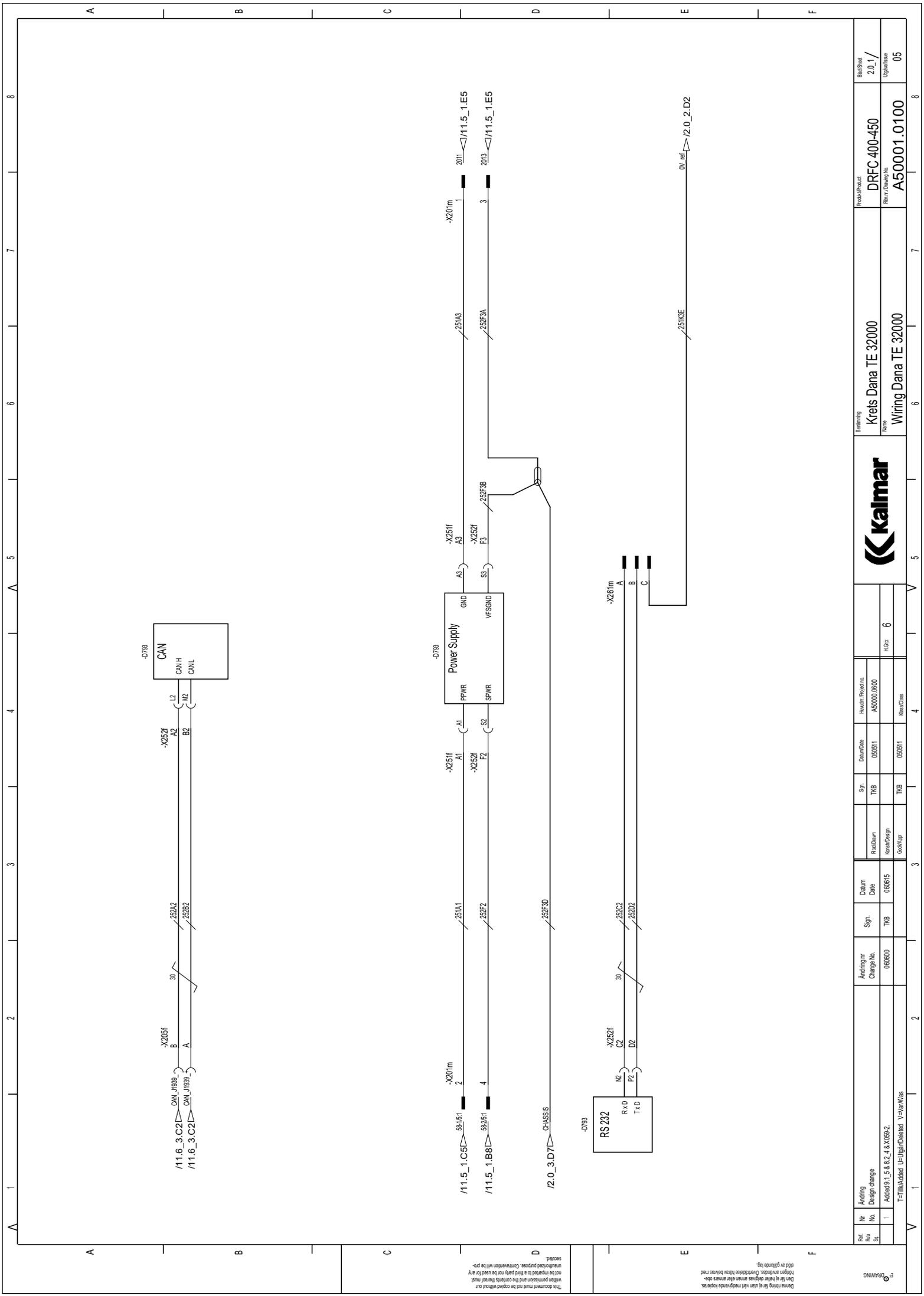
ELECTRONIC CONTROL UNIT, ENGINE

Rev. No.	Nr. of Changes	Availing Design Change No.	Sign.	Date	Sign.	Date	Drawn	Sign.	Date	Haven Project no.	Product	Block/Sheet
1		Added: L5 & L8, L4, X0592. T=Time/Added U=Upright/Deleted V=Var/Wires									Refer Drawing No.	05
											A50001.0100	
Krets Motor Cummins											Wiring Motor Cummins	
Kvalmar												
Electrical											Name	

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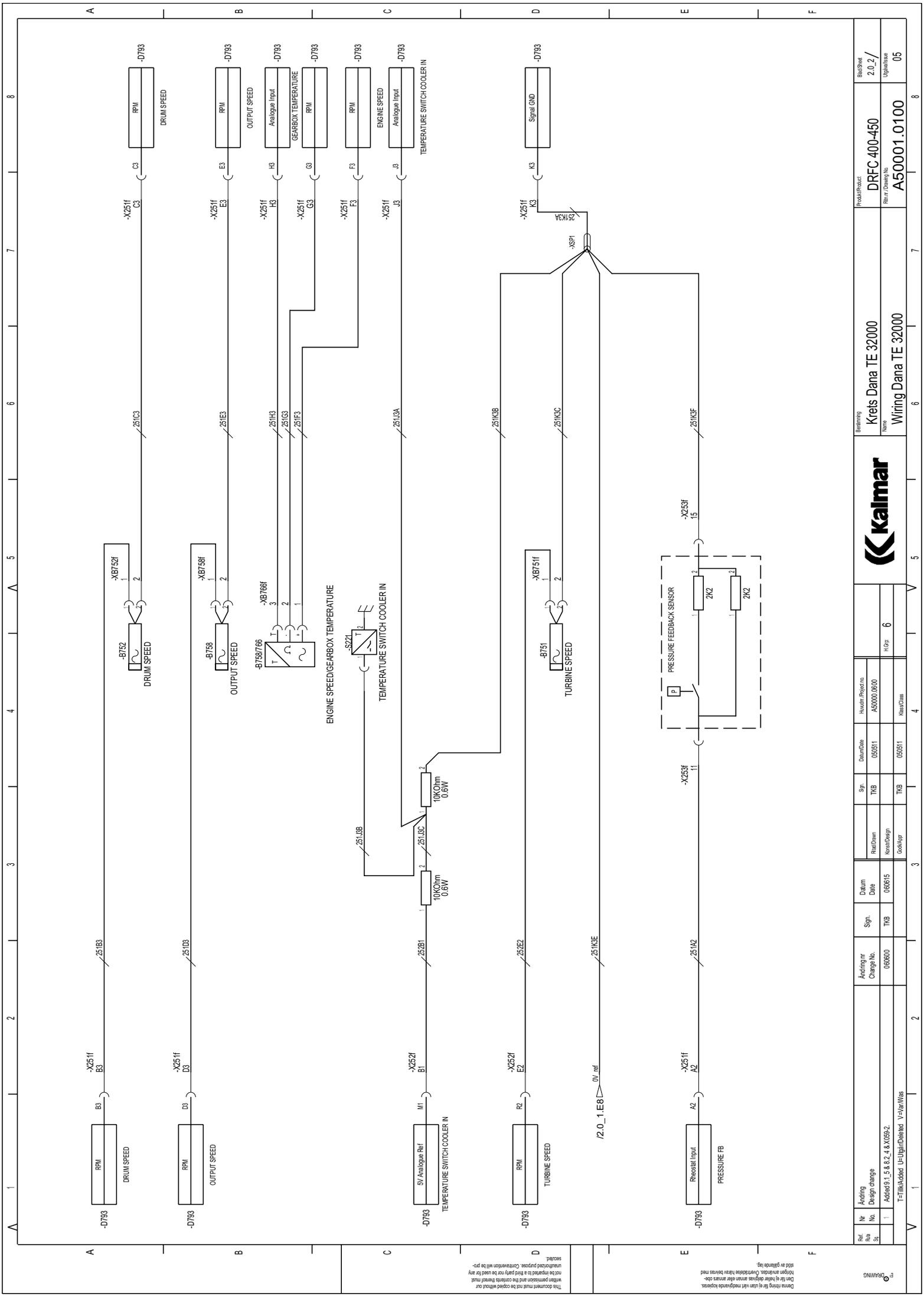






Rev. No.	1	Aviing nr	06600	Datum	060615	Sign.	TKG	Released	TKG	Drawn	TKG	Sign.	TKG	Drawn	050511	Project no.	A50000.05100	Revision	6
Aviing Design change		06600		060615		TKG		TKG		TKG		TKG		050511		A50000.05100		6	
1. Added: 1.5 & 8.2.4 & X2522		06600		060615		TKG		TKG		TKG		TKG		050511		A50000.05100		6	
T=TimA/oded U=Ugnt/Deled V=Var/Wies		06600		060615		TKG		TKG		TKG		TKG		050511		A50000.05100		6	
Kaltmar										Krets Dana TE 32000									
Wiring Dana TE 32000										DRFC 400-450									
Product/Project										A50001.0100									
Rev. of Drawing No.										2.0.1 /									
Uppgavsno										05									

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Rev. No.	1	Avning Design change	Avning nr Change No.	06800	Sign.	TKG	Datum Date	06805	Revision	TKG	Drawn	05051	Issue Date	05051	Project No.	A50000.0510	Revision	6	Class	TKG	
Rev. No.	1	Added: 1.5 & 8.2 & X252																			
T=Time/Added U=Ugnet/Deleted V=Var/Wies																					
Komet A/S										Krets Dana TE 32000											
Product/Model										DRFC 400-450											
Revision/Drawn No.										A50001.0100											
Blad/Sheet										2.0.2 / Ughænske											
Page No.										8											

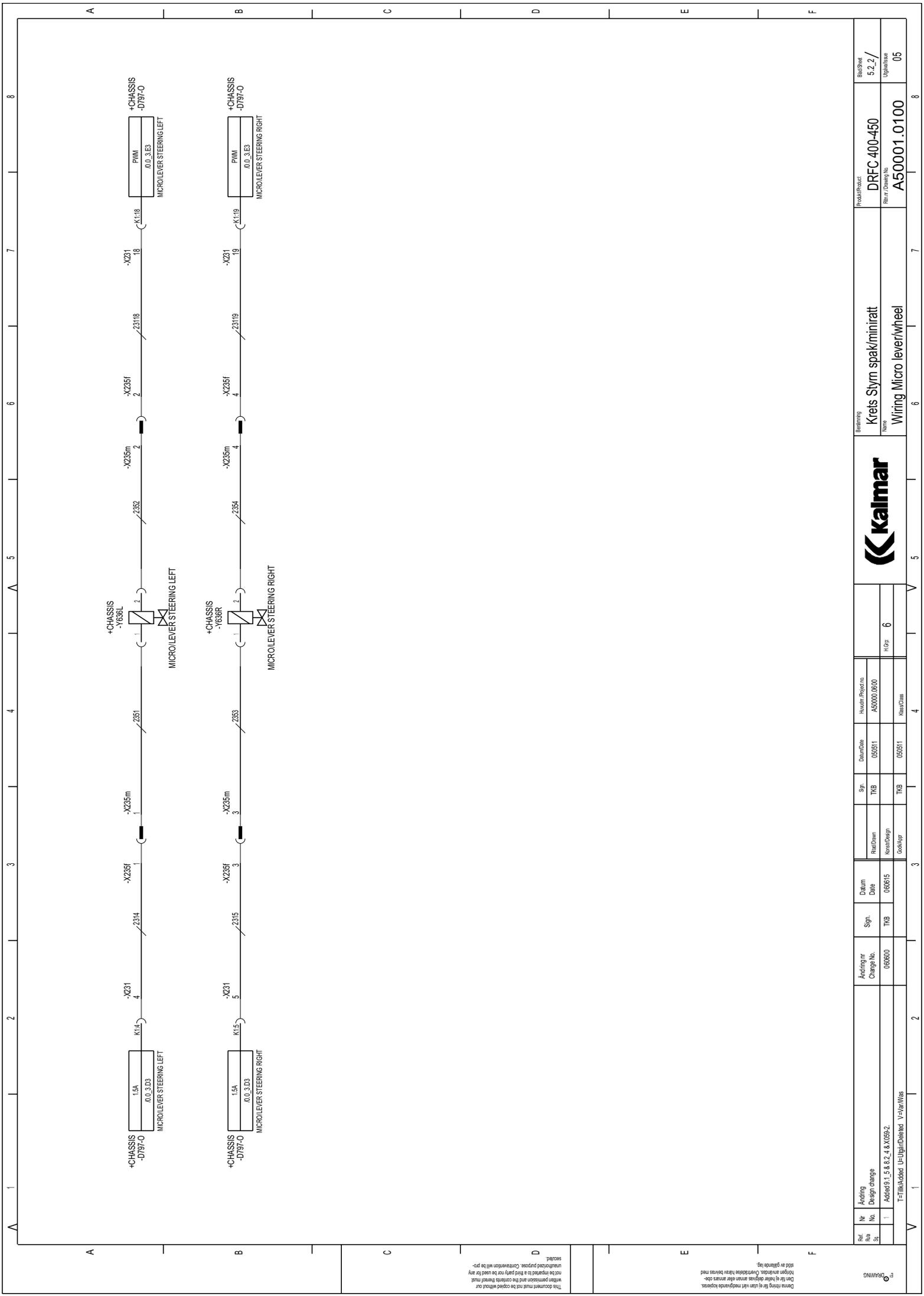












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Rev. No.	Nr. Design change	Avdring nr. Change No.	Datum Date	Sign.	Riser/Drawn	Sign.	Datum Date	Haven/Project no.	Blad/Sheet
1	Added to L5 & 8.2.4 & X2352. T=Time/Added U=Udgift/Deleted V=Var/Wies	066800	066815	TKG	TKG	TKG	050511	TKG	Product/Model
									Refer. Drawing No.
									A50001.0100
									Udgave/Issue
									05

Kalmar  
Krets Sym spak/miniratt  
Wiring Micro lever/wheel

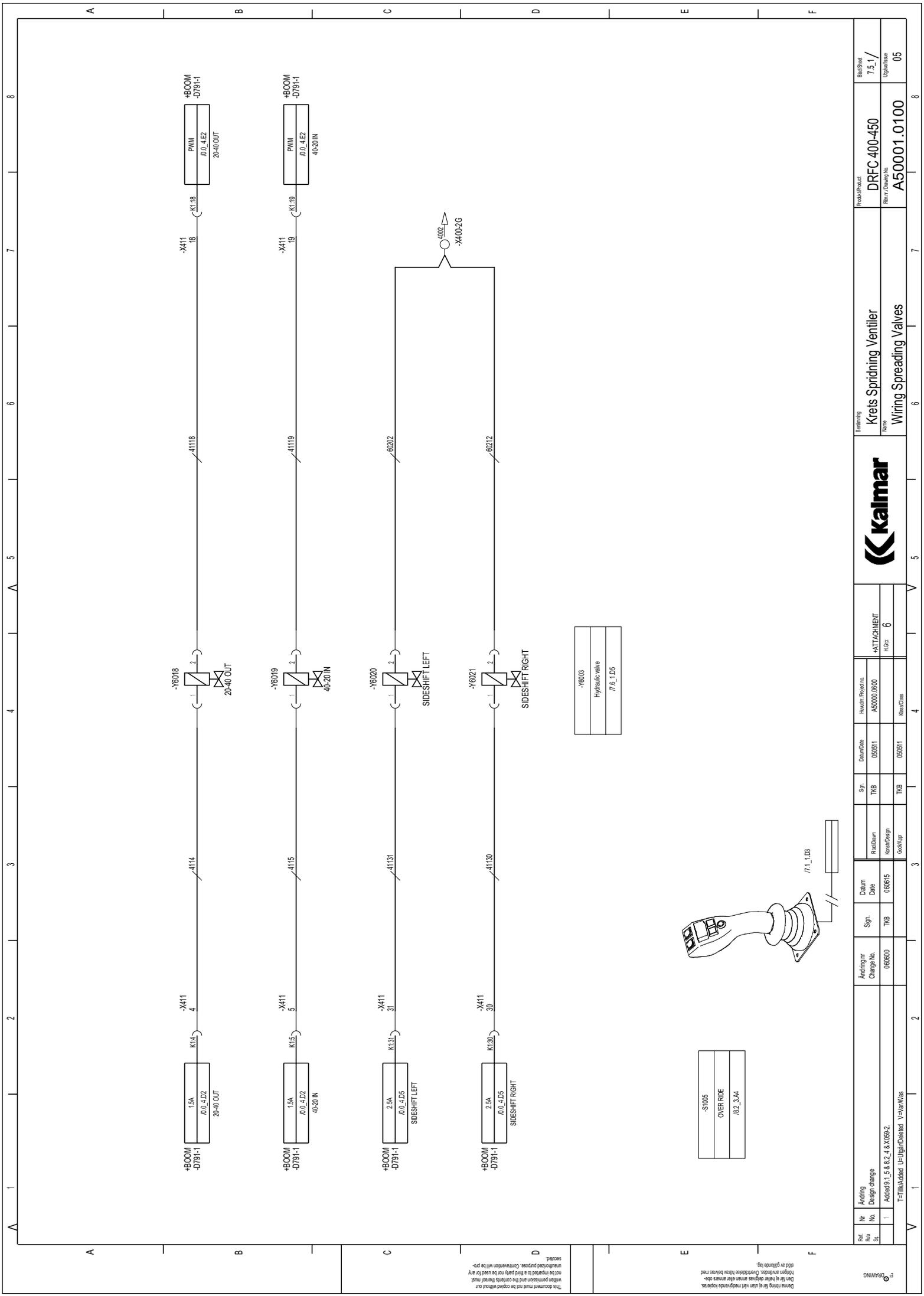












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DRFC 400-450  
 A50001.0100

Krets Spridning Ventil  
 Wiring Spreading Valves

Product No. DRFC 400-450  
 Rev. / Change No. A50001.0100

Blad/Sheet 7.5.1 / Udgave/Issue 05

Kalmar

Attachment 4-ATTACHMENT  
 Ksp: 6

Rev. No.	Aviing nr Change No.	Sign.	Datum Date	Revision	Handled by	Checked by
1	066800	TGB	066815	AS0000.0500	AS0000.0500	AS0000.0500

Aviing nr Change No. 066800  
 Sign. TGB  
 Datum Date 066815  
 Revision AS0000.0500  
 Handled by AS0000.0500  
 Checked by AS0000.0500

17.1\_1.D3

-S1005  
 OVER RIDE  
 /02\_3.A4

-V6003  
 Hydraulic valve  
 /7.6\_1.D5

2.5A /0.0\_4.D5 SIDESHIFT LEFT  
 2.5A /0.0\_4.D5 SIDESHIFT RIGHT

1.5A /0.0\_4.D2 20x40 OUT  
 1.5A /0.0\_4.D2 40x20 IN

+BOOM -D791-1  
 +BOOM -D791-1  
 +BOOM -D791-1  
 +BOOM -D791-1

-X411 4  
 -X411 5  
 -X411 31  
 -X411 30

-Y6018  
 -Y6019  
 -Y6020  
 -Y6021

41118  
 41119  
 60202  
 60212

K1.18  
 K1.19  
 K1.31  
 K1.30

PWM 0.0\_4.E2 20x40 OUT  
 PWM 0.0\_4.E2 40x20 IN

+BOOM -D791-1  
 +BOOM -D791-1

-X411 18  
 -X411 19

K1.18  
 K1.19

PWM 0.0\_4.E2 20x40 OUT  
 PWM 0.0\_4.E2 40x20 IN

+BOOM -D791-1  
 +BOOM -D791-1

-X411 18  
 -X411 19

K1.18  
 K1.19

PWM 0.0\_4.E2 20x40 OUT  
 PWM 0.0\_4.E2 40x20 IN

+BOOM -D791-1  
 +BOOM -D791-1

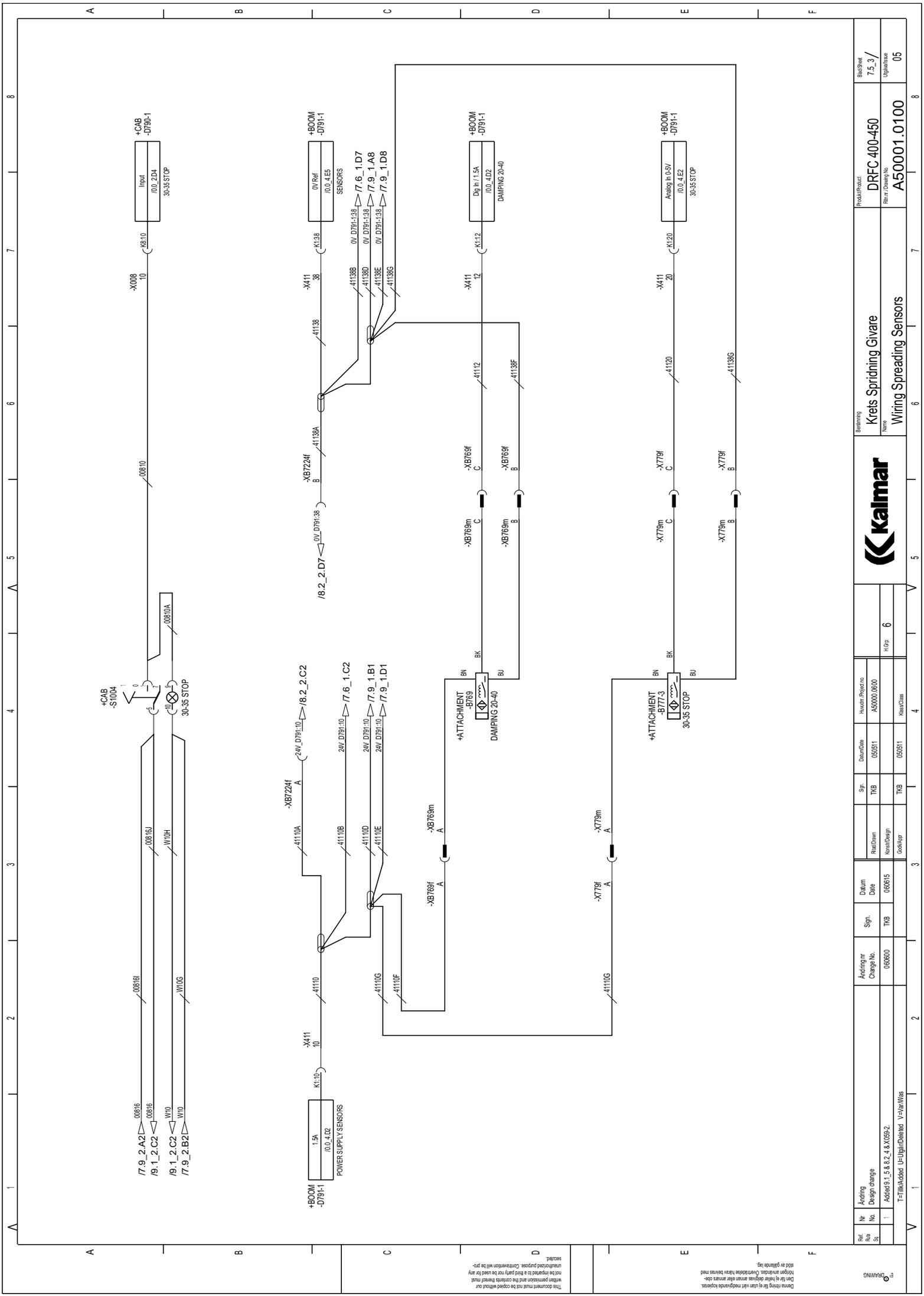
-X411 18  
 -X411 19

K1.18  
 K1.19

PWM 0.0\_4.E2 20x40 OUT  
 PWM 0.0\_4.E2 40x20 IN

+BOOM -D791-1  
 +BOOM -D791-1

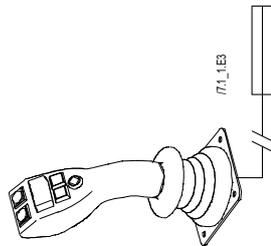
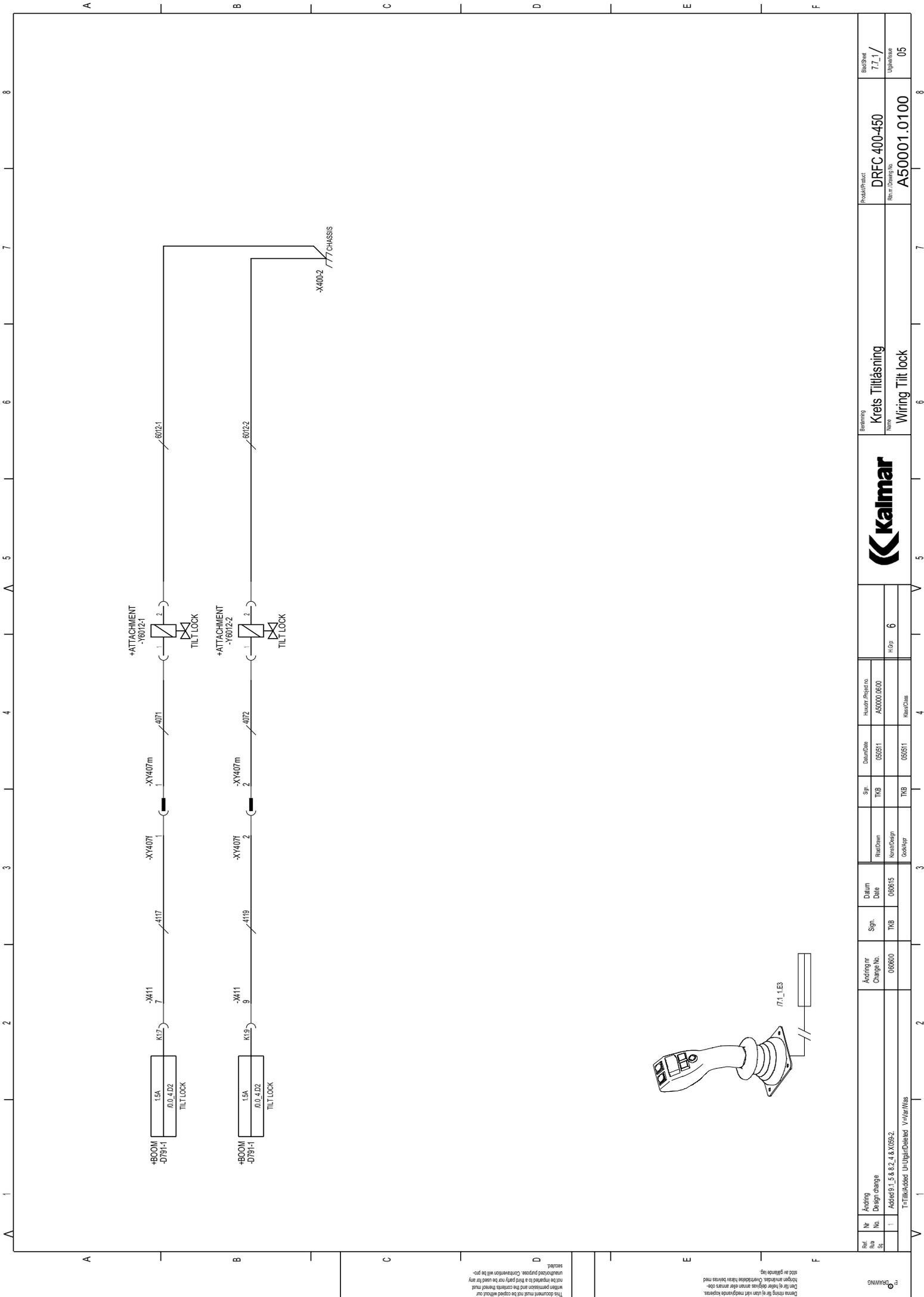




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Rev. Nr.	1	Åndring nr. Design change	066800	Datum Date	060615	Sign.	TKG	Drawn/Drawn	TKG	Rev. nr./Rev. no.	050811	Issue/Issue no.	AS0000/0510	Project/Projekt no.	AS0000/0510	Product/Produkt	DRFC 400-450	BlankSheet	7.5.3 / Udgave/Issue	05
<p style="text-align: center;"><b>Kalmar</b></p> <p style="text-align: center;">Battery Krets Spreading Givare Name Wiring Spreading Sensors</p>																				
<p style="text-align: center;">Product/Produkt: DRFC 400-450 Rev. nr./Rev. no.: A50001.0100</p>																				





Rev. No.	Nr. of Change	Avonding nr. Design change	Sign.	Datum Date	Sign.	Drawn Date	Sign.	Haven Project no.	BladSheet	
										066800
1		Added 1.5 & 8.2 & X6562							Product/Product	
		T=Terminal Added U=Uplift/Deleted V=Var/Wires							DRFC 400-450	
									Rev. of Change No.	
									A50001.0100	
									Name	
									Krets Tiltlocking	
									Wiring Tilt lock	
									BladSheet	
									7.7.1 /	
									Uplift/Deleted	
									05	

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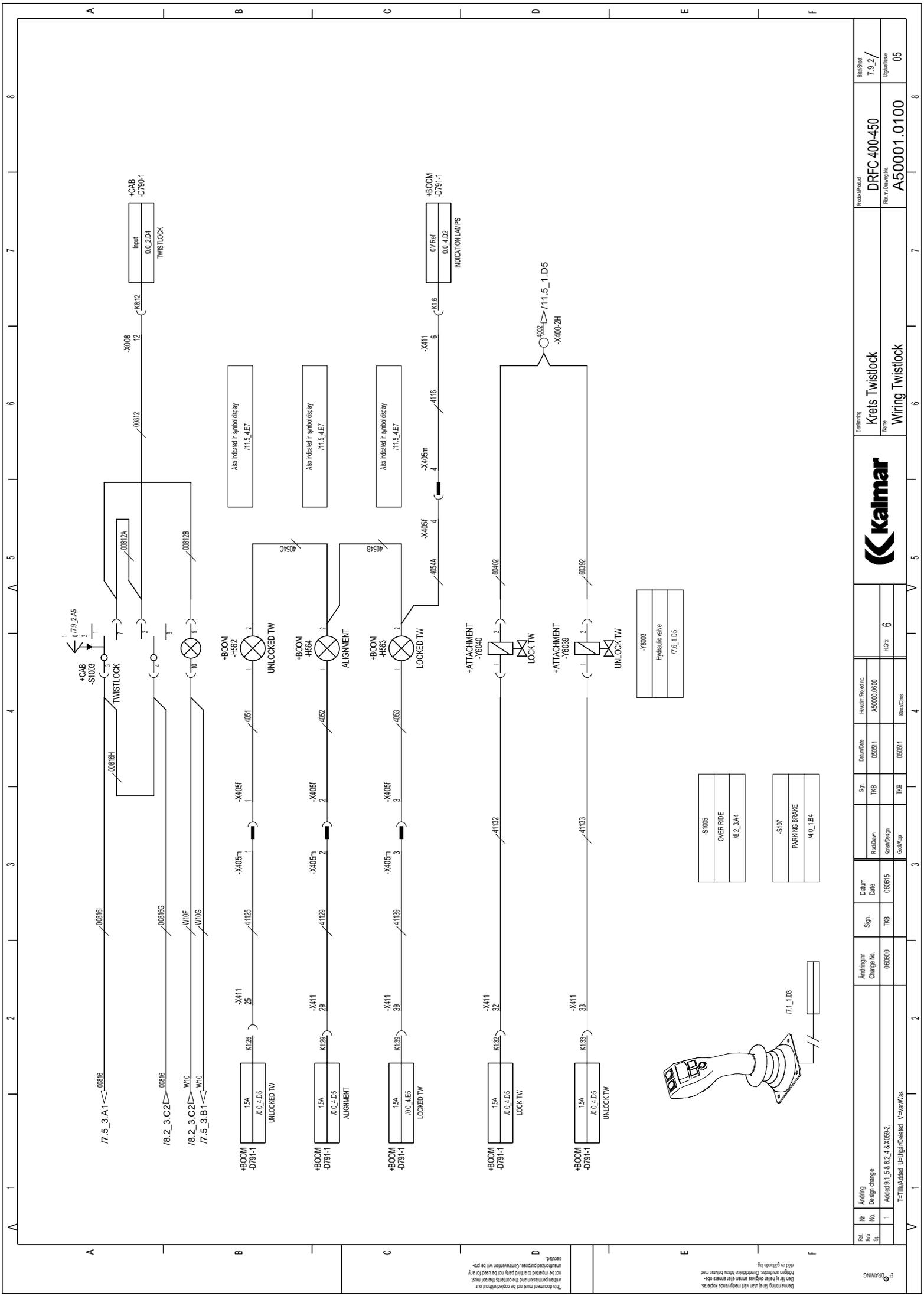
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sealed.







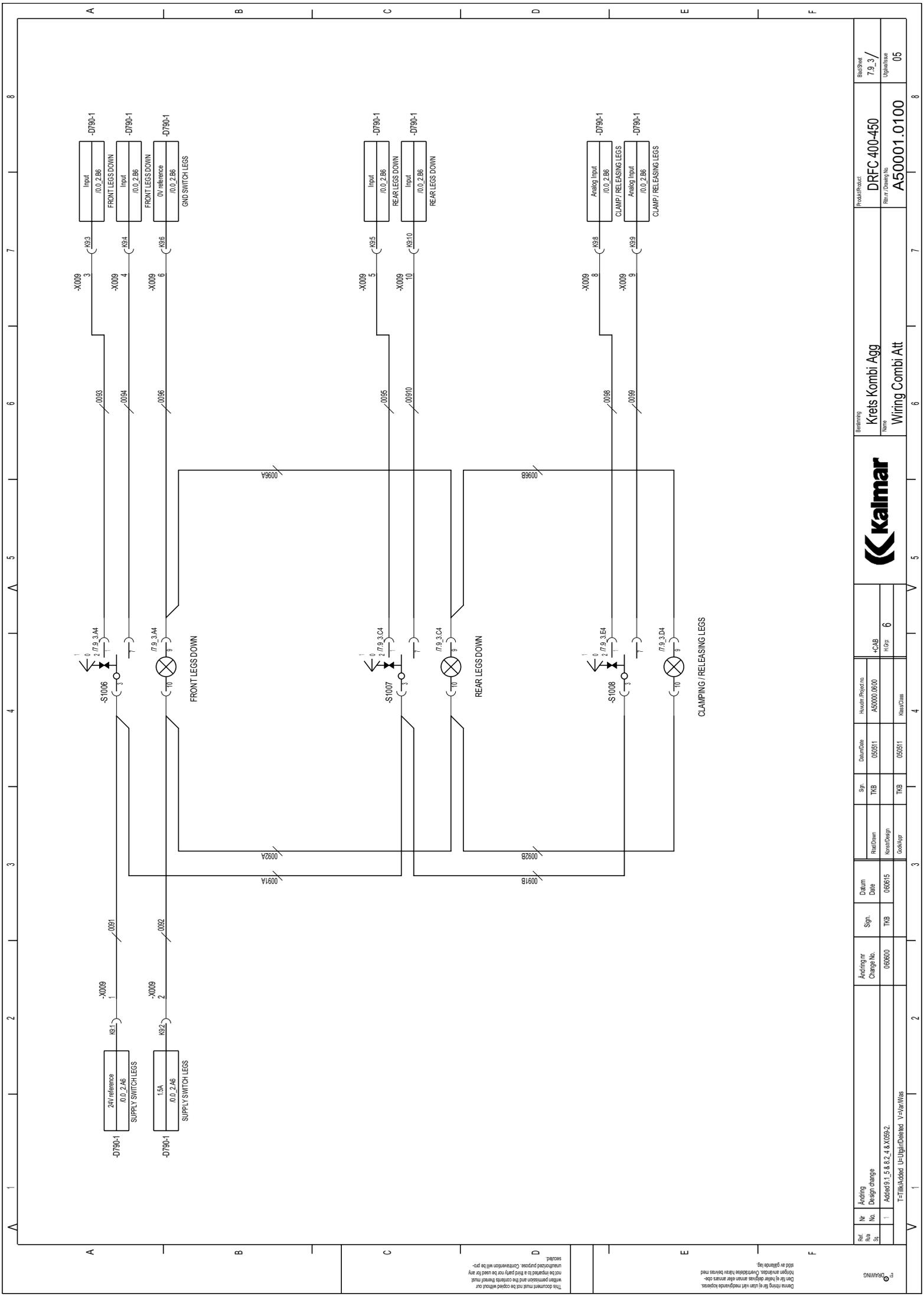


Rev. No.	1	Avding nr	066800	Datum	060615	Sign.	TKG	Drawn	TKB	Checked	TKB	Project no.	A50000.05100	Revision	7.9.2 / Uprøbet
Design change	A-tilføjet 1.5 & 8.2 & X1052.														
T=TimeA-ødet U=Uprøbet/debet V=Var/Wies															
<b>Krets Twistlock</b> Name: <b>Wiring Twistlock</b>															
Product/Model: <b>DRFC 400-450</b> Ref. / Order No.: <b>A50001.0100</b>															
Sheet No. <b>05</b> / Total Sheets <b>05</b>															

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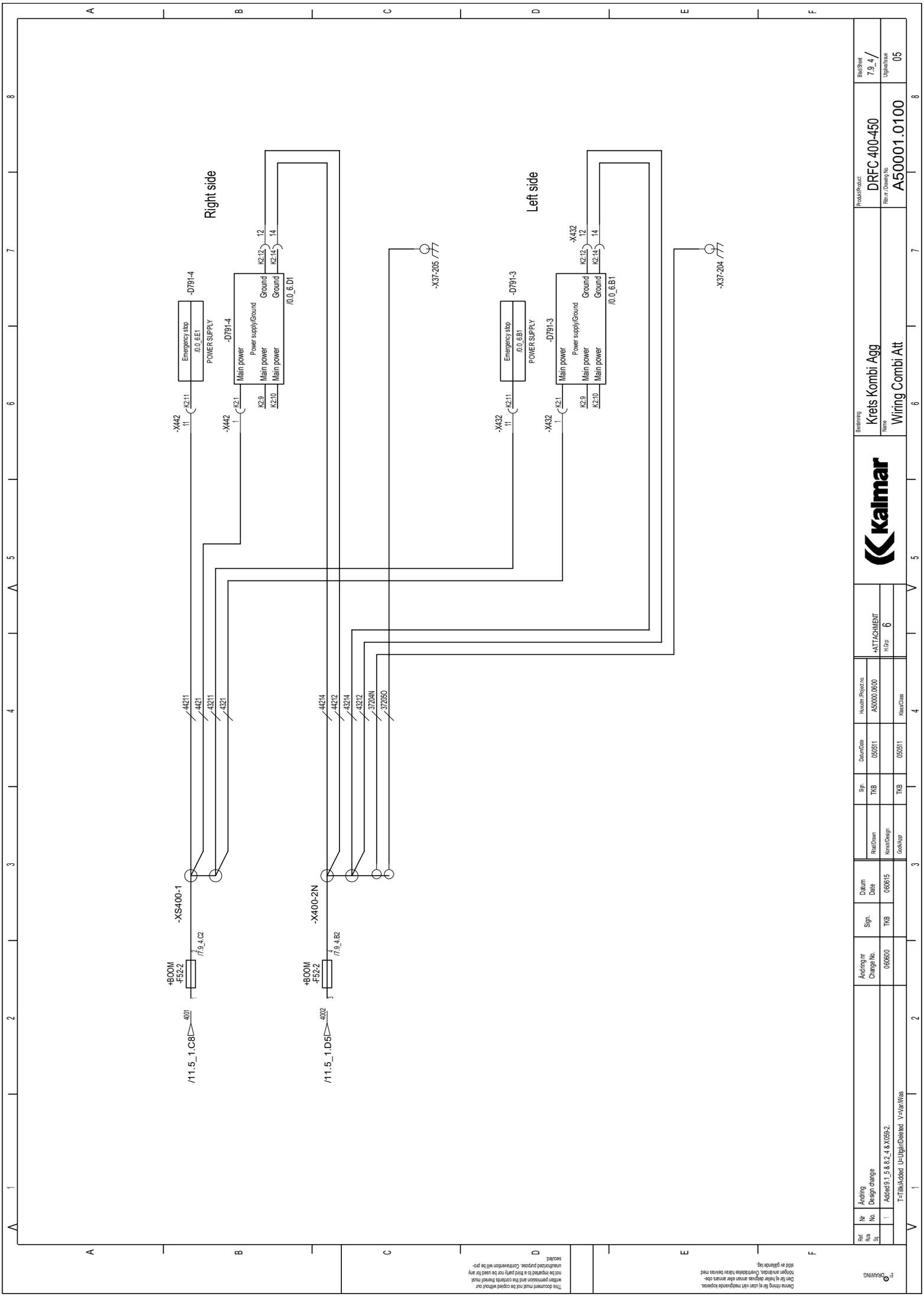
Denne tegning kan kun anvendes til fremstilling af maskiner og udstyr til brug i forbindelse med projekter, som er godkendt af Krets. Den kan ikke anvendes til andre formål. For yderligere oplysninger om anvendelse af denne tegning, kontakt venligst Krets. Denne tegning kan kun anvendes til fremstilling af maskiner og udstyr til brug i forbindelse med projekter, som er godkendt af Krets. Den kan ikke anvendes til andre formål. For yderligere oplysninger om anvendelse af denne tegning, kontakt venligst Krets.



Rev. No.	1	Nbr	Avding nr	Design change	066800	Sign.	TKG	Datum	Date	060615	RustDraw	TKG	Sign.	TKG	Datum	Date	050511	Huvud Projekt nr.	AS0000/05100	K-Tab	K-Grp	6	BladSheet	7.9.3 / Upphavs
Krets Kombi Agg Wiring Kombi Att																							Product/Product <b>DRFC 400-450</b>	
Kalmar																							Ref. / Order No. <b>A50001.0100</b>	

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Right side

Left side

Rev. No.	1	Nr. Design change	Added 1.5 & 8.2 & X352.		Datum Date	060615	Sign.	TKB	Drawn	TKB	Sign.	TKB	Date	050511	Haven Project no.	A50000.05100	+ATTACHMENT	K: 6	Product/Part	DRFC 400-450	BladSheet	7.9.4 /	Uppskrift	05
			T= Tillagd U= Uppgjord	V= Var/Wies																				



Stämning  
Krets Kombi Agg  
Name  
Wiring Combi Alt

4001  
/11.5\_1.C8

4002  
/11.5\_1.D5

4003  
/11.5\_1.E8

4004  
/11.5\_1.F8

4005  
/11.5\_1.G8

4006  
/11.5\_1.H8

4007  
/11.5\_1.I8

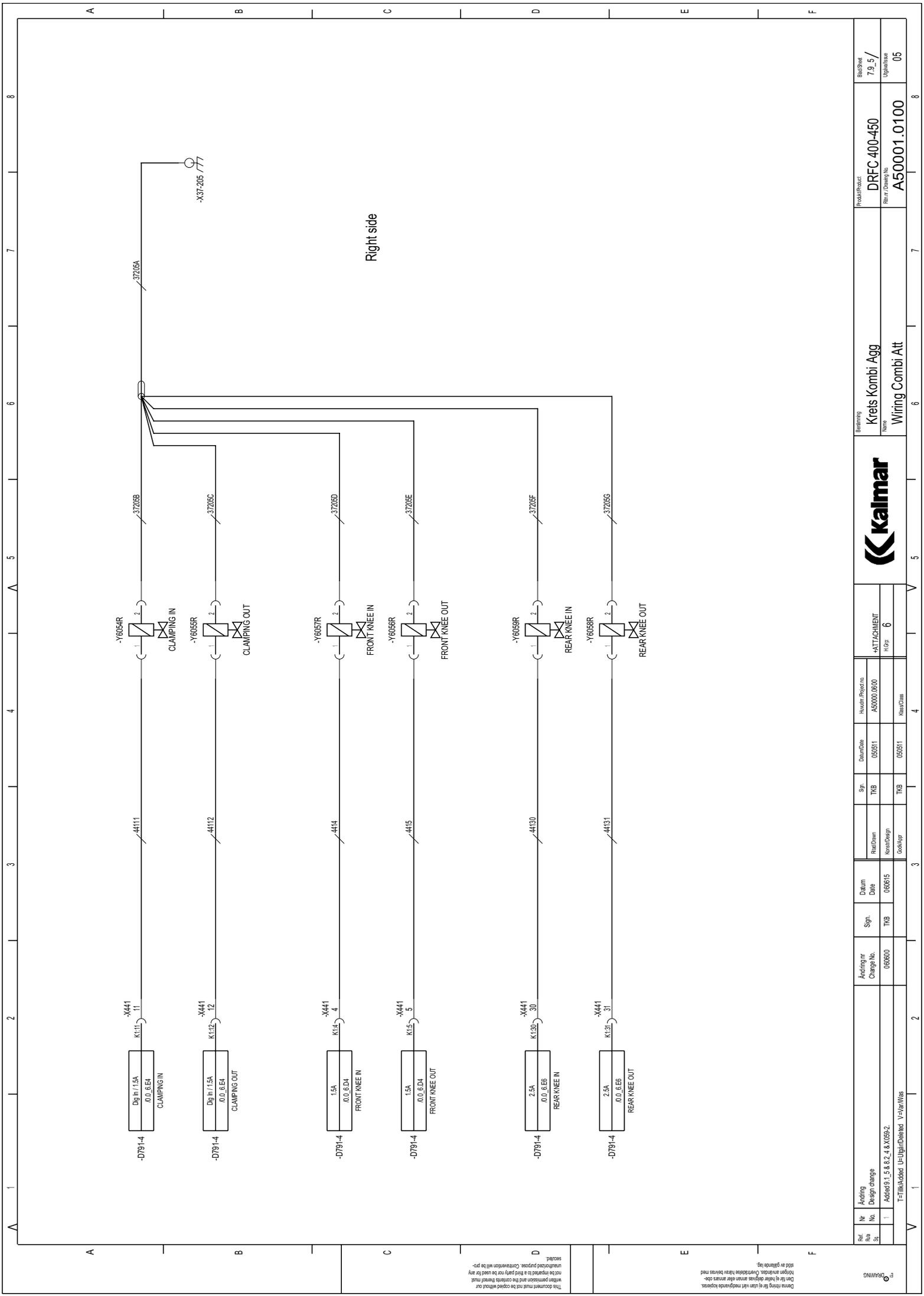
4008  
/11.5\_1.J8

4009  
/11.5\_1.K8

4010  
/11.5\_1.L8

4011  
/11.5\_1.M8

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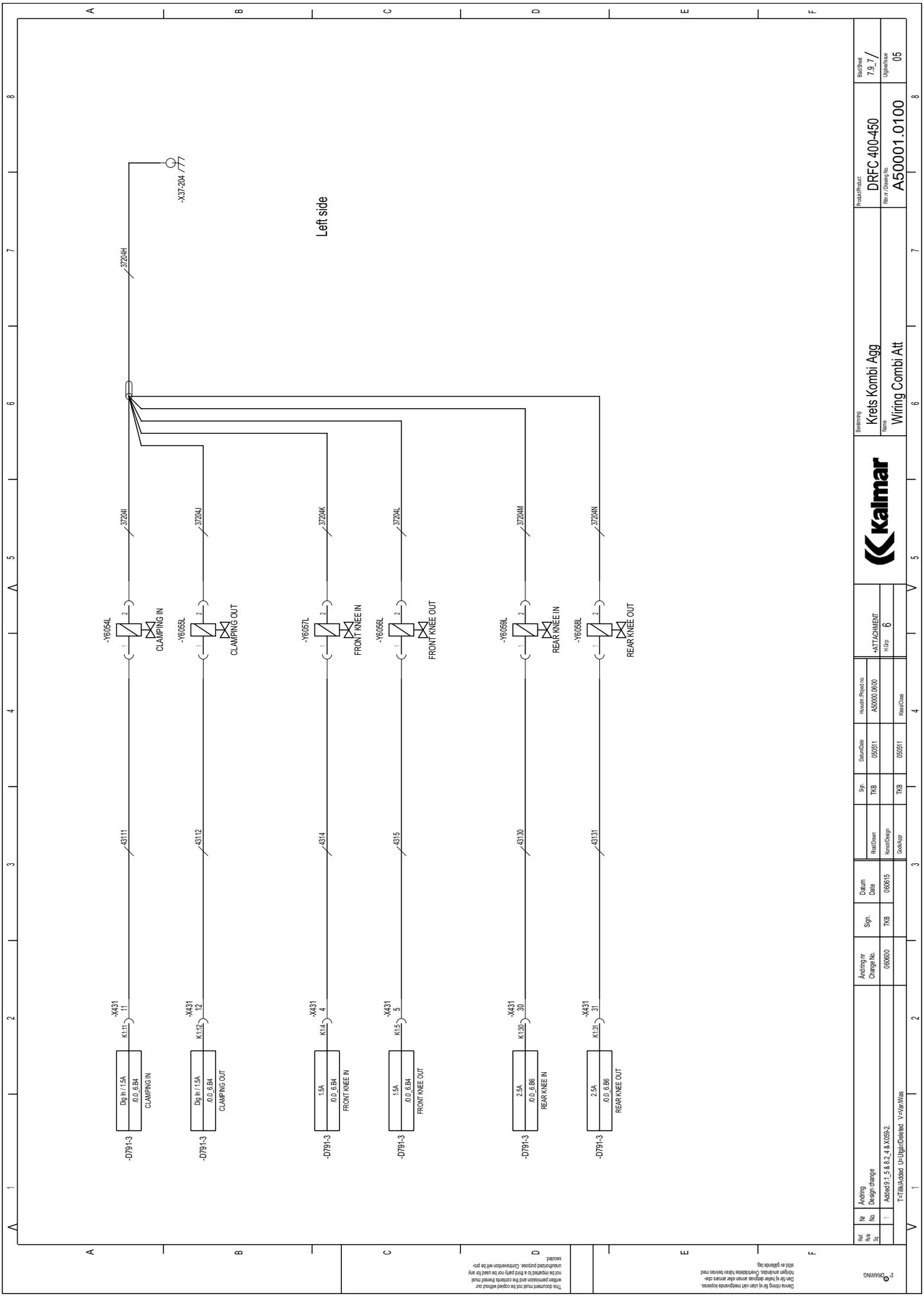
Right side

Rev. No.	1	Avding nr	06600	Sign.	TKB	Datum Date	06615	RwdDrawn	TKB	Sign.	TKB	DrawnDate	05051	Hwarrn / Project no.	AS0000.05100	+ATTACHMENT	Ksp.	6	BladSheet	7.9.5 / Uppskatta



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Left side

Rev. No.	1	Nr. Design change	066800	Sign. TKG	Datum Date 060615	RearDrawn TKG	Sgn. TKG	DrawnDate 050511	Haveni Project no. A50000.05100	Kvalitet	Krets Kombi Agg	Product/Modul DRFC 400-450	BladSheet 7.9.7 / Uppgavsbe
<p style="text-align: center;"><b>Kalmar</b></p> <p style="text-align: center;">Wiring Kombi Att</p>													
<p style="text-align: center;">+ATTACHMENT</p> <p style="text-align: center;">K: 6</p>													
<p style="text-align: center;">T=Tim/Acled U=Uppg/Deleted V=Var/Wies</p>													

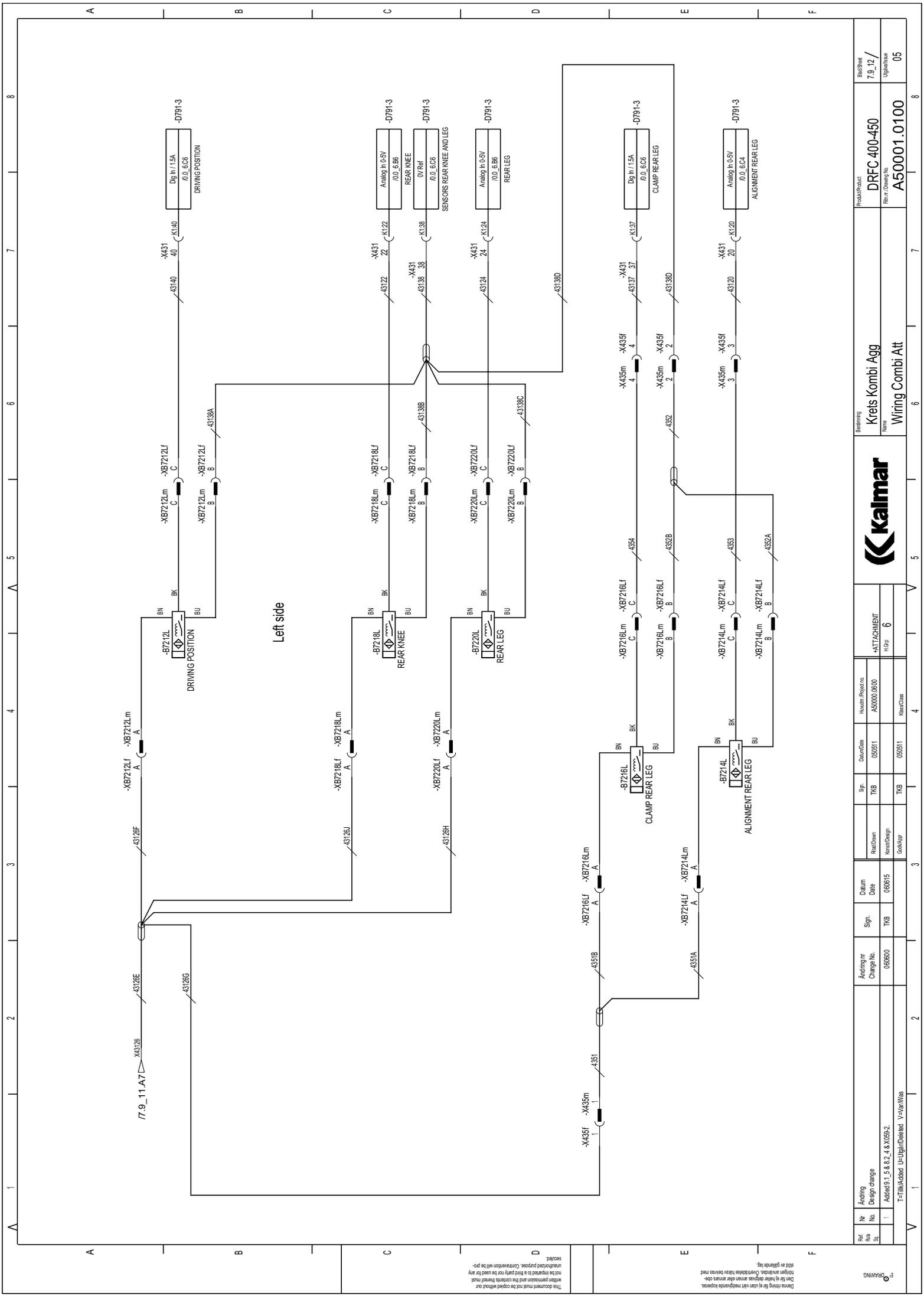
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Rev. No.	Nr	Avding nr Design change	Sign.	Datum Date	Sign.	Datum Date	Huvud Projekt no.	Krets Kombi Agg	Blad/Sheet 7.9_12/ Uppgående												
										43128E	43128G	43128F	43128J	43128H	43128I	43128K	43128L	43128M	43128N	43128O	43128P
1		06800	TKG	06815	TKG	05051	A50000.0510	Wiring Kombi Alt	05												
		T=Tim/Acled U=Ugån/Deleted V=Var/Wies						A50001.0100													

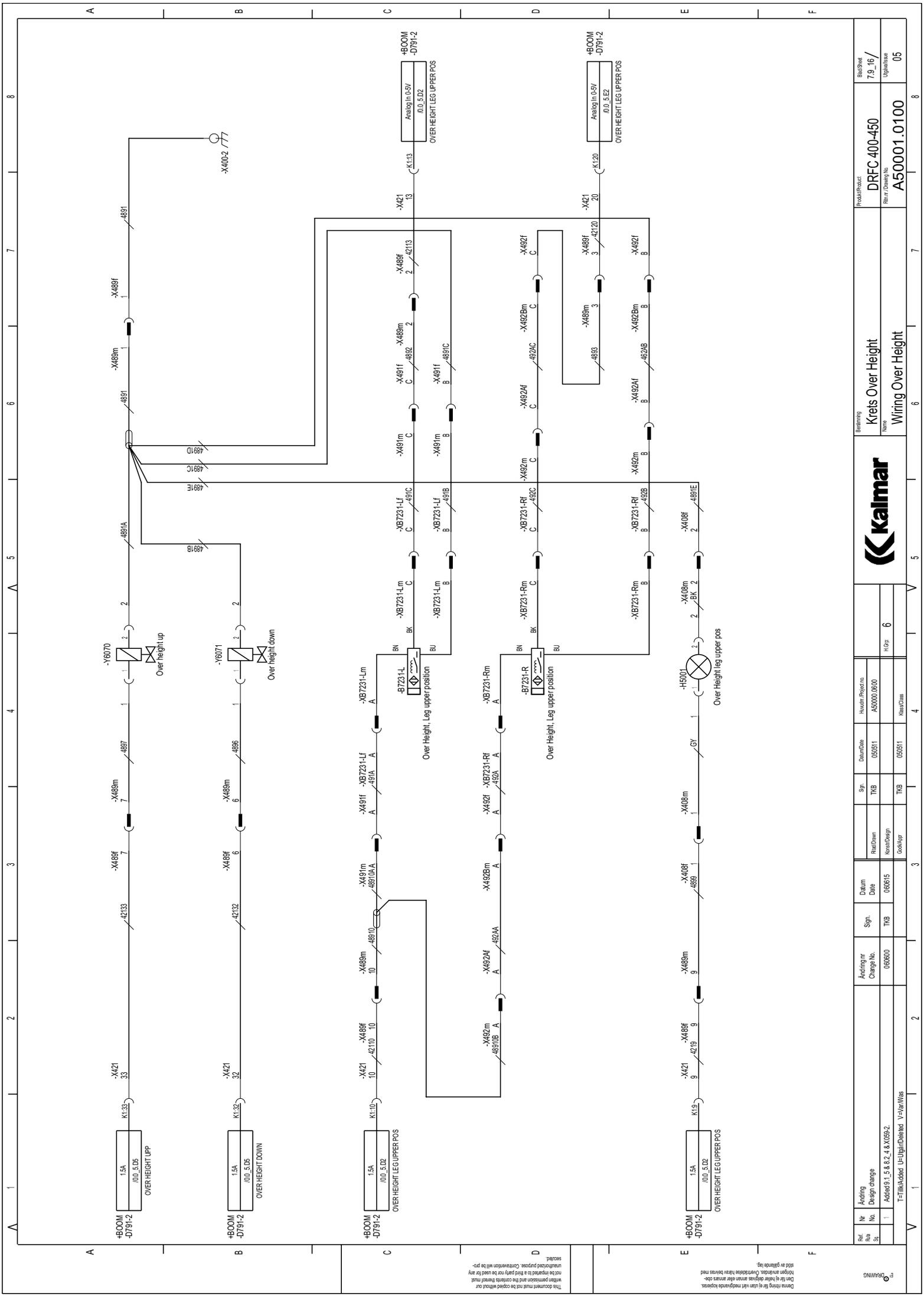


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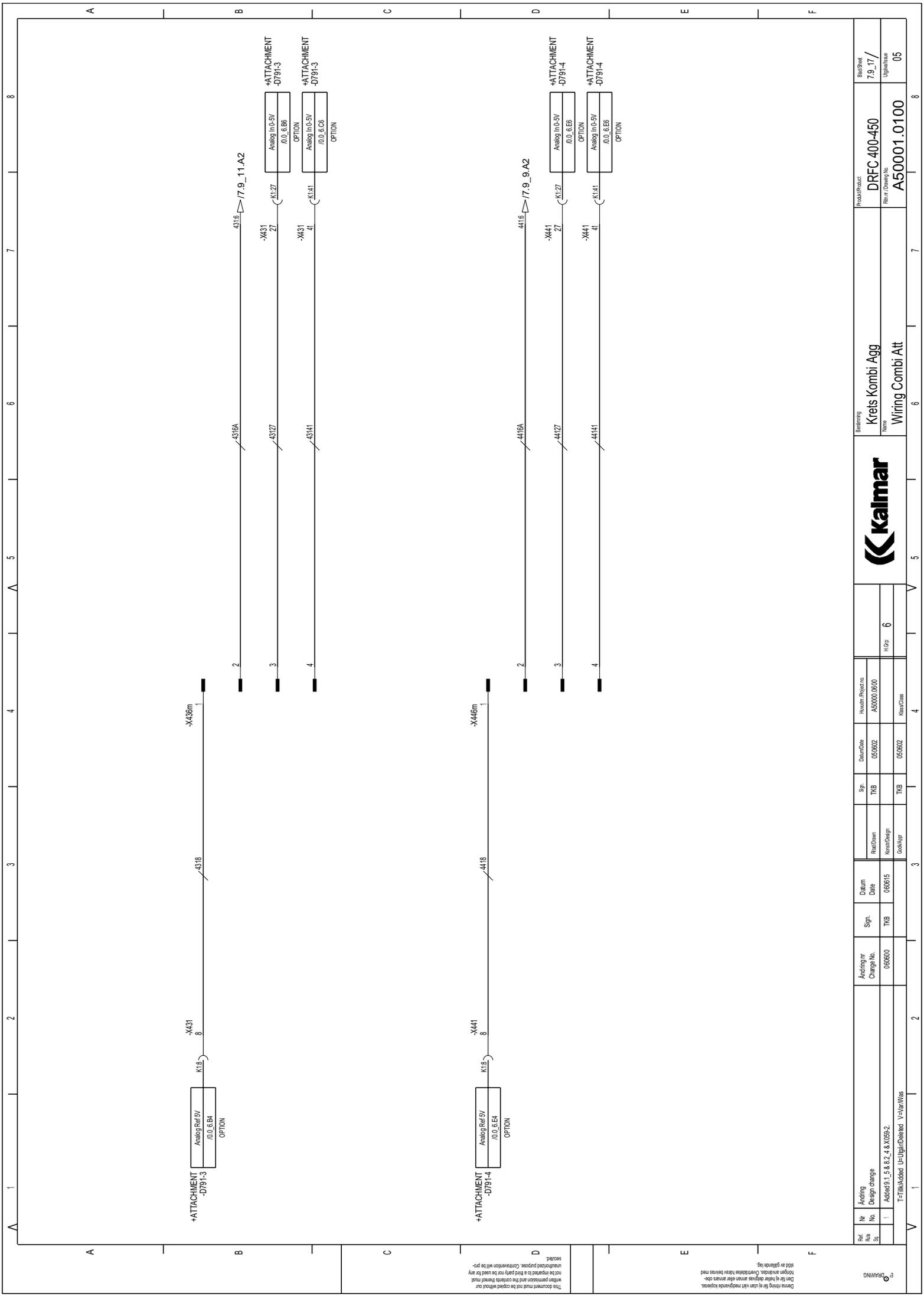






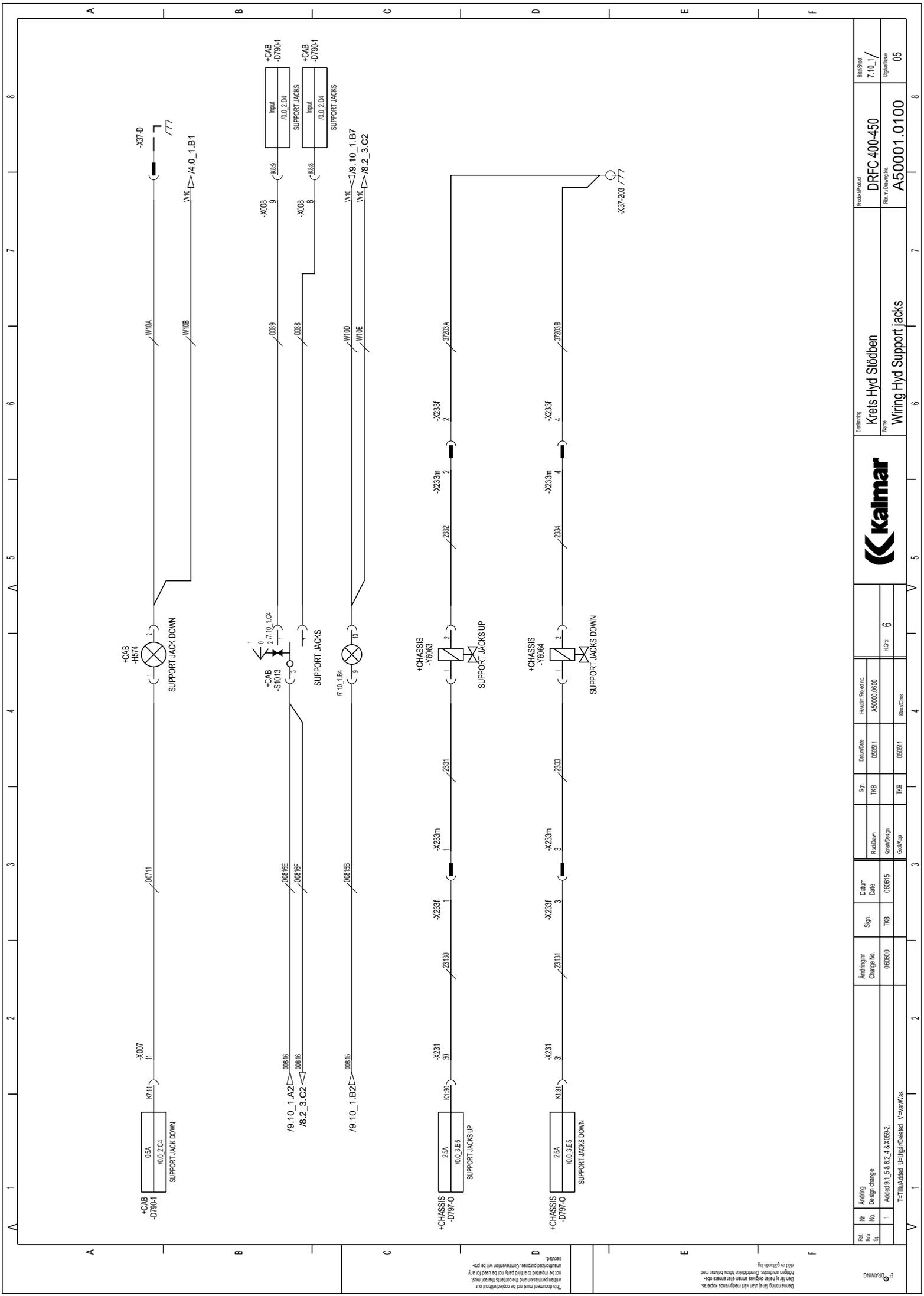


Rev. No.	1	Avding Design change	Avding nr Change No.	066800	Sign.	TKG	Datum Date	066815	Drawn	TKG	Sign.	TKG	Drawn Date	050511	Revision Project no.	A50000.0510	Item	6	Item	6
T=Time/Added U=Utgitt/Deleted V=Var/Wies																				
Krets Over Height										Wiring Over Height										
Krets Over Height										Wiring Over Height										
Product/Project										DRFC 400-450										
Rev. / Drawn No.										A50001.0100										
Blad/Sheet										7.9_16 / Uppskisse										
05										05										



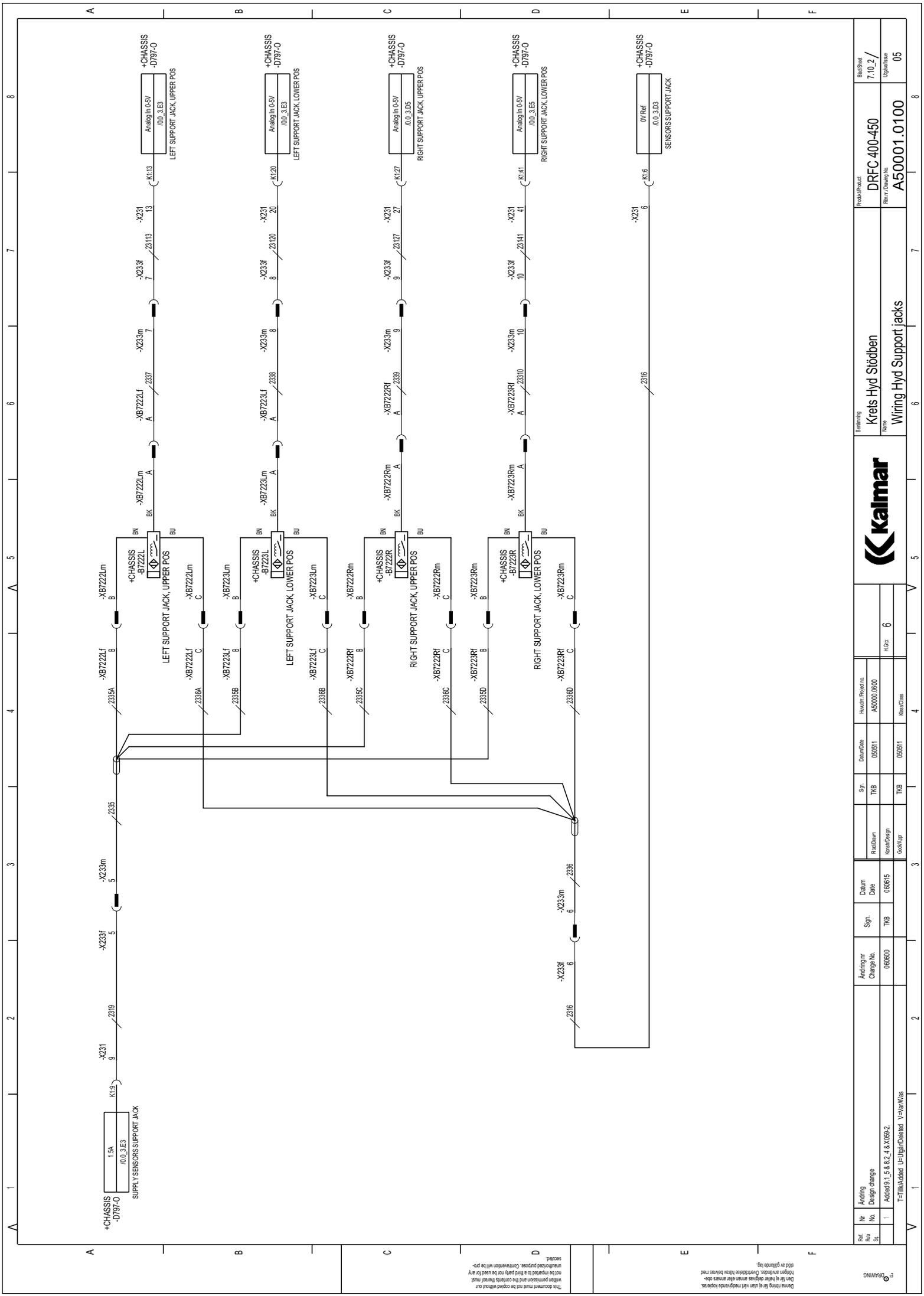
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Rev. Nr.	No.	Ändring nr. Design change	Ändring nr. Change No.	Sign.	Datum Date	Risikobeskrivelse Risk Descr.	Kontrolleret Checked	Tilrettet Prepared	Kategori Category	Hverken/Project no.	Produkt/Prod. No.	Blad/Sheet
T = Tillæg/Added U = Udgået/Deleted V = Var/Wies												
<div style="display: flex; justify-content: space-between;"> <span>AS50001.05100</span> <span>AS50001.05100</span> </div>												
												
<b>Krets Kombi Agg</b> Name: <b>Wiring Kombi Att</b>												
Produkt/Prod. No.: <b>DRFC 400-450</b> Rev. / Sheet No.: <b>A50001.0100</b>												
Blad/Sheet: <b>7.9_17 /</b> Udgave/Issue: <b>05</b>												



Rev. No.	Nr	Avöring Design change	Ändring nr Change No.	Sign.	Datum Date	Ritad/Drawn	Sgr.	Datum Date	Huvud/Project no.	Produkt/Product	Blad/Sheet
1	1	Ändrad 1, 5 & 8, 2 & 4, X0592	066800	TKB	066815	TKB	050511	TKB	A50000.05100	DRFC 400-450	7.10.1 / Uppgradering
T=Titel/Title U=Utgått/Deleted V=Var/Wires											
<div style="display: flex; justify-content: space-between;"> <span>Blad/Sheet</span> <span>Produkt/Product</span> <span>Blad/Sheet</span> </div> <div style="display: flex; justify-content: space-between;"> <span>Rev. No.</span> <span>Ändring nr Change No.</span> <span>Rev. No.</span> </div> <div style="display: flex; justify-content: space-between;"> <span>Sign.</span> <span>Datum Date</span> <span>Sign.</span> </div> <div style="display: flex; justify-content: space-between;"> <span>Ritad/Drawn</span> <span>Sgr.</span> <span>Datum Date</span> </div> <div style="display: flex; justify-content: space-between;"> <span>Huvud/Project no.</span> <span>Kontroll/</span> <span>Kontroll/</span> </div> <div style="display: flex; justify-content: space-between;"> <span>TKB</span> <span>TKB</span> <span>TKB</span> </div> <div style="display: flex; justify-content: space-between;"> <span>066815</span> <span>050511</span> <span>050511</span> </div> <div style="display: flex; justify-content: space-between;"> <span>A50000.05100</span> <span>A50000.05100</span> <span>A50000.05100</span> </div> <div style="display: flex; justify-content: space-between;"> <span>DRFC 400-450</span> <span>DRFC 400-450</span> <span>DRFC 400-450</span> </div> <div style="display: flex; justify-content: space-between;"> <span>7.10.1 / Uppgradering</span> <span>7.10.1 / Uppgradering</span> <span>7.10.1 / Uppgradering</span> </div>											

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Rev. No.	Nr. Design change	Date	Sign.	Datum	Drawn	Sgn.	Date	Haven Project no.	Product	Block/Sheet
1	Added 1.5 & 8.2 & X0592	06815	TKB	06815	TKB	05051	TKB	AS0000.0510	DRFC 400-450	7.10.2 / Uppgående
T=Time/Added U=Uppgående V=Var/Wies										05

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Stämning: Krets Hyd Stödben  
 Namn: Wiring Hyd Support jacks

Produkt: DRFC 400-450  
 Rev. / Block/Sheet: A50001.0100 / 05

8 7 6 5 4 3 2 1

A B C D E F





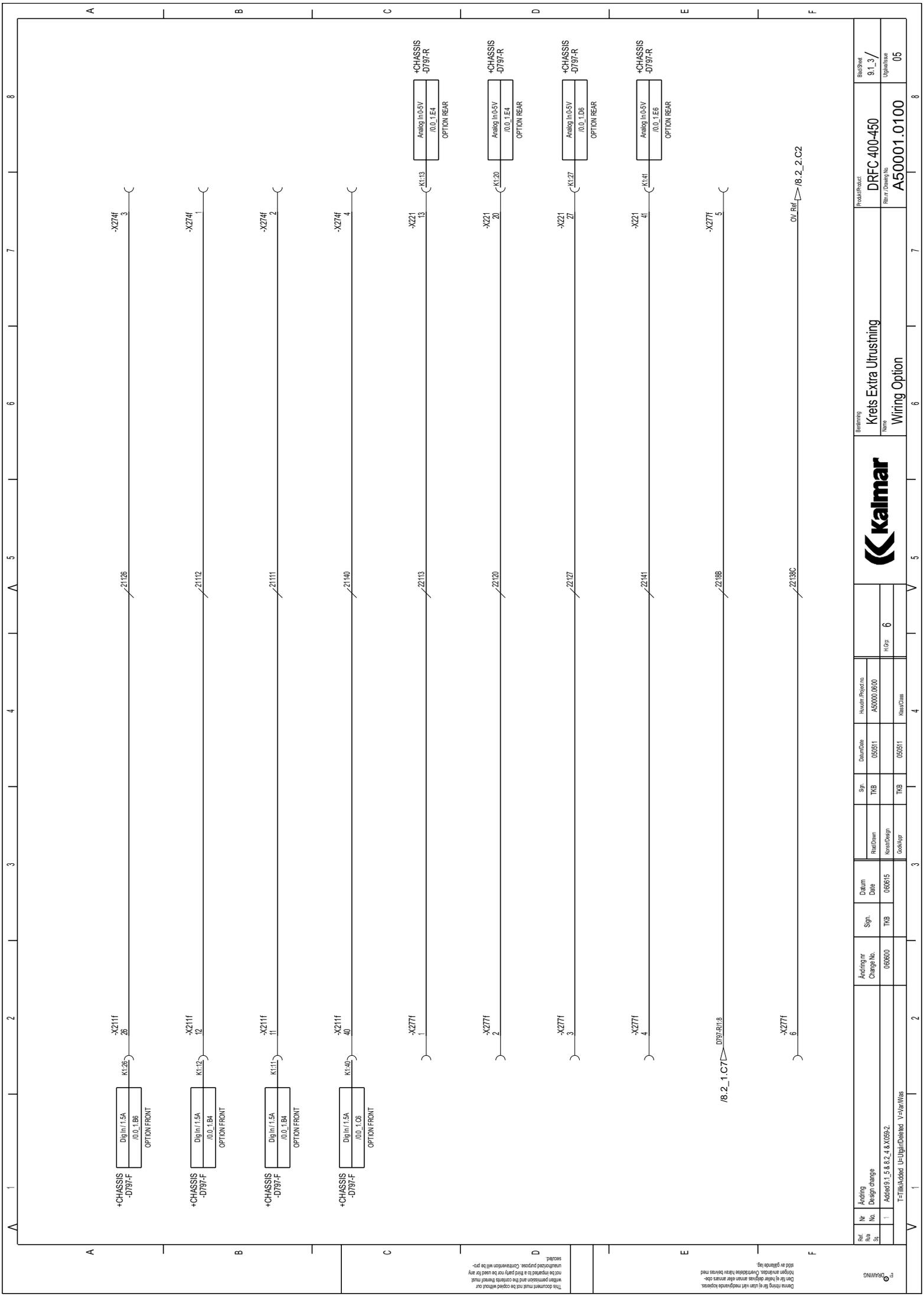












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 inge mabde. Kuruladde hiler amara me  
 sed eji gillede bi.

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Nr	Avding nr	Datum	Sign.	Datum	Sign.	DrawDate	Drawn	Checked	Project no.	Product	Block
1	06800	06815	TKB	06815	TKB	05051	TKB	TKB	A50000.05100	DRFC 400-450	9.1.3 / Uplinkbase
T=Title/Abdel U=Uplink/Deled V=Var/Wies										Rev. / Change No.	05
										Rev. / Change No.	A50001.0100
										Rev. / Change No.	05



Stationery  
**Krets Extra Utrustning**  
 Name  
**Wiring Option**

Product/Part  
**DRFC 400-450**

Block/Sheet  
 9.1.3 /  
 Uplinkbase

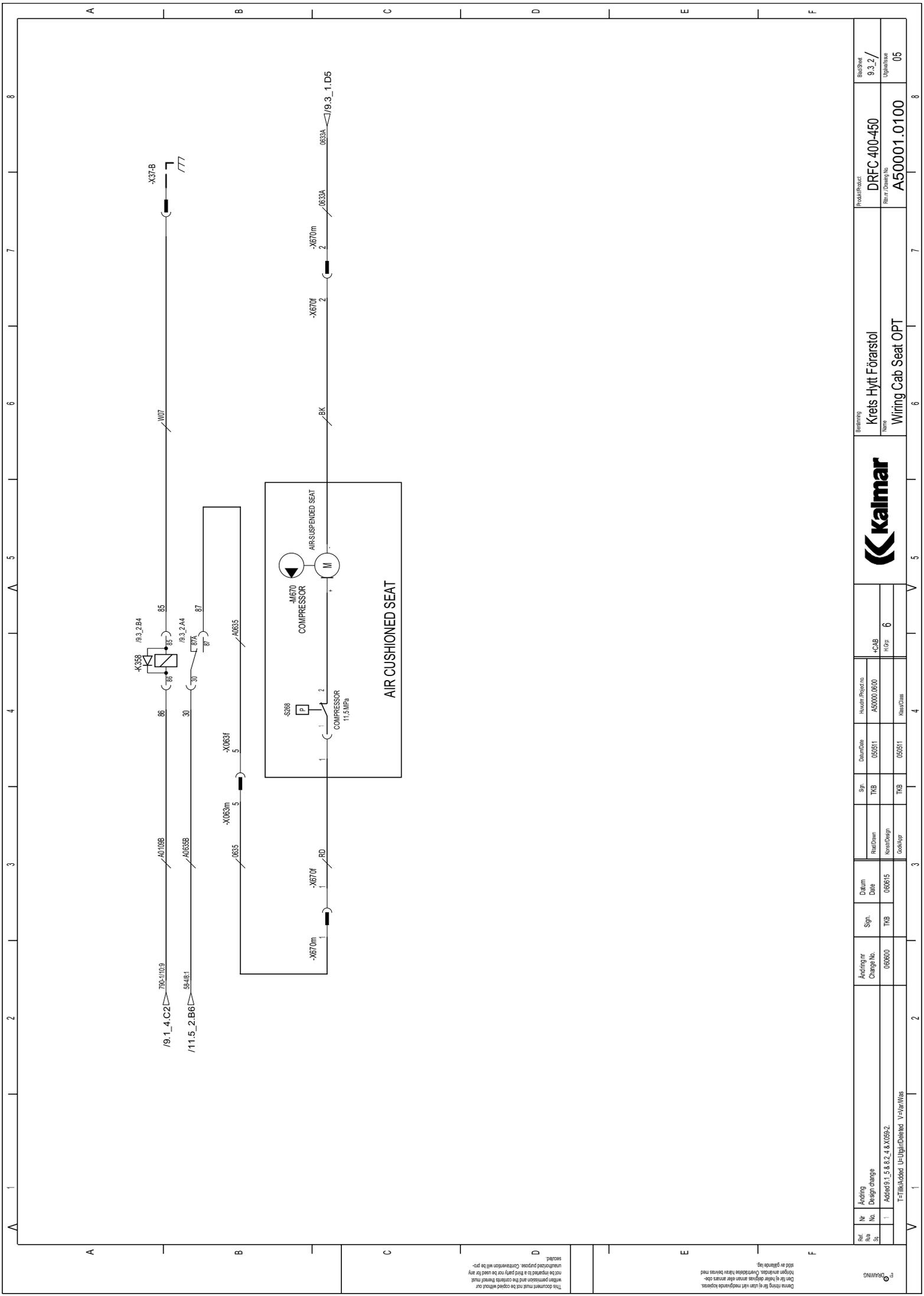
OV Ref: 18.2\_C2

18.2\_1\_C7 D797-Rtr.3



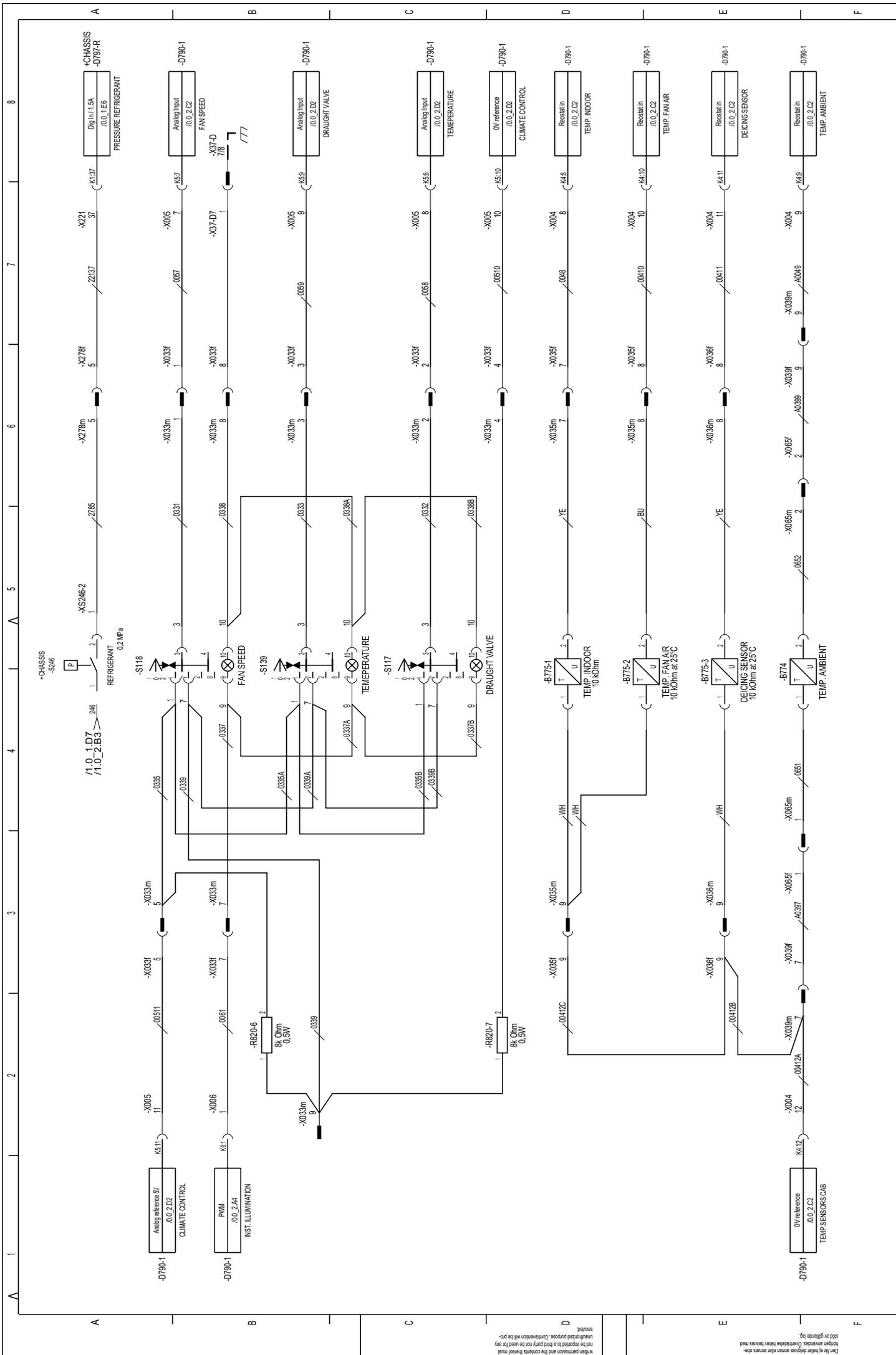






Rev. No.	Nr. Avändning	Design change	Ändring nr	Sign.	Datum	Riktig	Sign.	Datum	Huvudprojekt nr.	Krets Hytt Förarstol	Produkt	Blad/Sheet
1	1	Ändrad 1.5 & 8.2 & X0592.	066800	TKB	066815	TKB	TKB	050511	AS0000.05100	Wiring Cab Seat OPT	A50001.0100	Uppgående
T=F/Till/A/Ändrad U=Utgått/Deleted V=Var/Wies												
<div style="display: flex; justify-content: space-between;"> <span>8</span> <span>7</span> <span>6</span> <span>5</span> <span>4</span> <span>3</span> <span>2</span> </div>												

Ö  
 DRAWING  
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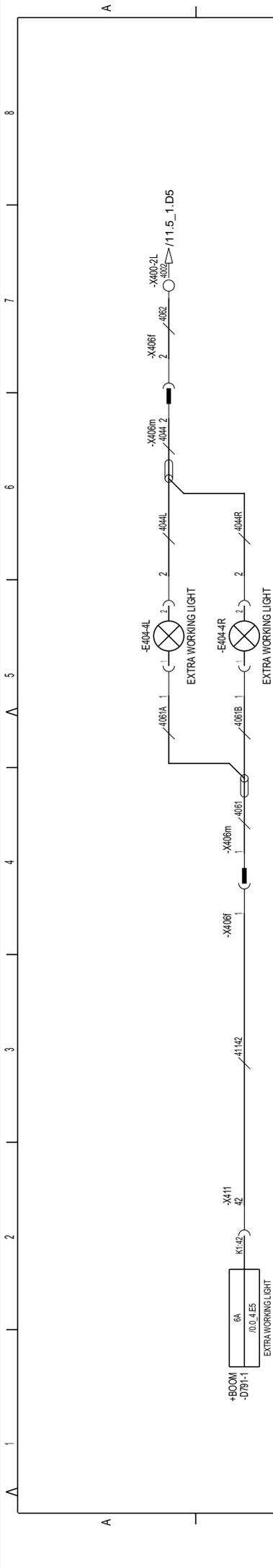
Rev. No.	1	Avd. No.	06800	Sign.	TGB	Date	06815	Drawn	Kennel	Checked	6	Project No.	A50000/0510	Customer	Krets Klimatsystem	Product	DRFC 400-450	Rev. No.	9.4.1 / Uppgrader
<p style="text-align: center;"><b>Kalmar</b></p> <p style="text-align: center;">Wiring Climate Control</p>																			
<p style="text-align: center;">A50001.0100</p>																			

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OPTION WORKING LIGHT ON ATTACHMENT

Rev. No.	1	N°	Aandring nr Change No.	066800	Sign.	TKG	Datum Date	066815	Rust/Dawn	Korn/Daegn Cook/Kvr	Sign.	TKG	DawnDate	050511	Huwert/Project no.	AS0000.05100	Klass/Class	K-Grp	6	Krets Extra Atb.bel. Agg	Product/Product	DRFC 400-450	BladSheet 9.6.2 /	Uitgave/Issue	05



Krets Extra Atb.bel. Agg  
Wiring Opt. Work Light Att

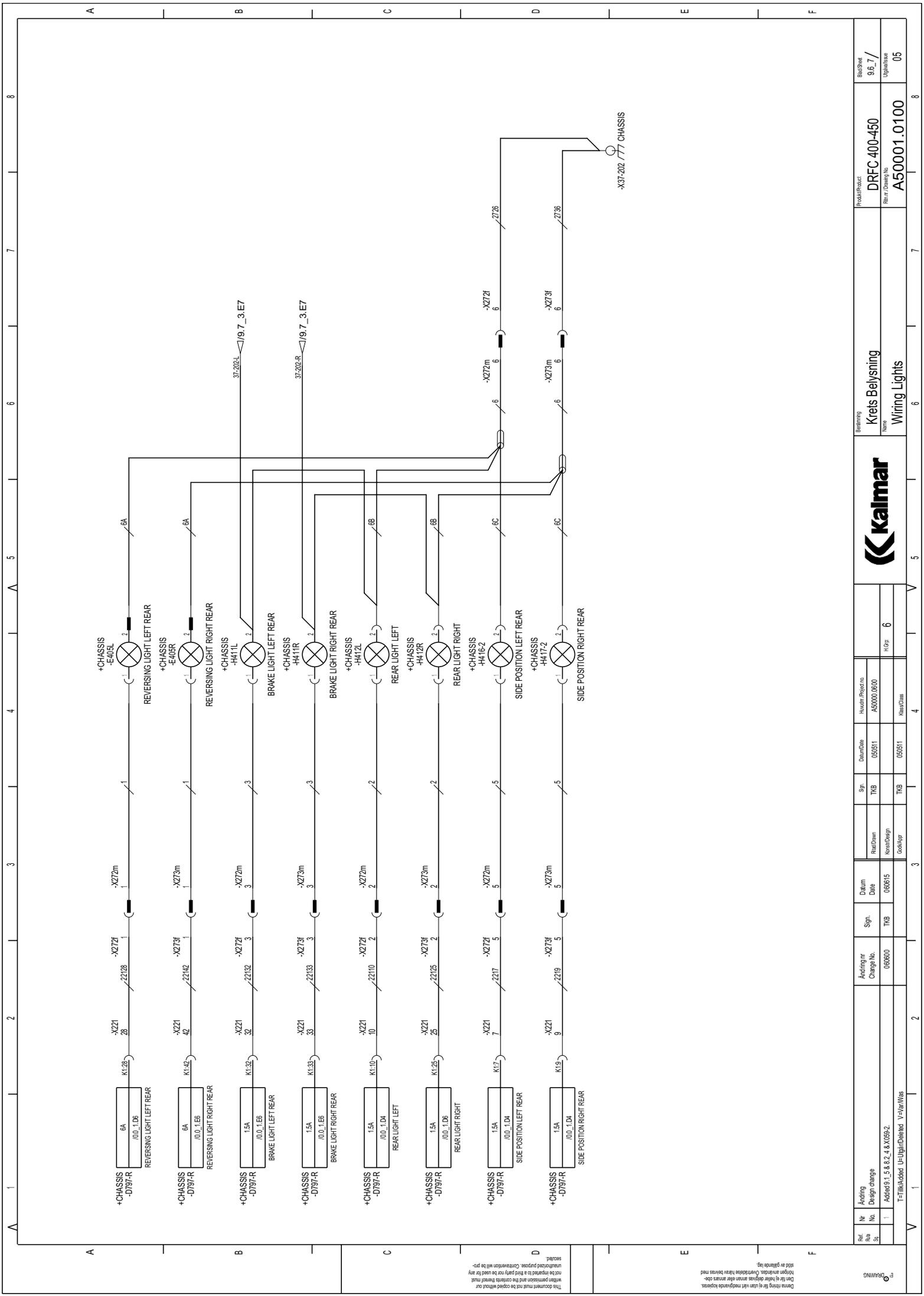
DRFC 400-450  
A50001.0100

BladSheet  
9.6.2 /  
Uitgave/Issue  
05







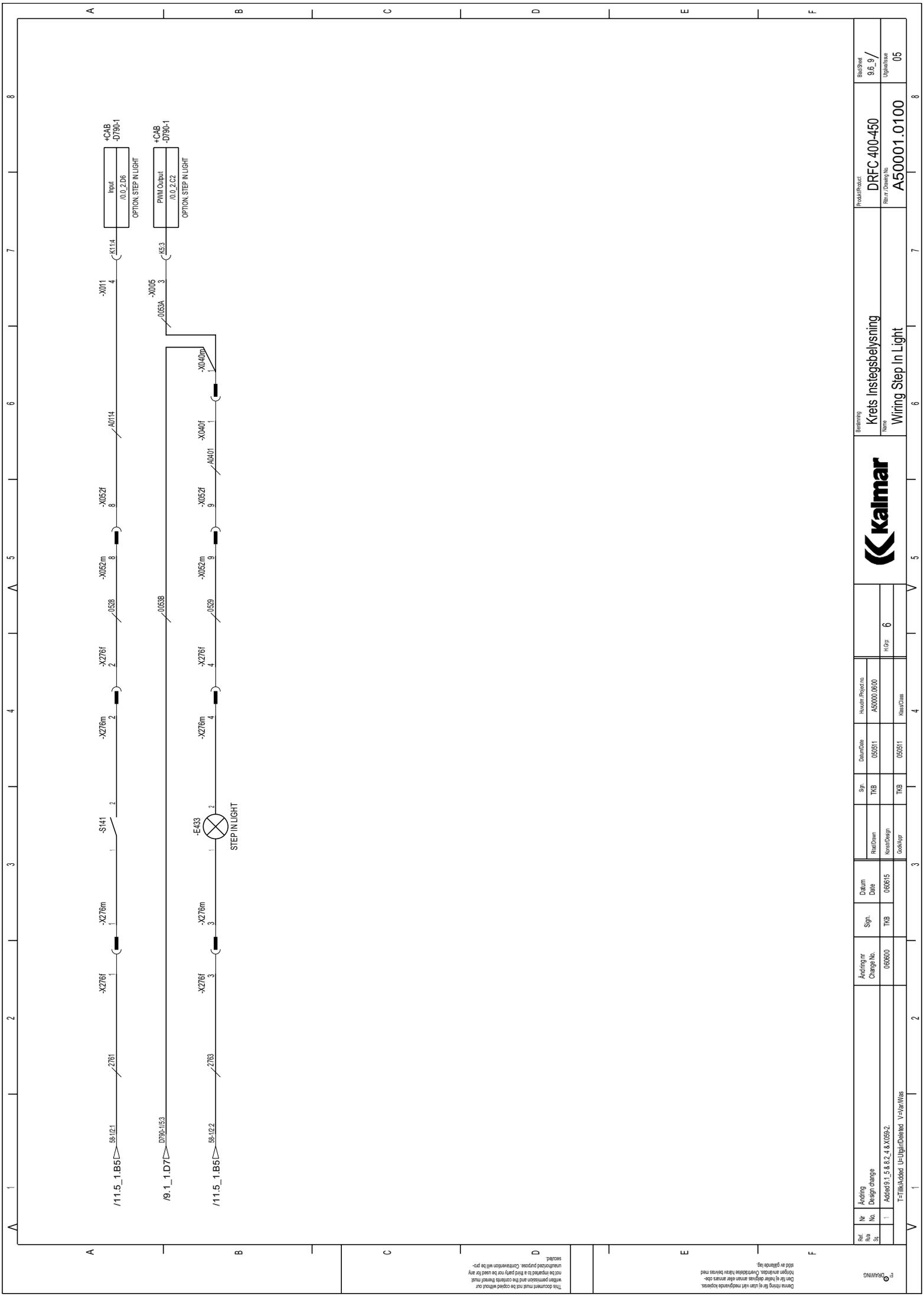


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Rev. No.	Nr. 1	Aviing Design change	Aviing nr Change No. 06800	Sign. TKB	Datum Date 068615	Riist/Drawn TKB	Sign. TKB	Datum Date 050511	Haveni/Project no. A50000.0510	Kop. 6	Blad/Sheet 9.6.7 / Udgave/Issue 05
Belysning Krets Belysning Name Wiring Lights											
Product/Produkt DRFC 400-450 Refer./Drawing No. A50001.0100											
Blad/Sheet 9.6.7 / Udgave/Issue 05											





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Nr	Åndring nr	Datum	Sign.	Åndring nr	Datum	Sign.	Åndring nr	Datum	Sign.
1	066800	066815	TKB	066800	066815	TKB	066800	066815	TKB

Rel. Nr	Åndring Design change	Åndring nr Change No.	Datum Date	Sign.	Åndring nr Change No.	Datum Date	Sign.	Åndring nr Change No.	Datum Date	Sign.
1	Added: 1, 5 & 8, 2, 4 & X052.	066800	066815	TKB	066800	066815	TKB	066800	066815	TKB

Blad/Sheet	Product/Produkt	Blad/Sheet
9.6.9 / Udgivelses	DRFC 400-450	9.6.9 / Udgivelses

Blad/Sheet	Product/Produkt	Blad/Sheet
A50001.0100	DRFC 400-450	A50001.0100

Blad/Sheet	Product/Produkt	Blad/Sheet
6	Krets Instegsbelysning	6

Blad/Sheet	Product/Produkt	Blad/Sheet
6	Wiring Step In Light	6

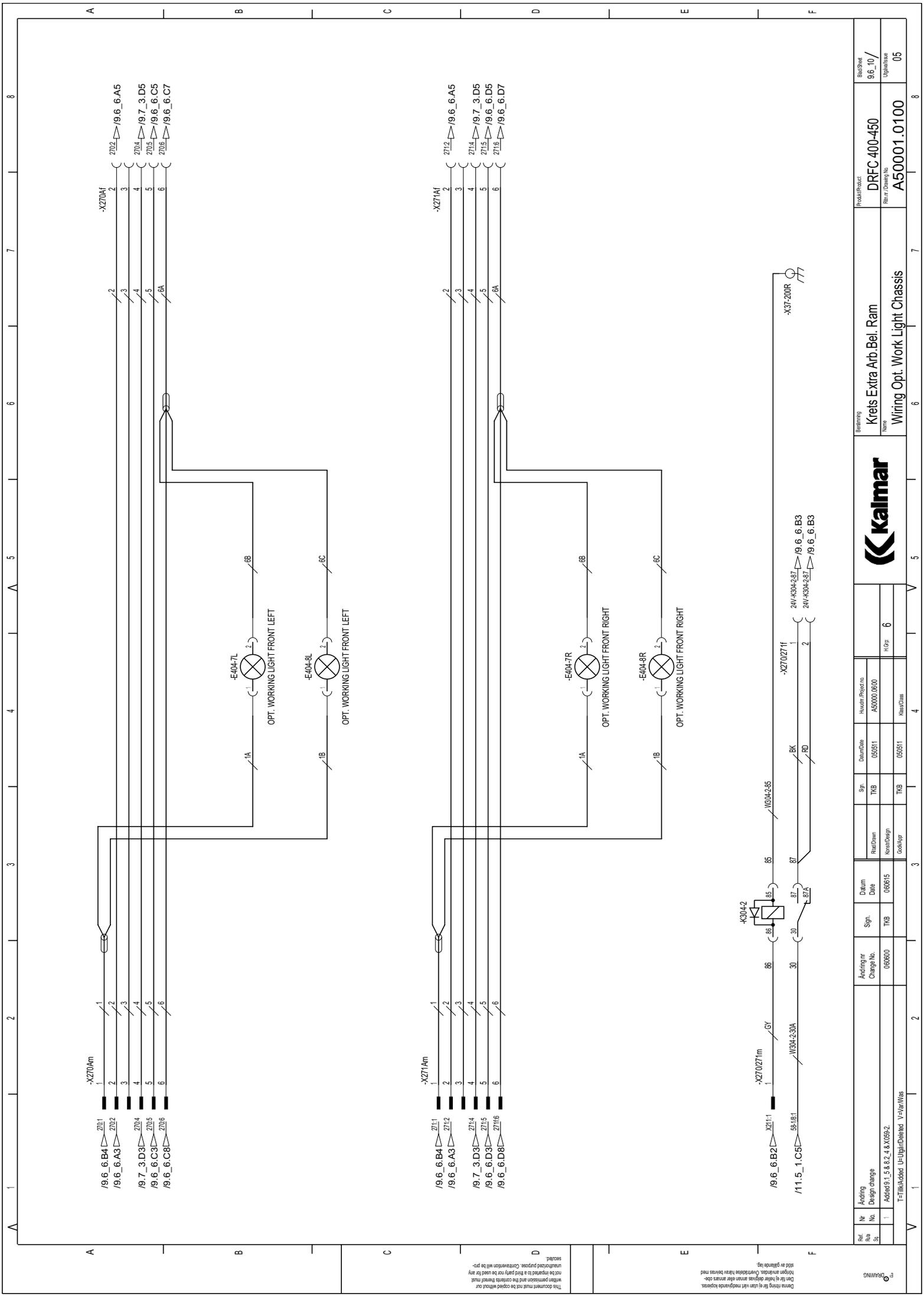
Blad/Sheet	Product/Produkt	Blad/Sheet
6	Wiring Step In Light	6

Blad/Sheet	Product/Produkt	Blad/Sheet
6	Wiring Step In Light	6

Blad/Sheet	Product/Produkt	Blad/Sheet
6	Wiring Step In Light	6

Blad/Sheet	Product/Produkt	Blad/Sheet
6	Wiring Step In Light	6

Blad/Sheet	Product/Produkt	Blad/Sheet
6	Wiring Step In Light	6



Rev. No.	1	Nbr	Avdng nr	Design change	No.	Sign.	Date	Datum	DrawDate	Sign.	Haven Project no.	Product/Product	BladSheet
T=TitelA.dobed U=UglatiDeleed V=Var/Wies													UglatiDeleed
Added: 1.5.8.8.2.4.8.X0592													
Kretis Extra Arb.Bel. Ram													A50001.0100
Wiring Opt. Work Light Chassis													
Kretis Extra Arb.Bel. Ram													A50001.0100
Wiring Opt. Work Light Chassis													
Kretis Extra Arb.Bel. Ram													A50001.0100
Wiring Opt. Work Light Chassis													

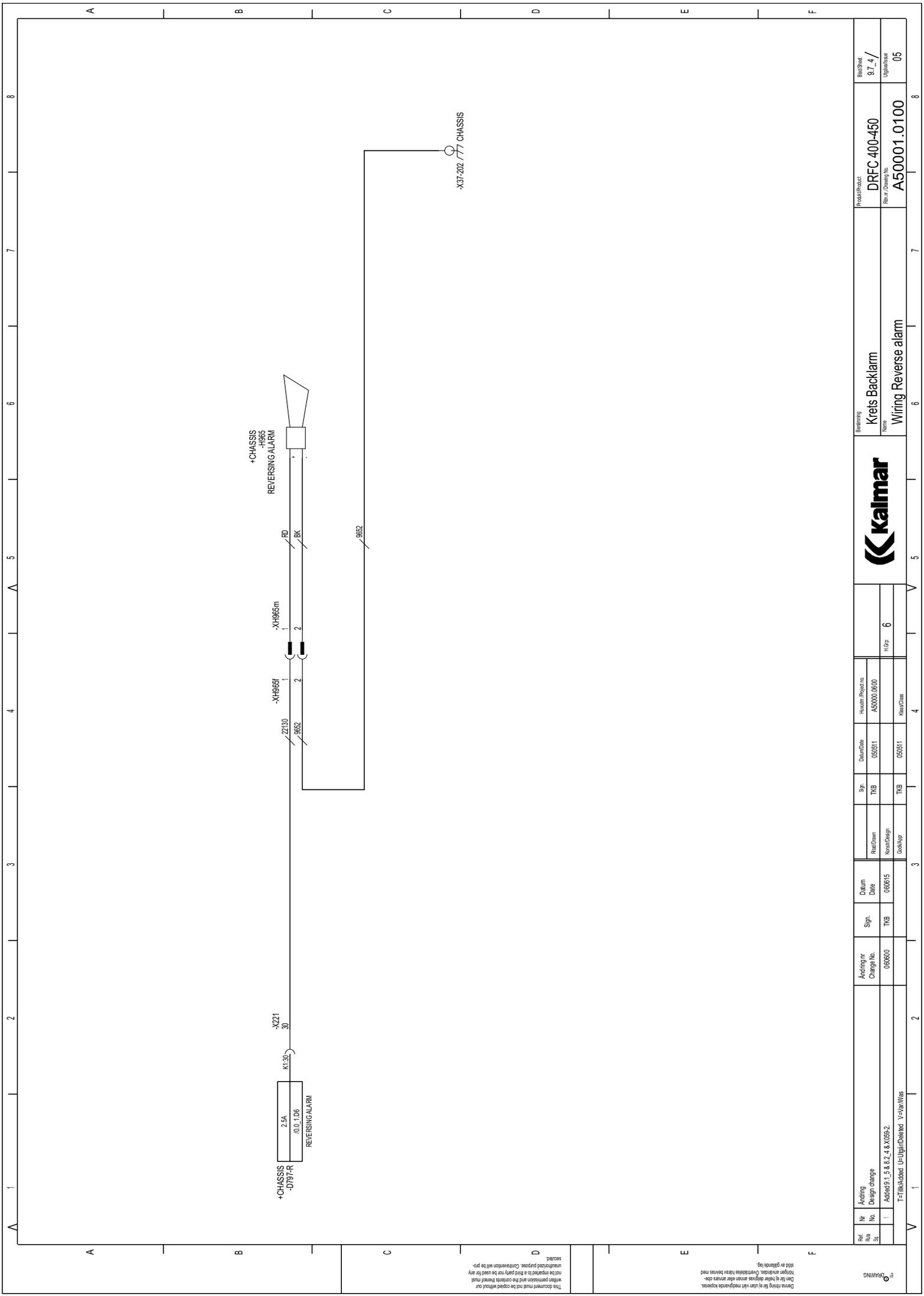


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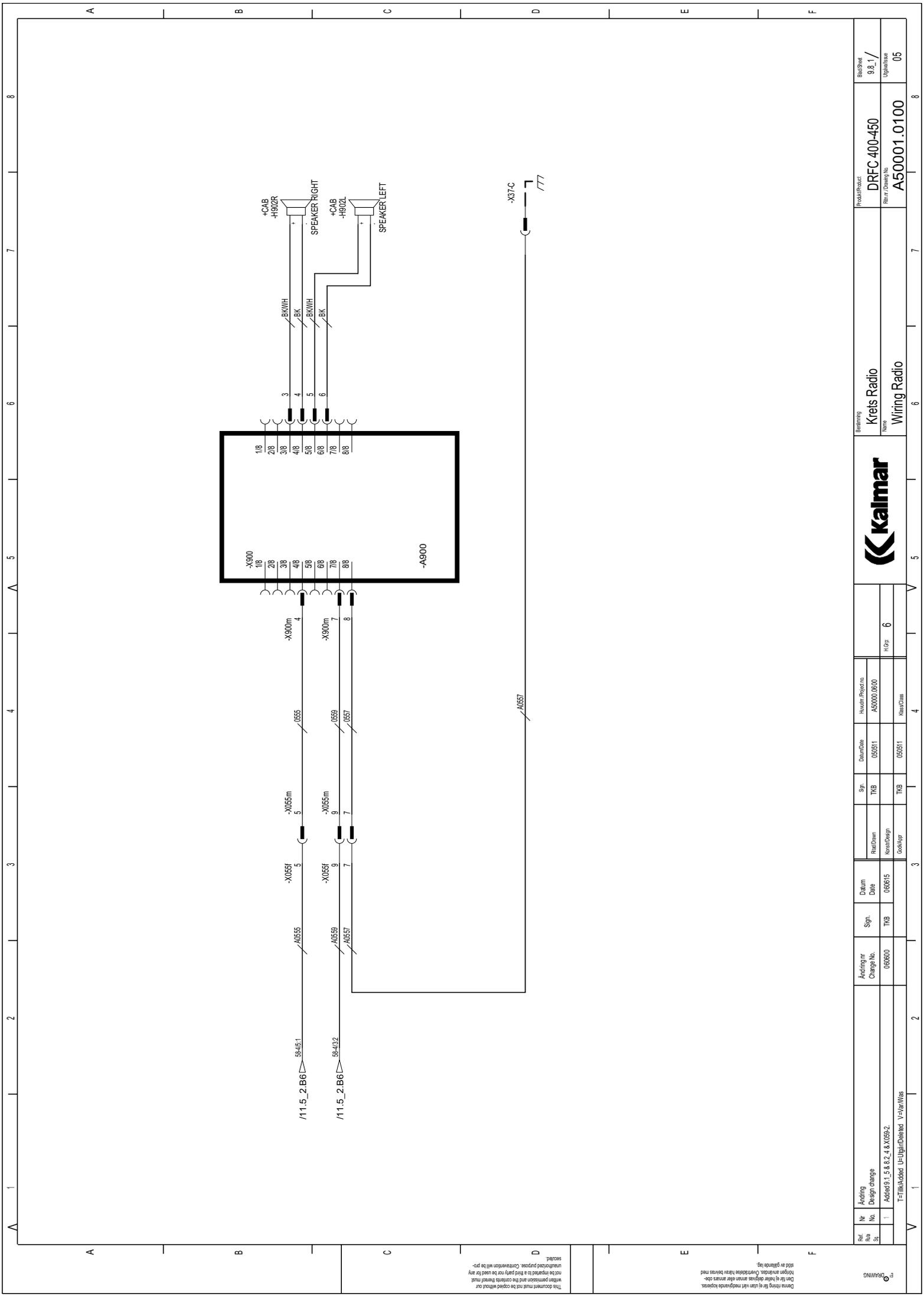




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Rev. No.	N°	Avding Design change	Avding nr Change No.	Sign.	Datum Date	RustDrawn	Sign.	Datum Date	Haven Project no.	Krets Backlarm	Product/Product	BladSheet
1	1	Added 1, 5 & 8, 2, 4 & X952.	06600	TKG	06615	TKG	TKG	05051	AS0000.05100	Wiring Reverse alarm	DRFC 400-450	97_4 / Uptake
T=TimetAced U=UptakeDeleted V=Var/Wies											A50001.0100	05

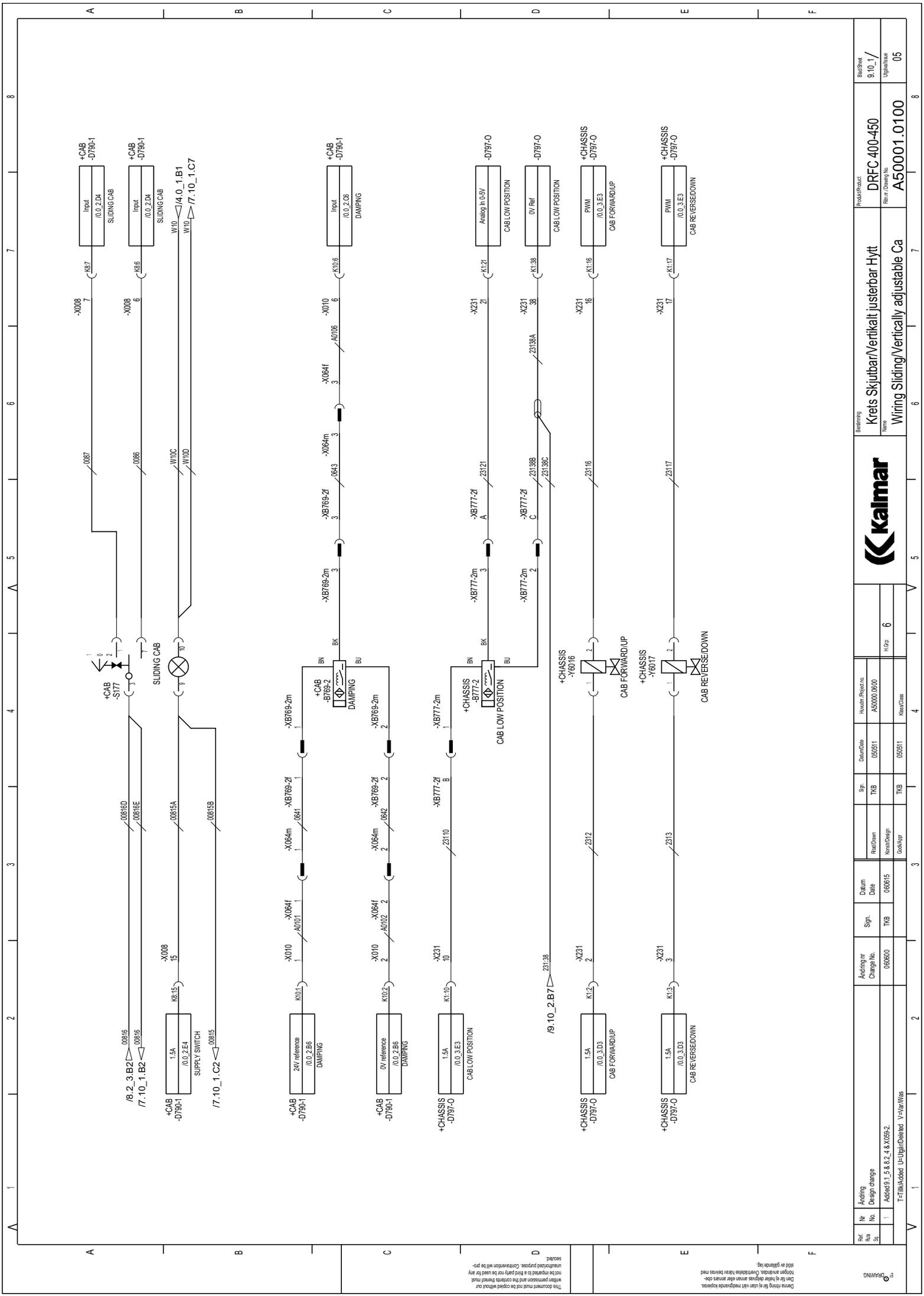




Rev. No.	1	N°	Avding nr	Design change	066800	Sign.	TKG	Datum Date	066815	RiadDrawn	TKG	Sign.	TKG	DatumDate	050511	Haven Project no.	AS0000.05100	H. Grp.	6	Product/Product	DRFC 400-450	BladSheet	9.8.1 /
T= Tillägg A= ändrad U= Uppgått/Deleted V= Var/Wies																							
A= Added 1, 5, 8, & 8, 2, 4, X0552.																							
T= Tillägg A= ändrad U= Uppgått/Deleted V= Var/Wies																							
Avding nr Change No. 066800																							
Datum Date 066815																							
Sign. TKG																							
DatumDate 050511																							
Haven Project no. AS0000.05100																							
H. Grp. 6																							
Krets Radio																							
Wiring Radio																							
Product/Product DRFC 400-450																							
BladSheet 9.8.1 /																							
Uptight/Date 05																							

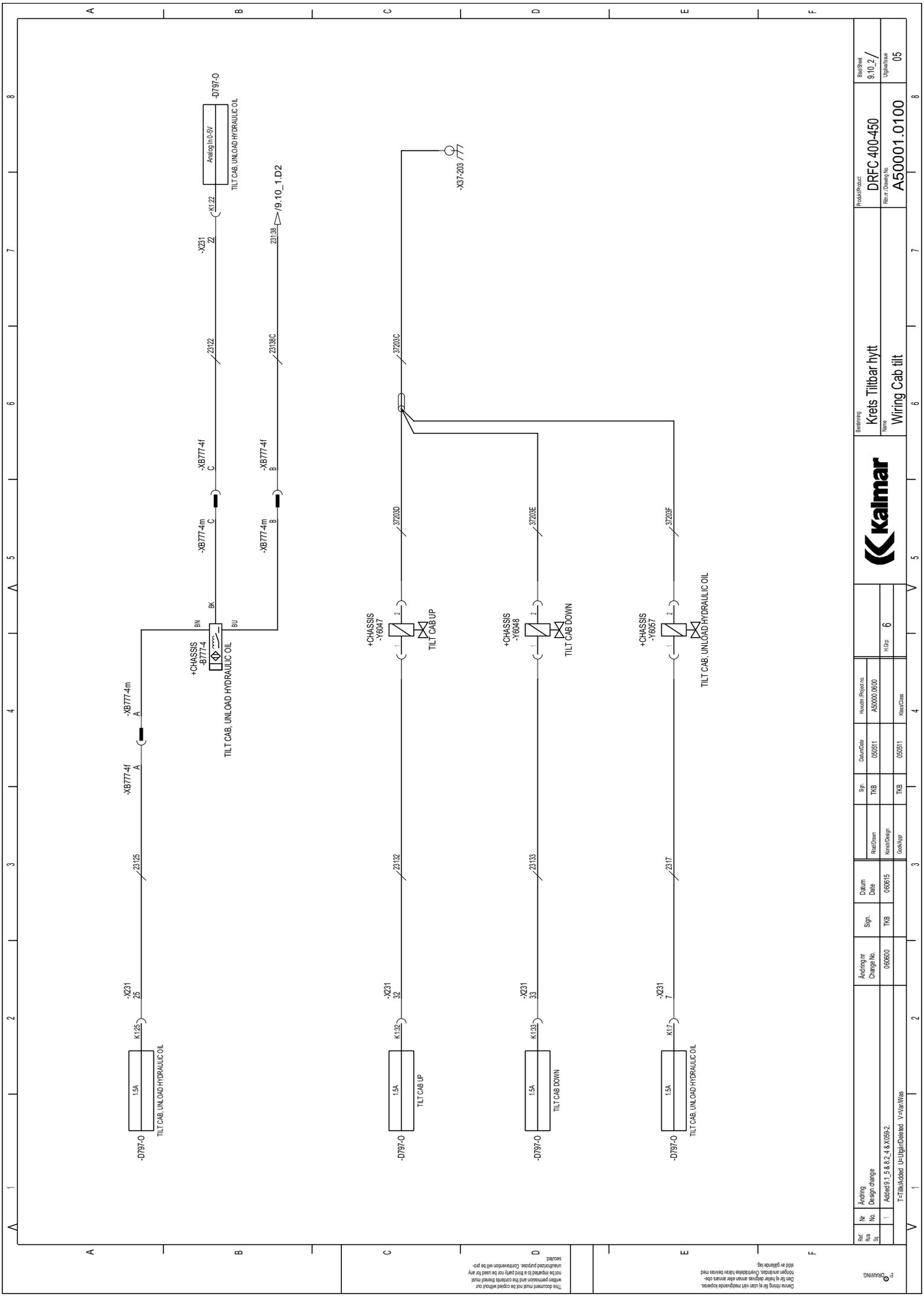
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Rev. No.	1	Andring nr	066800	Datum	060615	Sign.	TJK	Drawn	TJK	Checked	TJK	Project no.	A50000.0510	Revision	6
Design change	Added 1.5 & 0.2 & 3.E3 & X0652.														
T=Time/Added U=Utgitt/Deleted V=Var/Wies															
<b>Kalmar</b>															
Statensbygg <b>Krets Skjutbar/Vertikalt justerbar Hytt</b> Name: <b>Wiring Sliding/Vertically adjustable Ca</b>															
Produkt/Modell <b>DRFC 400-450</b> Refer./Drawing No. <b>A50001.0100</b>															
Blad/Sheet	9.10.1 / Uppgående														
Utgivnings	05														

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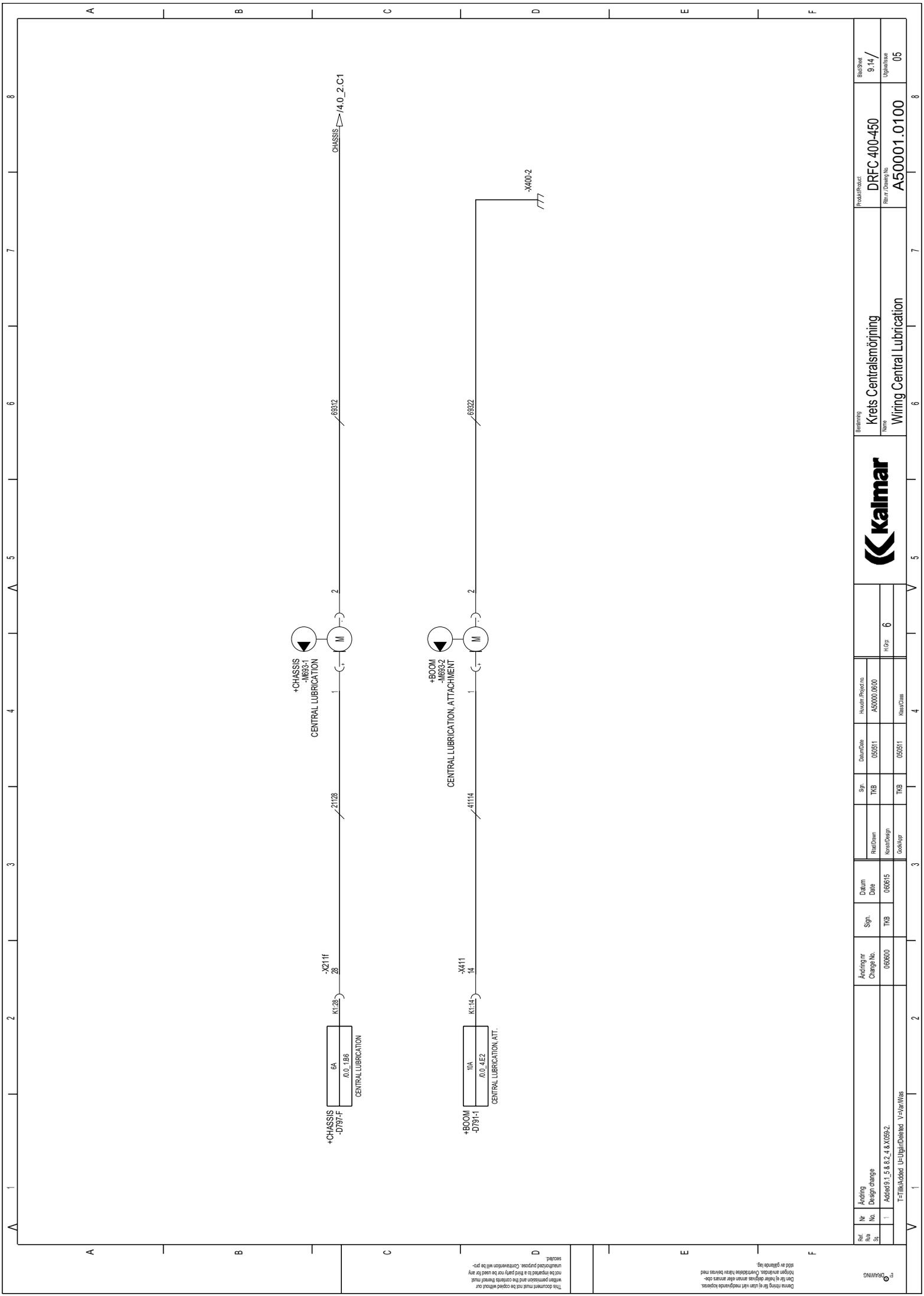


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Rev. No.	1	Åndring nr. Design change	066800	Sign.	TKG	Datum Date	060615	Risikodriv	TKG	DrumDate	050511	Hydraul. Projekt no.	A50000.05100	Revision	6	Blad/Sheet	9.10.2 / Udgivelses
<p>T = Tilføjet, A = Aendret, U = Udtaget, Deleted = Slettet</p>																	
<p>Produkt/Model: DRFC 400-450</p>																	
<p>Blad/Sheet: 9.10.2 / Udgivelses</p>																	
<p>Revision: A50001.0100</p>																	
<p>Blad/Sheet: 05</p>																	



Støttemejling: Krets Tiltbar hytt  
 Navn: Wiring Cab tilt



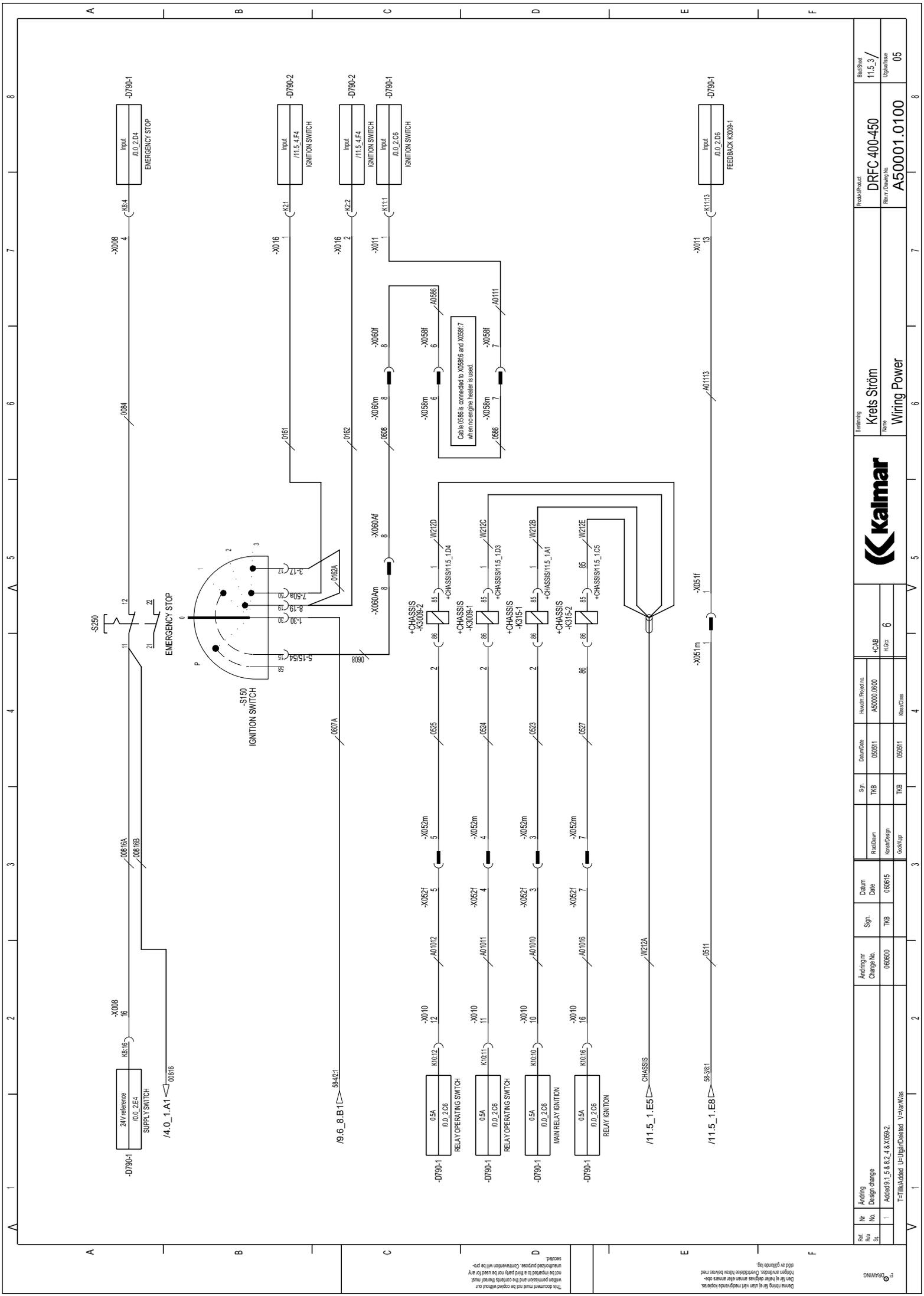
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Rev. No.	1	Arising Design change	06600	TKG	06615	TKG	05051	AS0000.05100	Kop. 6	Krets Centralsmøring	DRFC 400-450	9.14 / Udgave 05
Wiring Central Lubrication		A50001.0100		Krets Centralsmøring		DRFC 400-450		9.14 / Udgave 05		Product/Project		
Wiring Central Lubrication		A50001.0100		Krets Centralsmøring		DRFC 400-450		9.14 / Udgave 05		Product/Project		



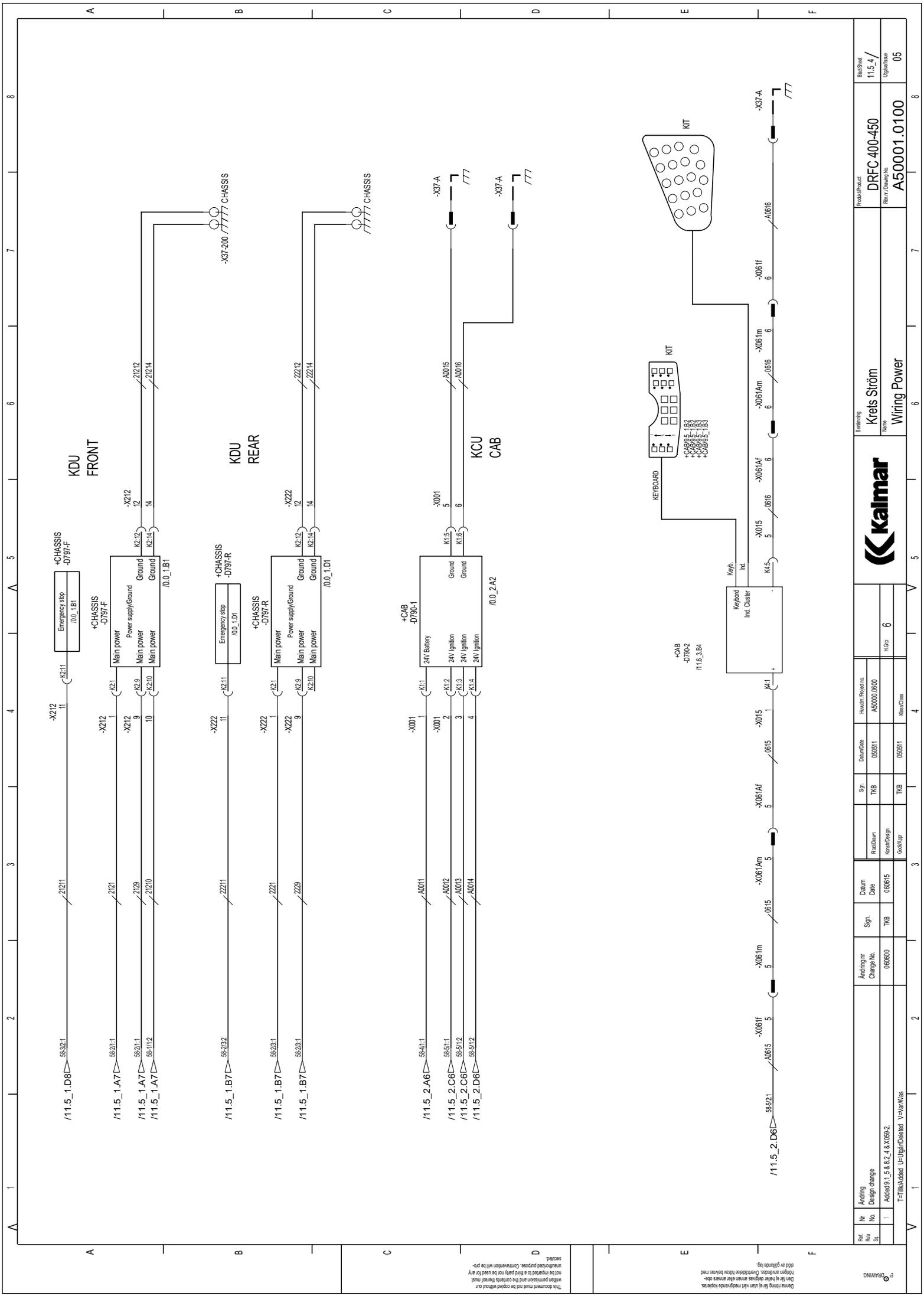






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Rev. No.	1	Aviing nr	06800	Sign.	TJK	Datum	06815	Drawn	KAB	Checked	6	Product	DRFC 400-450	BlotSheet	11.5.3 / Uppgrader		
Design change	A-Added 1.5 & 8.2 & X0582.																
T=Time/Added U=Uppgrader/V=Var/Wies												Product	A50001.0100	BlotSheet	11.5.3 / Uppgrader		
												Company	Krets Ström	Product	DRFC 400-450	BlotSheet	11.5.3 / Uppgrader
												Name	Wiring Power	Product	A50001.0100	BlotSheet	11.5.3 / Uppgrader

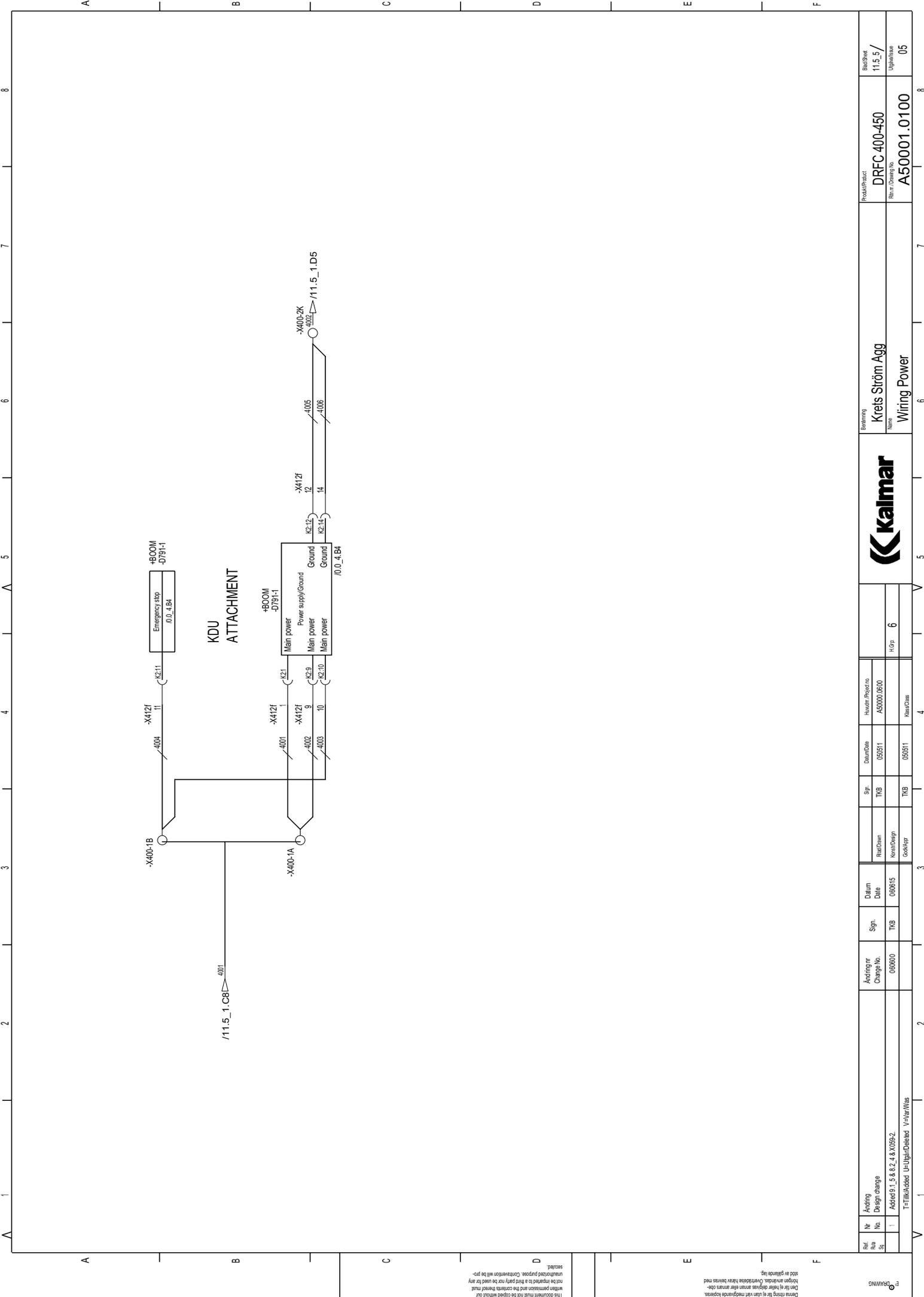


Rev. No.	1	Nr. Design change	06600	Sign. TKG	Date 060615	Drawn/Rev. TKB	Date 050511	Huvud Projekt nr. AS0000/0500	K: Grp 6	Krets Ström	Product/Modul DRFC 400-450	Blad/Sheet 11.5.4 / Uppskrift
T=Time/Årsked U=Uppgift/Deled V=Var/Wies										Wiring Power	A50001.0100	05

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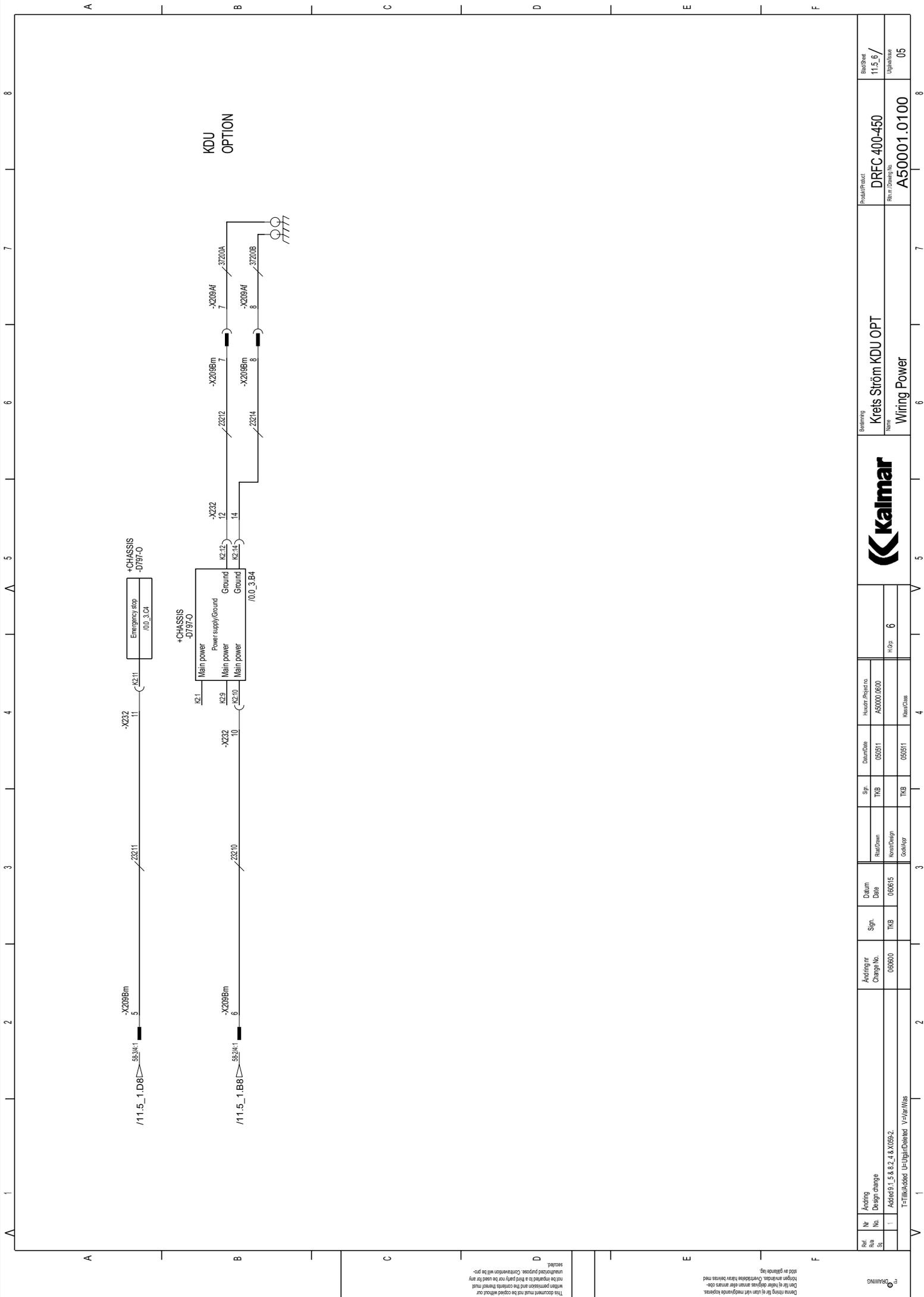
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Rev. No.	Nº	Ändring Design change	Ändring nr Change No.	Sign.	Datum Date	Risar/Drawn	Sign.	Datum Date	Huvud/Project no.	Produkt/Product	Blad/Sheet
1	1	Ändrad 1.5 & 8.2 & 4. X0592.	066800	TKB	066815	Huvud/Design	TKB	050511	AS0000.05100	Krets Ström Agg	Blad/Sheet
										Refer/Drawn No.	05
										Name	A50001.0100
										Wiring Power	
										Kalmar	
										Krets Ström Agg	
										Blad/Sheet	05
										Uppgått/Added	

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OPTION

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Rev. No.	1	Ändring nr Design change	066800	Sign. TKB	Datum Date	060615	Risarvorn Homidesign Cook/kyr	Sign. TKB	Datum Date	050511	Huvudprojekt nr AS50001.05100	Klass/Class	Krets Ström KDU OPT Wiring Power	Krets/Project DRFC 400-450	Bladsheet 11.5.6 / Uppskrivelse
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T= Tillagd U= Uppgjord

Ändring nr  
Design change

Sign.  
TKB

Datum  
Date

Risarvorn  
Homidesign  
Cook/kyr

Sign.  
TKB

Datum  
Date

Huvudprojekt nr  
AS50001.05100

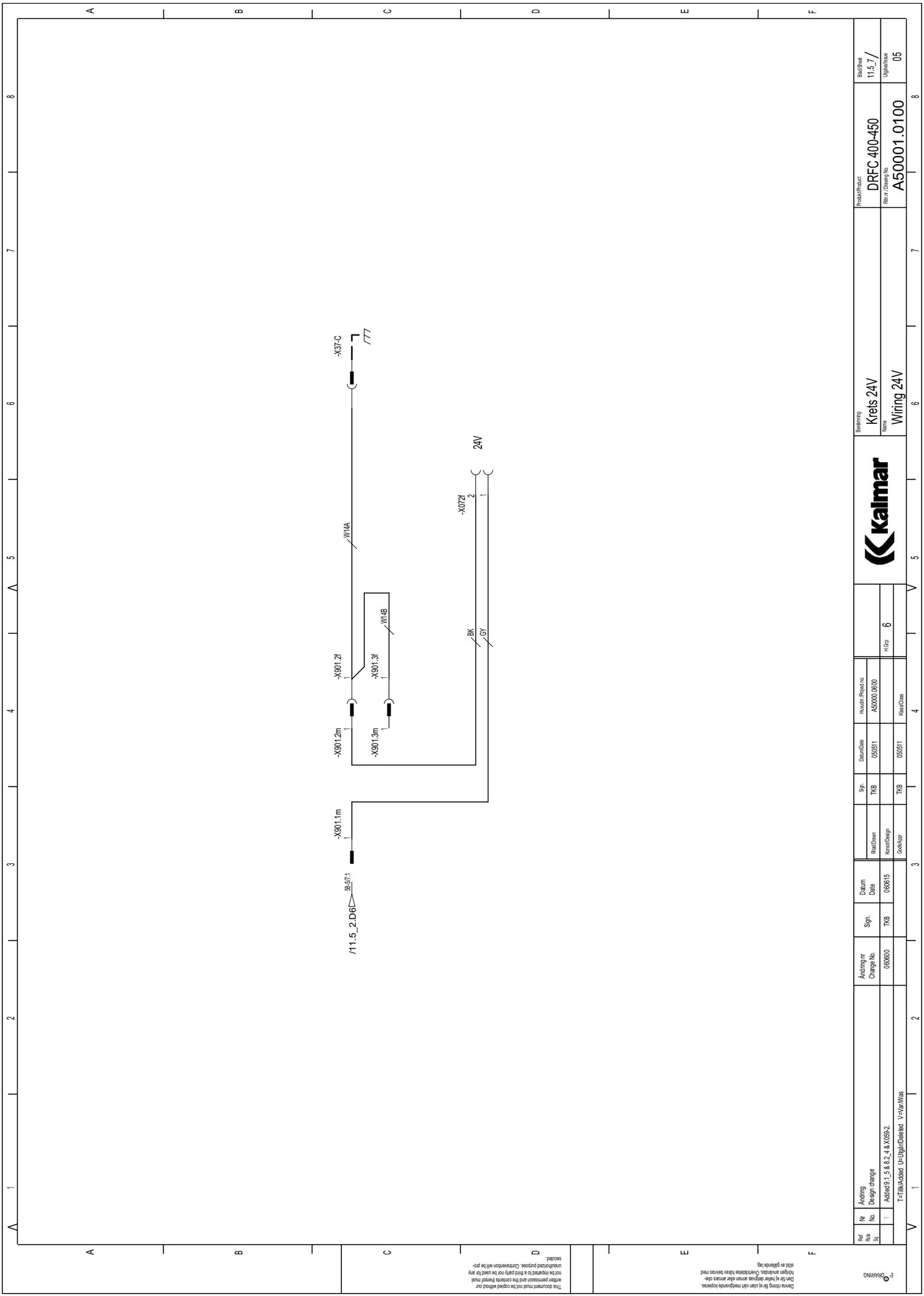
Klass/Class

Krets Ström KDU OPT  
Wiring Power

Krets/Project  
DRFC 400-450

Bladsheet  
11.5.6 /  
Uppskrivelse

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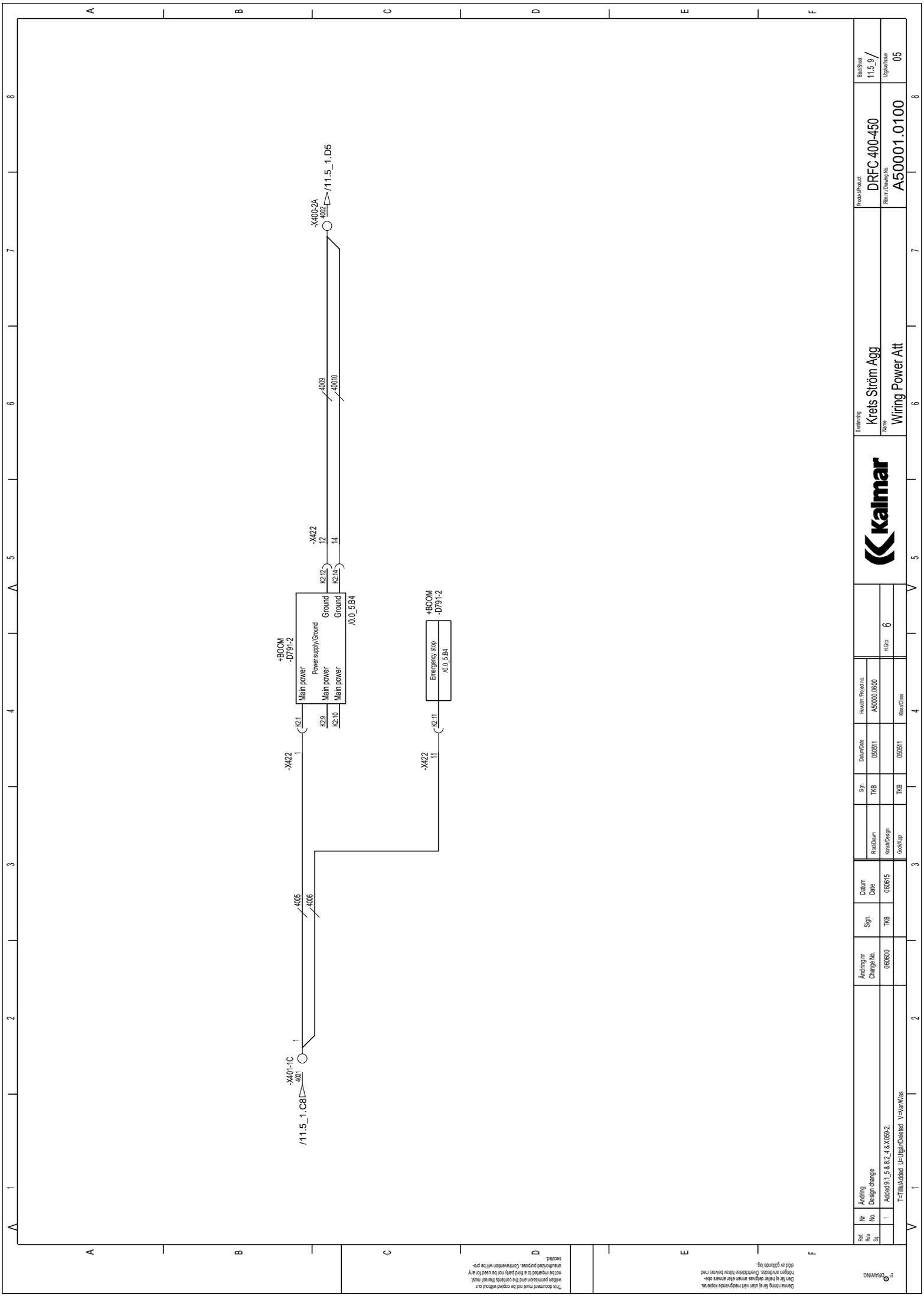


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N No	Arding Design change	Datum Date	Sign.	Arding nr Change No.	Datum Date	Sign.	RwdDraw	Hwnt/Design Cook/kyr	Hwnt/Project no. AS0000.05100	Kop 6	Product/Mod DRFC 400-450	Blad/Sheet 11.5.7 / Uplgh/Sheet
Krets 24V Wiring 24V												
Krets 24V Wiring 24V												
A50001.0100												





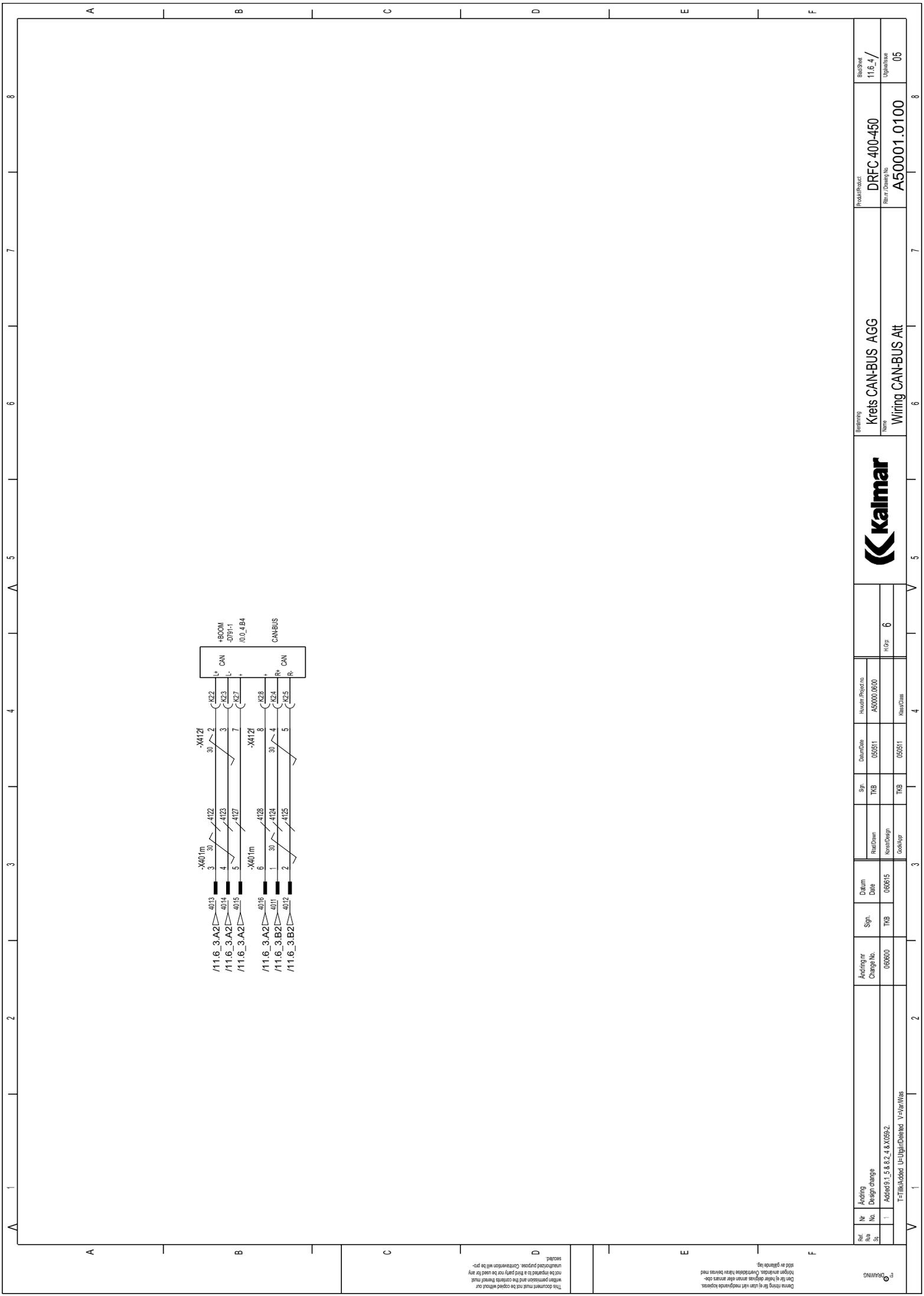


Rev. No.	1	Ändring nr Design change	066800	Sign. TKB	Datum Date	060615	Risedrawn Kontrollör	TKB	050511	Klass/Class	K:06	Blad/Sheet 11.5.9 / Uppgående	Produkt/Product DRFC 400-450	Refer. Order No. A50001.0100	Blad/Sheet 11.5.9 / Uppgående



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Rev. Nr. / No. / St.	Nr. / No. / Design change	Avdring nr. / Change No. / 066800	Sign. / TKG	Datum / Date / 060615	Riser/Drawn / Kemi/Design / Cook/Kvtr	Sign. / TKG	Dokument / Document / A50000.05100	Hverken / Project no. / A50000.05100	Kop nr. / 6	Blad/Sheet / 11.6.4 / Udgivelses / Udgivelses / 05
										
Betegnelse / Krets CAN-BUS AGG Navn / Wiring CAN-BUS Alt										







## Komponentförteckning / List of Components

Number	Categ.	Svenska	English
30	G	Batteri	Battery
32	A	Kretskort elcentral	Printed circuit board, Junction box
37	X	Terminal stomanslutning	Earthing terminal on chassis
39	X	Terminal minusanslutning	Terminal, negative terminal
51	F	Säkringshållare 1-polig	Fuse holder, 1-pole
52	F	Säkringshållare 2-polig	Fuse holder, 2-pole
56	F	Säkringshållare 6-polig	Fuse holder, 6-pole
58	F	Säkringshållare 8-polig	Fuse holder, 8-pole
59	F	Säkringshållare 12-polig	Fuse holder, 12-pole
62	F	Batterihandske 2-polig	Battery connector, 2-pole
64	F	Batterihandske 4-polig	Battery connector, 4-pole
72	X	Stickuttag 2-polig	Outlet, 2-pole
77	X	Stickuttag 7-polig	Outlet, 7-pole
78	X	Stickuttag extra 7-polig	Outlet, extra, 7-pole
100	S	Strömställare ljus	Switch, light
101	S	Strömställare omk hel/halvljus	Switch, main/dipped beam
102	S	Strömställare dimljus	Switch, fog light
103	S	Strömställare fjärrljus	Switch, distance light
104	S	Strömställare lastljus	Switch, mast lights
105	S	Strömställare arbetsljus	Switch, working lights
106	S	Strömställare containerljus	Switch, container light
107	S	Strömställare park broms	Switch, parking brake
108	S	Strömställare centr smörjning	Switch, central lubricator
109	S	Strömställare varningsljus	Switch, hazard lights
110	S	Strömställare rot varningsljus	Switch, rotating hazard beacon
111	S	Strömställare fönsterhiss	Switch, window regulator
112	S	Strömställare kylanläggning (AC)	Switch, air conditioner (AC)
113	S	Strömställare styrning alt	Switch, alternative steering
114	S	Strömställare läsbelysning	Switch, reading light
115	S	Strömställare instr belysning	Switch, instrument illumination
116	S	Strömställare innerbelysning	Switch, interior lighting
117	S	Strömställare värme	Switch, heating
118	S	Strömställare fläktm värme	Switch, heater fan
119	S	Strömställare vindrutetorkare	Switch, wiper
120	S	Strömställare spolare	Switch, washer
121	S	Strömställare blackout	Switch, blackout
122	S	Strömställare nöd hydraulpump	Switch, emergency hydraulic pump
123	S	Strömställare backspegel	Switch, observation mirror
124	S	Strömställare kallstart	Switch, cold start
125	S	Strömställare avgasbroms	Switch, exhaust brake
126	S	Strömställare diff spärr/broms	Switch, diff. Block
127	S	Strömställare värmesystem diesel	Switch, heating system diesel
128	S	Strömställare kraftuttag sida	Switch, power take off side
129	S	Strömställare kraftuttag bak	Switch, power take off rear
130	S	Strömställare hög/lågväxel	Switch, high/low gear
131	S	Strömställare färdväjlare fram	Switch, gear selector forward
132	S	Strömställare färdväjlare bak	Switch, gear selector rear
135	S	Strömställare växelväjlare	Switch, gear shift
136	S	Strömställare framhjuls styrning	Switch, forward wheel steering
137	S	Strömställare 4-hjuls styrning	Switch, 4-wheel steering
138	S	Strömställare crab styrning	Switch, crab steering

Number	Categ.	Svenska	English
139	S	Strömställare defroster	Switch, defroster
141	S	Strömställare Stegbelysning	Switch, Steplight
142	S	Strömställare fot	Switch, foot
143	S	Strömställare sitsvärme	Switch, seat heater
144	Q	Batterifrånskiljare	Battery disconnecting switch
145	S	Strömställare AT-regulator	Switch, AT-regulator
147	S	Strömställare körvisare	Switch, direction indicators
149	S	Strömställare signalhorn	Switch, horn
150	S	Strömställare startlås/ellas	Switch, main key switch
152	S	Strömställare intervalltorkare	Switch, intermittent wiper
156	S	Strömställare kupevärmare	Switch, cab heating
157	S	Strömställare stoltilt	Switch, seat tilt
158	S	Strömställare dimbakljus	Switch, rear fog light
159	S	Strömställare extra fram/back väljare	Switch, extra direction selector
160	S	Strömställare komb fram/back	Switch, combi-forward/reverse
161	S	Strömställare komb signal, ljus hel/halv spol,torkare m intervall körvisare	Switch, combi-horn, light main/dipped beam, washer, wiper (intermittent), direction indicator
162	S	Strömställare komb signal ljus hel/halv, spol, torkare m 2 int, fram/back	Switch, combi horn, light main/dipped beam, washer, wiper w 2int., forward/revers
163	S	Strömställare start på 2-an	Switch, start 2nd gear
165	S	Strömställare stolvärme	Switch, seat heater
166	S	Strömställare låsning vändskiva	Switch, interlocking of turntable
167	S	Strömställare luftfjädring	Switch, pneumatic springing
168	S	Strömställare låsn stol	Switch, interlocking of seat
169	S	Strömställare stolsvändning	Switch, reversible seat
170	S	Strömställare förångare (LPG)	Switch, evaporator (LPG)
171	S	Strömställare v-skiva upp/ner	Switch, fifth wheel up/down
172	S	Strömställare v-skiva fr/back	Switch, fifth wheel forward/reverse
173	S	Strömställare v-skiva skevning	Switch, fifth wheel, levelling
174	S	Strömställare,utskjut	Switch, projecting
175	S	Strömställare hyttlyft upp	Switch, cab hoist up
176	S	Strömställare hyttlyft ner	Switch, cab hoist down
177	S	Strömställare hyttskjutning	Switch, cab movement
178	S	Strömställare nollställning	Switch, reset
179	S	Strömställare Aut/man växling	Switch Aut/man gearshifting
180	S	Strömställare fyrhjulsdrift	Switch, 4-WD
190	S	Strömställare klimatanläggning	Switch, air conditioner
191	S	Strömställare recirkulation	Switch, re-circulation
192	S	Strömställare vattenavskiljare	
195	S	Strömställare joy-stick X	Switch, joy-stick X
196	S	Strömställare joy-stick X+Y	Switch, joy-stick X+Y
197	S	Strömställare längs/tvärskörning	Switch, length/sideways driving
198	S	Strömställare flytläge skevning	Switch, equalizing fifth wheel
199	S	Strömställare option	Switch, option
200	S	Brytkontakt lampa park broms	Contact, breaking,warning lamp,parking brake
201	S	Brytkontakt lampa färdbröms	Contact, breaking, warning lamp, brake
202	S	Brytkontakt lampa oljetryck motor	Contact, breaking, warning lamp, oil pressure engine
204	S	Brytkontakt tryck ackumulator	Contact, breaking, pressure accumulator tank
205	S	Brytkontakt innerbelysning	Contact, breaking, interior lighting

Number	Categ.	Svenska	English
206	S	Brytkontakt handskfack belysning	Contact, breaking, glove
207	S	Slutkontakt diff spärr	Contact, making, diff. interlock
208	S	Slutkontakt lampa temperatur spolkreis bromsar	Contact, making, warning lamp temperature brake
214	S	Slutkontakt överväxel	Contact, making, over drive
215	S	Slutkontakt temp motor	Contact, making, temperature engine
216	S	Slutkontakt bromsljus	Contact, making, brake lights
217	S	Slutkontakt backljus	Contact, making, reversing light
218	S	Slutkontakt AT-regulator	Contact, making, AT-control
219	S	Slutkontakt lampa luftfilter	Contact, making, indicating light air filter
220	S	Brytkontakt drivning	Contact, breaking, drive cut off
221	S	Slutkontakt temp växellåda	Contact, making, temperature gear box
222	S	Slutkontakt lampa temp moment - förstärkare	Contact, making, warning lamp temperature torque amplifier.
223	S	Släpkontakt signal	Contact, brush, horn
224	S	Slutkontakt insprutningspump	Contact, making, injection pump
225	S	Brytkontakt säkerhetsbälte	Contact, breaking, seat belt
228	S	Slutkontakt hyttlåsning	Contact, making, cab locking
229	S	Slutkontakt stolslåsning	Contact, making, seat locking
230	S	Brytkontakt stol	Contact, breaking, seat
231	S	Slutkontakt fotkontroll stolvändning	Contact, making, seat rotation, foot switch
232	S	Brytkontakt lampa luftanslutning släp	Contact, breaking, warning lamp air connection
233	S	Slutkontakt lampa låsning vändskiva	Contact, warning, interlocking of turntable
235	S	Slutkontakt sidoskjutning stol	Contact, making, side shifting of seat
236	S	Slutkontakt vattennivå	Contact, water level
239	S	Brytkontakt termisk	Contact, breaking, thermic
240	S	Slutkontakt termisk	Contact, making, thermic
241	S	Brytkontakt lampa luftmatning släp	Contact, breaking, warning lamp air supply to trailer
242	S	Slutkontakt lampa oljetryck v-låda	Contact, making, warning lamp, oil pressure gear box
243	S	Brytkontakt tryck kylmedia AC	Contact, breaking, coolant pressure (air condition)
244	S	Slutkontakt hydraulik aktiverad	Contact, making, hydraulics
245	S	Slutkontakt hydraultryck styrning	Contact, making, hydraulic pressure control
246	S	Slutkontakt tryck kylmedia	Contact, pressure refrigerant
250	S	Manöverbrytare	Operating Switch
251	S	Slutkontakt vändbar förarstol	Contact, making, VBFS
260	S	Slutkontakt lyft steg 1	Contact, making, hoist step 1
261	S	Slutkontakt lyft steg 2	Contact, making, hoist step 2
262	S	Slutkontakt tilt	Contact, making, tilting
263	S	Slutkontakt gaffelspridning	Contact, making, fork positioning
264	S	Slutkontakt sidoföring	Contact, making, sideshift
265	S	Slutkontakt stativ in/ut	Contact, making, lifting mast in-out
266	S	Brytkontakt hytt dörr	Contact, breaking cab door
267	S	Slutkontakt bromstryck	Contact, making, brake pressure
268	S	Slutkontakt kompressor	Contact, making, Compressor
269	S	Slutkontakt sax inne	Contact, making extender in
270	S	Slutkontakt överlastskydd	Contact, making, overload protection
299	S	Slut/brytkontakt option	Contact, making/braking option
300	K	Relä hel/halvljus	Relay, main/dipped beam

Number	Categ.	Svenska	English
301	K	Relä dimljus	Relay, fog light
302	K	Relä fjärrljus	Relay, distance light
303	K	Relä lastljus	Relay, mast light
304	K	Relä arbetsljus	Relay, working light
305	K	Relä backljus	Relay, reversing light
306	K	Relä helljus	Relay, main beam
307	K	Relä halvljus	Relay, dipped beam
308	K	Relä bromsljus	Relay, brake light
309	K	Relä parkeringsbroms	Relay, parking light
310	K	Relä körvisare vä	Relay, direction indicator left
311	K	Relä körvisare hö	Relay, direction indicator right
312	K	Relä startelement	Relay,element preheater
313	K	Relä vändbar förarstol	Relay, rotating driver's seat (VBFS)
314	K	Relä parkeringsbroms	Relay, parking brake
315	K	Relä tändningslås	Relay, ignition key
316	K	Relä torkare	Relay, wiper
317	K	Relä strålkastartorkare	Relay, roading lights wiper
318	K	Relä AT-regulator	Relay, AT-regulator
319	K	Relä varningsblinkers	Relay, hazard blinkers
320	K	Relä elektrisk stopp	Relay, electical stop
321	K	Relä intervalltorkare	Relay, intermittent wiper
322	K	Relä kylvätskenivå	Relay, coolant level
323	K	Relä blinkers	Relay, blinkers
324	K	Relä ragespärr	Relay, range interlock
325	K	Relä blinkande bromsljus (back)	Relay, flashing brake lights (reversing)
326	K	Relä blinkande bromsljus (runt)	Relay, flashing hazard brake lights
327	K	Relä växel neutral	Relay, gear neutral
328	K	Relä växelskifte	Relay, gear shift
329	K	Relä växel hög/låg	Relay, high/low gear
330	K	Relä startspärr	Relay, start interlock
331	K	Relä drivning fram	Relay, forward driving
332	K	Relä drivning bak	Relay, reversing driving
333	K	Tidrelä förvärmning	Time relay, automatically preheating
334	K	Relä frikoppling/drivbrytning	Relay, free wheel/drive disconnection
335	K	Relä växelventil 1:a (diesel, gas)	Relay, gear change valve 1-gear (diesel,LPG)
336	K	Relä växelventil 2:a (diesel, gas)	Relay, gear change valve 2-gear (diesel,LPG)
337	K	Relä drivriktning motor	Relay, motor drive direction
338	K	Relä kylfläkt drivmotor	Relay, cooling fan drive motor
339	K	Relä kylfläkt elskåp	Relay, cooling fan electrical box
340	K	Tidrelä fördröjt tillslag	Time relay, start delay
341	K	Tidrelä fördröjt fränslag	Time relay, stop delay
342	K	Relä drivning 2/4 hjul	Relay, switching 2/4 WD
343	K	Relä dimbakljus	Relay, fog light rear
344	K	Relä momentförstärkare	Relay, torque amplifier
345	K	Relä låsning vändskiva	Relay, interlocking of turntable
346	K	Relä frikoppling stollåsning	Relay, releasing of seat interlocking
347	K	Relä stolvändning/ljussignal	Relay, multifunction, seat rotation/light signal
348	K	Relä fläktmotor värmare	Relay, fan heating
349	K	Relä fartreglage	Relay, speed control
350	K	Relä pumpkontaktor/pumpkontroll	Relay, pump contactor/pump control
351	K	Relä hyttlyft upp	Relay, cab hoist up

Number	Categ.	Svenska	English
352	K	Relä hyttlyft ner	Relay, cab hoist down
353	K	Relä säkerhets slinga	Relay, safety loop
354	K	Relä styrsystem	Relay, signal control system
355	K	Relä sensorstyrning	Relay, sensor control
356	K	Skiftrelä längskörning/tvärskörning	Shift relay, length/sideways driving
357	K	Relä roterande varningsljus	Relay, hazard beacon
358	K	Relä kompressor luft	Relay, compressor air
359	K	Relä Hydrauloljekylare	Relay hydraulic oil cooler
360	K	Relä startsolenoid	Relay, starting solenoid
361	K	Relä kompressor AC	Relay, compressor air conditione
362	K	Relä vattenventil AC	Relay, water valve air conditioner
363	K	Relä kondensator AC	Relay, condenser air conditione
364	K	Relä stolsbrytare	Relay seat switch
365	K	Relä fönsterhiss upp	Relay, electrical screen elevator up
366	K	Relä fönsterhiss ner	Relay, electrical screen elevator down
367	K	Relä styrning	Relay, steerin
368	K	Relä lågt bromstryck	Relay, low brake pressure
369	K	Relä centralsmörjning	Relay, central lubrication
370	K	Relä centralsmörjning, aggregat	Relay, central lubrication, attachment
371	K	Relä lyfthöjd	Relay, liftheight
372	K	Relä blinkande varn.ljus, höjdbegränsn.	Relay, flashing beacon, lifting height limiter
373	K	Relä bakljus	Relay light
375	K	Huvudkontaktor reglersystem	Main contactor, operating control
376	K	Kontaktor fram reglersystem	Contactor, forward operating control
377	K	Kontaktor bak reglersystem	Contactor, reversing operating control
378	K	Kontaktor by-pass reglersystem/Fältförsvagning	Contactor, „by-pass“ operating control/ Field weakening
379	K	Kontaktor pumpmotor	Contactor, pump motor
380	K	Kontaktor	Contactor
381	K	Kontaktor återladdning	Contactor, recharging
382	K	Relä, förbikoppling säkerhetssystem	Relay, by-pass safety system
383	K	Relä, Stolsvärme	Relay, heated seat
384	K	Relä vattenseparator	Relay, waterseparator
385	K	Relä bränslepump insprutning	Relay, fuel injection pump
386	K	Relä, hög motortemperatur.	Relay, high motor temperature
387	K	Relä alternativ gaspedal	Relay alternative throttle pedal
388	K	Relä, Extra färdriktningväljare	Relay, Extra direction selector
389	K	Relä, Pausvärme	Relay, Paus heat
399	K	Relä option	Relay, option
400	E	G-lampa vä fram	Light bulb, roading light left hand front
400	E	G-lampa hö fram	Light bulb, roading light right hand rear
401	E	G-lampa vä bak	Light bulb, roading light left hand front
401	E	G-lampa hö bak	Light bulb, roading light right hand rear
402	E	G-lampa fjärrljus	Light bulb, distance light
403	E	G-lampa lastljus	Light bulb, mast light
404	E	G-lampa arbetsljus	Light bulb, working light
405	E	G-lampa backljus	Light bulb, rear light
406	E	G-lampa cont belysning vänster	Container light left-hand
406	E	G-lampa cont belysning höger	Container light right-hand
408	E	G-lampa park ljus vä fram	Light bulb, parking light, left-hand forward
408	E	G-lampa park ljus hö fram	Light bulb, parking light, right-hand forward
410	H	G-lampa broms ljus vä fram	Light bulb, brake light, left-hand forward

Number	Categ.	Svenska	English
410	H	G-lampa broms ljus hö fram	Light bulb, brake light, right-hand forward
411	H	G-lampa broms ljus vä bak	Light bulb, brake light, left-hand rear
411	H	G-lampa broms ljus hö bak	Light bulb, brake light, right-hand rear
412	H	G-lampa bak ljus vä bak	Light bulb, rear light, left-hand rear
412	H	G-lampa bak ljus hö bak	Light bulb, rear light right-hand rear
413	H	G-lampa bak ljus vä fram (VBFS)	Light bulb, rear light, left-hand forward (VBFS)
413	H	G-lampa bak ljus hö fram (VBFS)	Light bulb, rear light, right-hand forward (VBFS)
416	H	G-lampa sidomarkering vä fram	Light bulb, side position light, left-hand forward
416	H	G-lampa sidomarkering vä bak	Light bulb, side position light, left-hand rear
417	H	G-lampa sidomarkering hö fram	Light bulb, side position light, right-hand forward
417	H	G-lampa sidomarkering hö bak	Light bulb, side position light, right-hand rear
420	H	G-lampa positionsljus vänster	Light bulb, position light, left-hand
421	H	G-lampa positionsljus höger	Light bulb, position light, right-hand
422	H	G-lampa körvisare vä fram	Light bulb, direction indicator left-hand forward
423	H	G-lampa körvisare hö fram	Light bulb, direction indicator right-hand forward
426	H	G-lampa körvisare vä bak	Light bulb, direction indicator left-hand rear
427	H	G-lampa körvisare hö bak	Light bulb, direction indicator right-hand rear
428	H	G-lampa roterande varningsljus	Light bulb, flashing beacon lamp
429	E	G-lampa cigarettändare belysning	Light bulb, cigarette lighter illumination
431	E	G-lampa instrument belysning	Light bulb, instrument illumination
432	E	G-lampa handsfack belysning	Light bulb, glove pocket light
433	E	G-lampa instegs belysning	Light bulb, step-in lighting
434	E	G-lampa innerbelysning	Light bulb, interior lighting
435	E	G-lampa låsbelysning	Light bulb, reading lighting
436	E	G-lampa identifikationsljus	Light bulb, identification light
437	E	G-lampa identifikationsljus/takskylt	Light bulb, identification light/roof sign
438	E	G-lampa motorrumsbelysning	Light bulb, engine compartment light
439	E	Nummerskyltsbelysning	Light license plate
440	E	G-lampa värmereglage belysning	Light bulb, heating control light
445	H	G-lampa körvisare vä (extra)	Light bulb, extra direction indicator left
446	H	G-lampa körvisare hö (extra)	Light bulb, extra direction indicator right
451	H	G-lampa dimbaktljus vänster	Light bulb, fog light rear left
452	H	G-lampa dimbaktljus höger	Light bulb, fog light rear right
453	H	G-lampa bromsljus/körvisare vänster	Light bulb, brake light/dir. indicator left-hand
453	H	G-lampa bromsljus/körvisare höger	Light bulb, brake light/dir. indicator right-hand
454	H	G-lampa bromsljus blackout vänster	Light bulb, brake light blackout left-hand
454	H	G-lampa bromsljus blackout höger	Light bulb, brake light blackout right-hand
456	E	G-lampa backljus blackout IR vänster	Light bulb, rear light blackout IR left-hand
456	E	G-lampa backljus blackout IR höger	Light bulb, rear light blackout IR right-hand
457	H	G-lampa positionsljus blackout vänster	Light bulb, position light blackout left-hand

Number	Categ.	Svenska	English
457	H	G-lampa positionsljus blackout höger	Light bulb, position light blackout right-hand
458	E	G-lampa fram blackout vänster	Light bulb, roading light blackout left-hand
458	E	G-lampa fram blackout höger	Light bulb, roading light blackout right-hand
459	E	G-lampa fram blackout IR vänster	Light bulb, roading light blackout IR left-hand
459	E	G-lampa fram blackout IR höger	Light bulb, roading light blackout IR right-hand
460	E	G-lampa arb.belysning hytt blackout IR vä	Light bulb, working light cab blackout IR left
460	E	G-lampa arb.belysning hytt blackout IR hö	Light bulb, working light cab blackout IR right
461	E	G-lampa arb.bel. bom 20' blackout IR vä	Light bulb, working light boom20' b.out IR left
461	E	G-lampa arb.bel. bom 20' blackout IR hö	Light bulb, working light boom20' b.out IR right
462	E	G-lampa arb.bel. bom 40' blackout IR vä	Light bulb, working light boom40' b.out IR left
462	E	G-lampa arb.bel. bom 40' blackout IR hö	Light bulb, working light boom40' b.out IR right
463	H	G-lampa bak ljus vänster bak, blackout	Light bulb, rear light left-hand rear, blackout
463	H	G-lampa bak ljus höger bak, blackout	Light bulb, rear light right-hand rear, blackout
464	E	G-lampa cont belysning IR vänster	Light bulb, Container light IR left-hand
464	E	G-lampa cont belysning IR höger	Light bulb, Container light IR right-hand
465	H	G-lampa röd saxagregat ute	Light-bulb, red extender extended
466	H	G-lampa orange vertikåhååning på	Light bulb, orange vertical hold on
467	H	G-lampa gröå klåmtryck OK	Light bulb, green clamp pressure OK
468		G-Lampa Röd Maxlast	Light bulb, Red Overload
500	H	Kont lampa körvisare	Indicating lamp, direction indicator
501	H	Kont lampa körvisare (extra)	Indicating lamp, direction indicator extra
503	H	Varn lampa oljetryck motor	Warning lamp, oil pressure engine
504	H	Kont lampa helljus	Indicating lamp, main beam
505	H	Varn lampa laddning	Warning lamp, loading
506	H	Varn lampa laddning (extra)	Warning lamp, loading extra
507	H	Varn lampa fåådbroms	Warning lamp, brake
508	H	Varn lampa parkerings broms	Warning lamp, parking brake
509	H	Varn lampa nivå kylvatten	Warning lamp, coolant level
510	H	Kont lampa diff spåå	Indicating lamp, diff. interlock
512	H	Varn lampa temp momentfååst	Warning lamp, temperature converter
514	H	Kont lampa ååvervååxel	Indicating lamp, overdrive clutch
519	H	Kont lampa halvljus	Indicating lamp, dipped lights
524	H	Kont lampa luftfilter	Indicating lamp, air filter
525	H	Kont lampa UNIKAT	Indicating lamp, UNIKAT
528	H	Kont lampa fåårvååmning	Indicating lamp, preheating
530	H	Kont lampa framhjuls styrning	Indicating lamp, forward wheel steering
531	H	Kont lampa 4-hjuls styrning	Indicating lamp, 4-wheel steering
532	H	Kont lampa crab styrning	Indicating lamp, crab steering
533	H	Kont lampa hyd.pump	Indicating lamp, emergency hyd. pump
547	H	Varn lampa centralvarning	Warning lamp, central warning
549	H	Varn lampa oljetryck v-lååda	Warning lamp, oil pressure gear box
550	H	Varn lampa hyttlåååning	Warning lamp, cab lock

Number	Categ.	Svenska	English
551	H	Varn lampa temp v-låda	Warning lamp, temperature gear box
552	H	Varn lampa bromstryck	Warning lamp, brake pressure
554	H	Varn lampa temp spolkreets bromsar	Warning lamp, temp. cooling system brakes
555	H	Varn lampa temp kylvatten mot	Warning lamp, temperature coolant engine
556	H	Varn lampa låsning vändskiva	Warning lamp, interlocking of turntable
560	H	Varn lampa temp drivmotor el	Warning lamp, temperature, drive motor
561	H	Varn lampa temp pumpmotor el	Warning lamp, temperature, pump motor
562	H	Varn lampa öppen twistlock	Warning lamp, unlocked twist lock
563	H	Varn lampa låst twistlock	Warning lamp, locked twist lock
564	H	Varn lampa anliggning	Warning lamp, alignment
565	H	Varn lampa temp motor el	Warning lamp, temperature motor
569	H	Kont lampa elvärme	Indicating lamp, electric heater
569	H	Kont lampa elvärme	Indicating lamp, electric heater
570	H	Varn lampa överkoppling säkerhetssystem	Warning lamp, by-pass safety system
571	H	Kont lampa bränslenivå	Indicating lamp, fuel level
572	H	Varningslampa lyfthöjd	Warning lamp lifting height
573	H	Kontroll lampa motor information	Indicator lamp engine information
574	H	Kontroll lampa stödben nere	Indicator lamp support jacks down
575	H	Kontroll lampa stödben ur arb.läge	Indicator lamp support jacks out of working pos
576	H	Kontroll lampa anliggning främre ben	Indicator lamp, alignment front legs
577	H	Kontroll lampa anliggning bakre ben	Indicator lamp, alignment rear legs
578	H	Kontroll lampa klämläge främre ben	Indicator lamp, clamp position front legs
579	H	Kontroll lampa klämläge bakre ben	Indicator lamp, clamp position rear legs
580	H	Kontroll lampa främre ben uppe	Indicator lamp, front legs upper position
581	H	Kontroll lampa främre ben nere	Indicator lamp, front legs lower position
582	H	Varningslampa överlast	Warning lamp overload
583	H	Kontroll lampa anliggning ett ben	Indicator lamp, alignment one leg
584	H	Kontroll lampa anliggning alla ben	Indicator lamp, alignment all legs
599	H	Kont lampa option	Indicating lamp, option
600	Y	M-ventil avgasbroms	Solenoid valve, exhaust brake
601	Y	M-ventil diff spärr	Solenoid valve, diff. interlock
602	Y	M-ventil broms	Solenoid valve, brake
603	Y	M-ventil värme	Solenoid valve, heater
604	Y	M-ventil kraftuttag sida	Solenoid valve, power take off, side
605	Y	M-ventil kraftuttag bak	Solenoid valve, power take off, rear
606	Y	M-ventil 2/4 hjuldrift	Solenoid valve, 2/4WD
607	Y	M-ventil hög/låg växel	Solenoid valve, high/low gear
608	M	Pumpaggregat hyttlyft	Pump unit, cab hoist
609	M	Ställmotor gaspådrag	Regulating motor, throttle
610	Y	M-ventil hydraulsystem allm	Solenoid valve, hydraulics, general
611	Y	M-ventil flödesbegränsning	Solenoid valve, flow restriction
612	M	Ställmotor recirkulation	Regulating motor, re-circulation
613	Y	M-ventil momentförstärkare	Solenoid valve, torque amplifier
614	Y	M-ventil rangespärr	Solenoid valve, ranging interlock
615	Y	M-ventil hjulvridning	Solenoid valve, wheel turning
616	Y	M-ventil kallstart	Solenoid valve, cold start aid
617	Y	M-ventil AT-regulator by-pass	Solenoid valve, AT-regulator by-pass
618	Y	M-ventil vatten klimatanläggning	Solenoid valve, water air conditioner
620	Y	M-ventil vändskiva upp	Solenoid valve, fifth wheel up
621	Y	M-ventil vändskiva ner	Solenoid valve, fifth wheel down

Number	Categ.	Svenska	English
622	Y	M-ventil vändskiva fram	Solenoid valve, fifth wheel forward
623	Y	M-ventil vändskiva bak	Solenoid valve, fifth wheel rear
624	Y	M-ventil skevning hö	Solenoid valve, levelling right hand
625	Y	M-ventil skevning vä	Solenoid valve, levelling left hand
626	Y	M-ventil AT-regulator	Solenoid valve, AT-regulator
627	Y	M-ventil vakuüm	Solenoid valve vacuum
628	Y	M-ventil bränsleblandning	Solenoid valve fuelmixture
630	Y	M-ventil v-låda fram	Solenoid valve, gear box, forward gear
631	Y	M-ventil v-låda back	Solenoid valve, gear box, rear gear
632	Y	M-ventil v-låda spole 1	Solenoid valve, gear box, 1 gear
633	Y	M-ventil v-låda spole 2	Solenoid valve, gear box, 2 gear
634	Y	M-ventil v-låda spole 3	Solenoid valve, gear box, 3 gear
635	Y	M-ventil klämtryck	Solenoid valve, clamping pressure
636	Y	M-ventil styrning	Solenoid valve, steering
637	Y	M-ventil flytläge skevning	Solenoid valve, equalizing fifth wheel
638	Y	M-ventil stopp insprut pump	Solenoid valve, stop injection pump
639	Y	M-ventil låsning orbitrol ls	Solenoid valve, locking LS orbitrol
640	Y	M-ventil gasol	Solenoid valve, LPG
641	Y	M-ventil förångare (LPG)	Solenoid valve, evaporator (LPG)
642	Y	M-ventil park broms	Solenoid valve, parking brake
643	Y	M-ventil låsning stol (VBFS)	Solenoid valve, seat locking (VBFS)
644	Y	M-ventil låsning vändskiva	Solenoid valve, fifth wheel locking
645	Y	Magnetkoppling komp AC	Magnetic clutch, compressor AC
646	Y	M-ventil stolsvändning	Solenoid valve, seat rotation
647	Y	M-ventil stolstilt	Solenoid valve, seat tilt
648	Y	M-ventil luftfjädring	Solenoid valve, pneumatic springing
649	B	Termostat klimatansläggning	Thermostat, air condition
650	M	Torkarmotor fram	
650	M	Torkarmotor fram	
650	M	Torkarmotor fram	
650	M	Torkarmotor fram	
650	M	Torkarmotor fram	
651	M	Vindrutespolarmotor	Washer motor
652	M	Strålkastarmotor	Light motor
653	M	Strålkastarspolarmotor	Light washer motor
654	M	Startmotor	Starter motor
655	M	Kylfläkt drivmotor (EC)	Cooling fan, main motor (EC)
656	M	Kylfläkt elskåp (EC)	Cooling fan, electrical box (EC)
657	M	Fläktmotor värme	Heating fan
658	G	Generator (extra)	Alternator extra
659	G	Generator utan laddregulator	Alternator without loading regulator
660	G	Generator med laddregulator	Alternator with loading regulator
661	M	Fönsterhissmotor	Screen elevator motor
662	G	Laddregulator	Loading regulator
663	M	Doseringspump klimatanläggning	Dosage pump, air condition
664	M	Cirk pump klimatanläggning	Circulating pump, air condition
665	V	Diod	Diode
666	M	Fläktmotor cirkulation	Circulation fan
667	M	Cirkulationspump värmesystem	Circulation pump heating system
668	M	Kylfläkt hydraulolja	Cooling fan, hydraulic oil
669	E	Värmare kupe/ motor diesel	Heater compartment/engine diesel
670	M	Kompressor	Compressor
671	M	Doseringspump diesel	Dosage pump diesel
672	M	Spjäll motor, ECC	Draught valve motor, ECC
673	Y	Vatten ventil motor, ECC	Water valve motor, ECC

Number	Categ.	Svenska	English
674	M	Kylfläkt bromsolja	Cooling fan, brake fluid
675	M	Motor, Stolsvändning	Motor, Seat rotation
676	Y	Solenoid Broms stolsvändning	Solenoid brake , seat rotation
685	A	Reglerenhet termostat AC	Control unit, termostat AC
690	B	Fartreglage (EC)	Speed control (EC)
693	M	Pump centralsmörjning	Pump, central lubrication
694	M	Styrmotor	Steering motor
695	M	Drivmotor (EC)	Drive motor (EC)
696	M	Pumpaggregat nödstyrning	Pump, emergency steering
697	B	Elbroms	Electric brake
698	M	Pumpmotor (EC)	Pump motor (EC)
699	Y	M-ventil option	Solenoid valve, option
700	P	Hastighetsmätare	Speedometer
701	P	Mätare oljetemp v-låda	Gear box oil temperature gauge
702	P	Klocka	Clock
703	P	Varvtalsmätare	Engine rev meter
704	P	Tryckluftsmätare	Air pressure gauge
705	P	Mätare oljetryck v-låda	Gear box oil pressure gauge
706	P	Termometer temp kylvätska motor	Temperature gauge, engine coolant
707	P	Bränslemätare	Fuel gauge
708	P	Timräknare	Hour meter
709	P	Kapacitetsmätare batteri	Capacity gauge, battery
710	P	Tidur motor/kupevärmare	Timer, engine- and cab heater
711	P	Räknare, impuls	Counter, impulse
712	P	Mätare oljetryck motor	Motor oil pressure gauge
714	P	Mätare, temp. Hydraulolja	Hydraulic fluidtemperature, guage
715	P	Extra instrument allm	Extra instrument, general
720	S	Givare vändbar förarstol	Transmitter, revolving driver's seat (VBFS)
740	D	FleetManager kontrollenhet	FleetManager control unit
741	U	FleetManager batterifilter	FleetManager battery filter
742	D	FleetManager kortläsare	FleetManager card device
743	D	FleetManager accelerations givare	FleetManager acceleration sensor
751	B	Givare varvtal turbin	Transmitter, speed turbin
752	B	Givare varvtal inre växellåda	Transmitter, speed internal gear chain
753	B	Varvtalsgivare motor	Transmitter, engine revolution
754	B	Givare lufttryck	Transmitter, air pressure
755	B	Givare hydraulfilter indikering	Transmitter, hydraulics filter indication
756	B	Temperatur kylvätska motor	Transmitter, engine coolant temperature
757	B	Bränslenivågivare	Transmitter, fuel level
758	B	Varvtalsgivare v-låda	Transmitter, gear box revolution
759	B	Nivåindikator kylvätska	Transmitter, coolant level
760	B	Givare rev-spärr/aut-vxl trans	Transmitter, reversing interlock / automatic gear change system (on gearbox output shaft)
761	B	Givare rev-spärr/aut-vxl motor	Transmitter, reversing interlock / automatic gear changing system (engine speed)
762	B	Givare temp, spolkrets bromsar	Transmitter, brake flushing circuit
763	B	Givare nivå hydraulolja	Transmitter, hydraulic fluid level
764	B	Givare servotryck växellåda	Transmitter, gear box servo pressure
765	B	Givare oljetryck v-låda	Transmitter, oil pressure gear box
766	B	Givare oljetemp. v-låda	Transmitter, oil temperature gear box
767	B	Givare oljetryck motor	Transmitter, oil pressure engine
768	B	Givare oljetryck hydraulik	Transmitter, hydraulic pressure

Number	Categ.	Svenska	English
769	B	Givare ändläge	Transmitter, end position
770	B	Givare rattutslag	Transmitter, steering wheel angle
771	B	Givare vinkel	Transmitter, angle
772	B	Givare temp bromsolja	Transmitter, temperature brake fluid
773	B	Givare närvaro	Transmitter, presence
774	B	Givare utomhustemp	Transmitter, ambient temperature
775	B	Givare temp klimatanläggning	Transmitter, temperature air condition
776	B	Givare temp hydraulolja	Transmitter, hydraulic temperature
777	B	Givare läge	Transmitter, position
778	B	Givare drivbrytning	Transmitter, drive break
779	A	Reglersystem återladdning (EC)	Control system, recharging (EC)
780	A	Reglersystem åkmotor (EC)	Control system main motor (EC)
781	A	Reglersystem pumpmotor (EC)	Control system pump motor (EC)
782	A	Logik interface 2 drivmotorer	Logic (interface) two main motors (EC)
783	A	Logik interface gaspådrag	Logic (interface) throttle
784	A	Logik interface bromsregl	Logic (interface) brake control
785	A	Logik interface styrsystem	Logic (interface) control system
786	A	Servoförstärkare styrsystem	Servo amplifier steering system
789	B	Givare allmän	Transmitter, common
790	D	Elektronisk kontrollenhet ECU, hytt	Electronic Control Unit ECU, cab
791	D	Elektronisk kontrollenhet aggregat	Electronic Control Unit, attachment
792	D	Elektronisk kontrollenhet styrning	Electronic Control Unit, steering system
793	D	Elektronisk kontrollenhet växellåda	Electronic Control Unit, gearbox
794	D	Elektronisk kontrollenhet motor	Electronic Control Unit, engine
795	P	Display	Display
796	D	Elektronisk kontrollenhet, lasthantering	Electronic Control Unit, Loadhandling
797	D	Elektronisk kontrollenhet, ram	Electronic Control Unit, frame
798	D	Elektronisk kontrollenhet, stolvändning	Electronic Control Unit, seat rotation
799	A	Logik allm (option)	Logic, general (option)
800	S	Startelement	Start element
802	E	Eluppvärmd backspegel	Electrical heated observation mirror
803	E	Eluppvärmd stol	Electrical heated seat
804	E	Cigarettändare	Cigarette lighter
805	E	Elvärme hytt	Electrical heating cab
806	A	Aggregat klimatanläggning	Aggregate, air conditioner
807	R	Potentiometer	Potentiometer
808	E	Eluppvärmd lufttorkare	Electrical heater air dryer
810	A	Kondensator AC, fläkt	Condensator AC, fan
815	S	Manöverspak	Control lever
820	R	Motstånd	Resistor
821	C	KONDENSATOR	CAPACITOR
822	Z	Signalfilter	Signal filter
823	U	Signalomvandlare höger	Signal amplifier, right
824	U	Signalomvandlare vänster	Signal amplifier, left
825	R	Reglage spakstyrning	Controls, (steering with control levers).
826	Y	Ventil spakstyrning	Valve, (steering with control levers).
827	A	Växellåda	Gearbox
828	R	Shuntmotstånd	Shunt-resistor
830	L	Tändspole	Ignition coil
835	E	Tändstift	Ignition plug
840	S	Strömfördelare	Distributor
850	H	Signalhorn	Horn
853	H	Summer	Buzzer
888	E	Lufttork, kompressor	Air Dryer, Compressor

Number	Categ.	Svenska	English
900	A	Radio/bandspelare	Radio/tape recorder
901	U	Spänningsomvandlare	Voltage converter
902	B	Högtalare	Loud speaker
903	W	Antenn radio	Aerial, radio
905	A	Kommunikationsradio	Communication radio
906	W	Antenn kommunikationsradio	Aerial, communication radio
907	A	Monitor	Monitor
908	A	Kamera	Camera
909	A	Skrivare	Printer
910	U	Spänningsomvandlare 80V/24V	Voltage converter 80 V / 24 V
911	A	Dataterminal	Dataterminal
940	A	Logik batterivakt	Logic switch , battery watch
941	U	Laddningsutjämnare	Even charger
950	A	Logik transistortändning	Logic transistor ignition
955	A	Logik övervarningssskydd (LPG)	Logic overspeed protection (LPG)
960	A	Logik rev-spärr/aut-vxl	Logic unit, reversing interlock/automatic gear changing
961	A	Motor/kupevärmare	Engine- and cab heater
962	E	Logik slitageind kol elmotor	Logic indication of wear, brush electrical motor
965	H	Backvarnare	Reversing alarm
1001	S	Strömställare, TW	Switch, TW
1002	S	Strömställare, lossa TW	Switch, unlocking of TW
1003	S	Strömställare, låsa TW	Switch, locking of TW
1004	S	Strömställare, stopp vid 30'-35'	Switch, stop at 30 -35'
1005	S	Strömställare, förbikoppling av säkerhetssystem	Switch, overriding of the safety system
1006	S	Strömställare, fällning främre ben	Switch, front legs down
1007	S	Strömställare, fällning bakre ben	Switch, rear legs down
1008	S	Strömställare, klämma/lossa ben	Switch, clamping/-releasing legs
1009	S	Strömställare, Motor information	Switch, Engine information
1010	S	Strömställare, tilt av hytt	Switch, tilt of cab
1011	S	Strömställare IR ljus	Switch IR light
1012	S	Strömställare utskjut 20"-40"	Switch, Extension 20"-40"
1013	S	Strömställare stödben	Switch, Support jacks
1014	S	Strömställare förbikoppling rotationstopp	Switch, over ride rotation stop
1015	S	Strömställare förbikoppling höjdbeg/tp-beg	Switch, over ride height limit/tp-limit
1016			
1017	S	Strömställare diagnostik öka/minska	Switch, diagnostics increase/decrease
1018	S	Strömställare diagnostik on/off	Switch, diagnostics on/off
1019	S	Strömställare rastvärme	Switch, paus heat
1020	S	Strömställare automatisk släpp/kläm funktion	Switch automatic release/clamp funktion
1021	S	Strömställare sax	Switch extender
1022	S	Strömställare vertikalhållning	Switch, vertical position
1023	S	Strömställare låsning övre arm	Switch, lock upper arm
1024	S	Strömställare Korta Armen av/på	Switch, Short Arm on/off
1025	S	Strömställare pappersfunktioner av/på	Switch, paper funksions on/off
1026	S	Strömställare omkoppling pappers/klämmagregat	Switch, switch papper/bale clamp
1027	S	Strömställare lyfthöjdsförval	Switch, lift height selection
1028	S	Strömställare lyfthöjdsförval öka	Switch, lift height selection increase
1029	S	Strömställare lyfthöjdsförval minska	Switch, lift height selection decrease

Number	Categ.	Svenska	English
1030	S	Strömställare läraringång givare ultraljud	Switch, teaching ultrasonic sensor
1031	S	Strömställare, Over Height Upp/Ned	Switch, Over Height Up/Down
1032	S	Brytare backljus	Switch reverse light.
1033	S	Flytta korta armen	Move short arm
1034	S	Strömställare förbikoppling startspärr	Switch Override Start interlock
1035	S	Strömställare Val av klämtryck	Switch, Clamp pressure selection
1036	S	Strömställare Korta Armen av/på	Switch , Short Arm on/off
1037	S	Strömställare låsning skevning	Switch, lock levelling
1038	S	Strömställare Övre armpar/Sidoföring	Switch Upper arms/Sideshift
1039	S	Strömställare Inching	Switch, Inching
1040	S	Switch stopp motor	Switch, Stop engine
1041	S	Strömställare motorrumsbelysning	Switch, light engine compartment
1042	S	Strömställare höjjustering stol	Switch, Seat height level
1043	S	Strömställare längdjustering stol	Switch, Seat for/aft adjustment
1044	S	Strömställare Tankväljare	Switch, Tankselector
1045	S	Strömställare Avstängning backalarm	Switch, Rev. Alarm on/off
2000	D	Elektronisk kontrollenhet, proportionalventil	Electronic control unit, propotional valve
3001	K	Relä rotation	Relay, rotation
3002	K	Relä tilt	Relay, tilt
3003	K	Relä sidoföring	Relay, side shifting
3004	K	Relä längdinställning	Relay, length adjustment
3005	K	Relä twist lock	Relay, twist lock
3006	K	Relä spridning	Relay, spreading
3007	K	Relä lyft/sänk	Relay, lifting/lowering
3008	K	Relä hydraulfunktion extra	Relay, extra hydraulic function
3009	K	Relä manöverbrytare hydr	Relay, operating switch
3010	K	Relä bromsljus vxl std/blackout	Relay, brake light shift std/blackout
3011	K	Relä backljus vxl std/blackout	Relay, reversing light shift std/blackout
3012	K	Relä arb.bel hytt vxl std/blackout	Relay, working light cab, shift std/blackout
3013	K	Relä arb.bel. bom 20' vxl std/blackout	Relay,working light boom20' shift std/b.out
3014	K	Relä arb.bel. bom 40' vxl std/blackout	Relay,working light boom40' shift std/b.out
3015	K	Relä vxl bromsljus/blinkers vä	Relay, shift brake light/direction indicator left
3015	K	Relä vxl bromsljus/blinkers hö	Relay, shift brake light/direction indicator right
3016	K	Relä signalhorn	relay, horn
3017	K	Relä containerbelysning	Relay, Container light
3018	K	Relä containerbelysning IR	Relay, Container light IR
3305	K	Relä VBFS, backljus	Relay, rotating driver's seat, reversing light
3306	K	Relä VBFS, helljus	Relay, rotating driver's seat, main beam
3307	K	Relä VBFS, halvljus	Relay, rotating driver's seat, dipped beam
3308	K	Relä VBFS, bromsljus	Relay, rotating driver's seat, brake light
3310	K	Relä VBFS, körvisare vä	Relay, rotating driver's seat, direction indicator left
3311	K	Relä VBFS, körvisare hö	Relay, rotating driver's seat, direction indicator right
3330	K	Relä, säkerhetsbälte	Relay, seat belt
3331	K	Relä VBFS, drivning fram	Relay, rotating driver's seat, forward driving

Number	Categ.	Svenska	English
3332	K	Relä VBFS, drivning bak	Relay, rotating driver's seat, reversing driving
3349	K	Relä VBFS, fartreglage	Relay, rotating driver's seat, speed control
3404	K	Relä VBFS, mastljus	Relay, rotating driver's seat, mast light
3412	K	Relä bak ljus	Relay, rotating driver's seat, rear light
3768	K	Relä oljetryck hydraulik	Relay, hydraulic pressure
3769	K	Relä, blockering av hyttilt	Relay, blocking of cab tilt
3770	K	Relä anliggning	Relay, alignment
3771	K	Relä Krok	Relay, Hook
3772	K	Relä laddsignal (D+)	Relay, charge signal (D+)
3773	K	Relä 12V för minne radio	Relay 12V for radio memory
3774		Relä kylfläkt olja	Relay, cooling fan oil
3775			
5000	H	Kont lampa tryck lyfttång	Indicating lamp, pressure lift tong
5001	H	Varn lampa, Over Height ben uppe	Warn. Lamp, Over Height leg upper pos
6001	Y	M-ventil blockering höger	Solenoid valve, blocking right
6002	Y	M-ventil blockering vänster	Solenoid valve, blocking left
6003	Y	M-ventil inkoppling av hydraulik till topplyft	Solenoid valve, activation of toplift hydraulics
6004	Y	M-ventil sänk	Solenoid valve, lower
6005	Y	M-ventil lyft	Solenoid valve, lift
6006	Y	M-ventil bom ut	Solenoid valve, boom out
6007	Y	M-ventil bom in	Solenoid valve, boom in
6008	Y	M-ventil vridning medsols	Solenoid valve, rotation clockwise
6009	Y	M-ventil vridning motsols	Solenoid valve, rotation counter-clockwise
6010	Y	M-ventil tilt ut	Solenoid valve, tilt out
6011	Y	M-ventil tilt in	Solenoid valve, tilt in
6012	Y	M-ventil tilt	Solenoid valve, tilt
6013	Y	M-ventil fällning främre ben	Solenoid valve, lowering front legs
6014	Y	M-ventil fällning bakre ben	Solenoid valve, lowering rear legs
6015	Y	M-ventil klämma/lossa ben	Solenoid valve, clamping/releasing legs
6016	Y	M-ventil Hyttskjutning fram	Solenoid valve, cab movement forward
6017	Y	M-ventil Hyttskjutning bak	Solenoid valve, cab movement reverse
6018	Y	M-ventil spridning ut	Solenoid valve, spreading out
6019	Y	M-ventil spridning in	Solenoid valve, spreading in
6020	Y	M-ventil sidoföring vänster	Solenoid valve, side shift left
6021	Y	M-ventil sidoföring höger	Solenoid valve, side shift right
6022	Y	M-ventil extra hydraulfunktion ut	Solenoid valve, extra hydraulic function out
6023	Y	M-ventil extra hydraulfunktion in	Solenoid valve, extra hydraulic function in
6024	Y	M-ventil stativ ut	Solenoid valve, mast out
6025	Y	M-ventil stativ in	Solenoid valve, mast in
6026	Y	M-ventil höger framhjul styrning vänster	Solenoid valve, right front wheel, steering left
6027	Y	M-ventil höger framhjul styrning höger	Solenoid valve, right front wheel, steering right
6028	Y	M-ventil vänster framhjul styrning vänster	Solenoid valve, left front wheel, steering left
6029	Y	M-ventil vänster framhjul styrning höger	Solenoid valve, left front wheel, steering right
6030	Y	M-ventil höger bakhjul styrning vänster	Solenoid valve, right rear wheel, steering left

Number	Categ.	Svenska	English
6031	Y	M-ventil höger bakhjul styrning höger	Solenoid valve, right rear wheel, steering right
6032	Y	M-ventil vänster bakhjul styrning vänster	Solenoid valve, left rear wheel, steering left
6033	Y	M-ventil vänster bakhjul styrning höger	Solenoid valve, left rear wheel, steering right
6034	Y	M-ventil skevning	Solenoid valve, levelling
6035	Y	M-ventil skevning höger	Solenoid valve, levelling right
6036	Y	M-ventil skevning vänster	Solenoid valve, levelling left
6037	Y	M-ventil kylfläkt	Solenoid valve, Cooling fan
6038	Y	M-ventil frikoppling koppling	Solenoid valve, lockup clutch
6039	Y	M-ventil öppna twistlock	Solenoid valve, unlocked twist lock
6040	Y	M-ventil låsa twistlock	Solenoid valve, locked twist lock
6041	Y	M-ventil nöd, twistlock	Solenoid valve, emergency, twistlock
6042	Y	M-ventil mellan bom	Solenoid valve, middle boom
6043	Y	Magnetventil, fällning torn (RTCH)	Solenoid valve, boom lowering (RTCH)
6044	Y	M-ventil blockering twistlock	Solenoid valve, blocking twistlock
6045	Y	M-ventil blockering lyft	Solenoid valve, blocking lift
6046	Y	M-ventil utskjut	Solenoid valve, projecting
6047	Y	M-ventil, hyttilt upp	Solenoid valve, cab tilt up
6048	Y	M-ventil, hyttilt ner	Solenoid valve, cab tilt down
6049	Y	M-ventil, kylkrets broms	Solenoid valve, cooling circuit brake
6050	Y	M-ventil blockering utskjut	Solenoid valve, blocking projecting
6051	Y	M-ventil, regenerering höger	Solenoid valve, regeneration right
6052	Y	M-ventil, regenerering vänster	Solenoid valve, regeneration left
6053	Y	M-ventil, körläge	Solenoid valve, driving position
6054	Y	M-ventil, klämma ihop	Solenoid valve, clamping in
6055	Y	M-ventil, klämma isär	Solenoid valve, clamping out
6056	Y	M-ventil, främre knä ut	Solenoid valve, front knee out
6057	Y	M-ventil, främre knä in	Solenoid valve, front knee in
6058	Y	M-ventil, bakre knä ut	Solenoid valve, rear knee out
6059	Y	M-ventil, bakre knä in	Solenoid valve, rear knee in
6060	Y	M-ventil, främre ben upp	Solenoid valve, front legs up
6061	Y	M-ventil, bakre ben upp	Solenoid valve, rear legs up
6062	Y	M-ventil, urkoppling hydraulpump	Solenoid valve interruption hydraulic pump
6063	Y	M-ventil, stödben upp	Solenoid valve, brace up
6064	Y	M-ventil, stödben ner	Solenoid valve, brace down
6065	Y	M-ventil, frikoppling vridbroms	Solenoid valve, lockup rotation brake
6066	Y	M-ventil, v-låda, drivning	Solenoid valve, gearbox, drive
6067	Y	M-ventil, v-låda, oljetryck till 1:a/3:e växeln	Solenoid valve, gearbox, oilpressure to 1st/3rd gear
6068	Y	M-ventil sax/rotation	Solenoid valve extender/rotation
6069	Y	M-ventil, v-låda, oljetryck till 2:a/4:e växeln	Solenoid valve, gearbox, oilpressure to 2nd/4th gear
6070	Y	M-ventil Over Height upp	Solenoid valve, Over Height up
6071	Y	M-ventil Over Height ner	Solenoid valve, Over Height down
6072	Y	M-ventil klämtryck	Solenoid valve clamp pressure
6073	Y	Proportional ventil, Opti speed	Proportional valve, Opti speed
6074	Y	M-ventil, v-låda, växelväljare för 2:a/4:e växeln	Solenoid valve, gearbox, gearswitch for 2nd/4th gear
6075	Y	M-ventil, v-låda, växelväljare för 1:a/3:e växeln	Solenoid valve, gearbox, gearswitch for 1st/3rd gear
6076	Y	M-ventil blockering sänk	Solenoid valve, blocking lower
6077	Y	M-ventil Inching	Solenoid valve, Inching

Number	Categ.	Svenska	English
6078	Y	M-ventil,Avstängning Övre klämarm	Solenoid valve, upper arm off
6079	Y	M-Ventil, Sidoföring/Övre armar	Solenoid valve, Sideshift/Upper arms
6080	Y	M-ventil, aktivering hyttkörning	Solenoid valve, activate sliding cab
7200	S	Givare, axeltryck höger	Sensor, axle pressure right
7201	S	Givare, axeltryck vänster	Sensor, axle pressure left
7202	S	Givare, anliggning vänster fram	Sensor, alignment left front
7202	S	Givare, anliggning höger fram	Sensor, alignment right front
7203	S	Givare, anliggning vänster bak	Sensor, alignment left rear
7203	S	Givare, anliggning höger bak	Sensor, alignment right rear
7204	S	Givare, öppen vänster twistlock	Sensor, unlocked twistlock left
7204	S	Givare, öppen höger twistlock	Sensor, unlocked twistlock right
7205	S	Givare, låst vänster twistlock	Sensor, locked twistlock left
7205	S	Givare, låst höger twistlock	Sensor, locked twistlock right
7206	S	Givare, gaffel aggregat	Sensor, fork attachment
7207	S	Givare, 2WD/4WD	Sensor, 2WD/4WD
7208	S	Givare, hytt i körläge	Sensor, Cab in drive position
7209	S	Givare, oljefilter indikering	Sensor, Oil filter indication
7210	S	Givare, hytt i transportläge	Sensor, Cab in transportation position
7211	S	Givare, lyfthöjd	Sensor, lifting height
7212	S	Givare, körläge	Sensor, driving position
7213	S	Givare, Anliggning främre ben	Sensor, Alignment front legs
7214	S	Givare, Anliggning bakre ben	Sensor, Alignment rear legs
7215	S	Givare, kläm främre ben	Sensor, Clamp front legs
7216	S	Givare, kläm bakre ben	Sensor, Clamp rear legs
7217	S	Givare, främre knä	Sensor, front knee
7218	S	Givare, bakre knä	Sensor, rear knee
7219	S	Givare, främre ben	Sensor, front legs
7220	S	Givare, bakre ben	Sensor, rear legs
7221	S	Givare, styraxel	Sensor, steering axle
7222	S	Givare, stödben uppe	Sensor, brace up
7223	S	Givare, stödben nere	Sensor, brace down
7224	B	Givare, mätläge våg	Sensor, measurepoint scale
7225	B	Givare, rotationsstopp	Sensor, rotation stop
7226	B	Givare, tryck lyftcylinder	Sensor, pressure lift cylinder
7227	B	Givare, tryck klämma	Sensor, pressure clamp
7228	B	Givare lyfthöjd analog	Sensor lift height analogue
7229	B	Givare tiltvinkel analog	Sensor tilt angle analogue
7230	B	Givare ultraljud last position	Sensor, ultrasonic load position
7231	B	Givare, Over Height, Ben uppe	Sensor, Over Height, Leg upper position
7232	B	Givare,IR Last position	Givare,IR Load position
7233	B	Givare lambda sond	Sensor lambda sond
7234	B	Givare vatten i bränsle	Transmitter water in fuel
8071	R	Potentiometer lyft/sänk	Potentiometer lift/lower
8072	R	Potentiometer tilt	Potentiometer tilt
8073	R	Potentiometer sidoföring	Potentiometer side shifting
8074	R	Potentiometer spridning	Potentiometer spreading
8075	R	Potentiometer extra	Potentiometer extra
8076	R	Potentiometer mast in/ut	Potentiometer reach in/out
8077	R	Potentiometer höger framhjul	Potentiometer right front wheel
8078	R	Potentiometer vänster framhjul	Potentiometer left front wheel
8079	R	Potentiometer höger bakhjul	Potentiometer right rear wheel
8080	R	Potentiometer vänster bakhjul	Potentiometer left rear wheel
8081	R	Potentiometer tiltvinkel	Potentiometer tilt angle
8082	R	Potentiometer fläkthastighet, ECC	Potentiometer fan speed, ECC

Number	Categ.	Svenska	English
8083	R	Potentiometer temperatur, ECC	Potentiometer temperature, ECC
8084	R	Potentiometer spjäll, ECC	Potentiometer draught valve, ECC
8085	R	Potentiometer rotation	Potentiometer rotation
8086	R	Potentiometer sax	Potentiometer extender
8087	R	Potentiometer klämma	Potentiometer clamp
8088	R	Potentiometer skevning	Potentiometer levelling
8089	R	Potentiometer kroklåsning	Potentiometer flaps
8090	V	Laser, pappersaggretgat	Lase, Pulp an Paper
8091			
9000	M	Motor höj/sänkbar stolspelare	Motor rise/lower seat column
9001	D	Åkerströms fjärrkontroll	Åkerströms Remote Control
9002			
9003	H	Varningssignal aut. rörelse	Warning alarm aut. movement
9888	A	test	
93774	K	Relä hållkrets	Relay, Holdcircuit



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# Technical data

## Data and volume

### Data

<b>1 Engine</b>	Volvo TWD1240VE	Volvo TAD1250VE	Cummins QSM11
Power acc. to ISO 3046 (net power)	256 kW at 2000 rpm	247 kW at 1900 rpm	261 kW at 2000 rpm
Torque ISO 3046	1751 Nm at 1200 rpm	1760 Nm at 1400 rpm	1830 Nm at 1100-1400 rpm
Alternator	2240 W (28 V / 80 A)		2400 W (24 V / 100 A)
System voltage	24 V (2 x 12 V / 140 Ah)		

<b>2 Transmission</b>	Dana TE32000
No. of gears forward – reverse	4 – 4

<b>3 Power transmission</b>	Meritor PRC7534	Kessler D102
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<b>4 Brakes</b>	Wet Disc Brakes - Drive wheels
Parking brake	Spring brake - Drive wheels

<b>5 Steering</b>	Hydraulic servo
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<b>6 Wheel suspension</b>	DRF420	DRF400/450	DRF450, X
Dimensions front - rear	18.00x25/36	18.00x25/40	18.00x33/36
Tyre pressure (also see pressure plate)	1.0 MPa		

<b>9.6 Frame, body, cab and accessories, lighting system</b>		
<b>Light</b>	<b>Rating (W)</b>	<b>Socket</b>
Control lights	1.2	W2x4.6d
Interior lighting	10	S8.5
Rear lights	5	BA15s
Brake lights	21	BA15s
Direction indicators	21	BA15s
Running lights	5	W2.1x9.5d
Headlights (high and low beams)	75/70	P43t-38
Back-up lights	70	PK22s
Work lights	70	PK22s
Work lights Xenon 	35	D1S Xenon tube. Insert and ballast replaced complete.
Rotating beacon	70	PK22s

### Volumes

For oil types see tab *F Technical data*.

<b>1 Engine</b>	Volvo TWD1240VE	Volvo TAD1250VE	Cummins QSM11
Fuel tank	550 l		
Fuel quality	Diesel according to EN590		
Cooling system	68 l	40 l	40 l
Engine oil	35 l	35 l	34 l

<b>2 Transmission</b>	Dana TE32000
Transmission oil	60 l when changing (80 l total)

<b>3 Power transmission</b>	Meritor PRC7534	Kessler D102
Differential	50 l	65 l
Hub reduction	2x10 l	2x12 l

<b>4 Brakes</b>	
Brake system	140 l

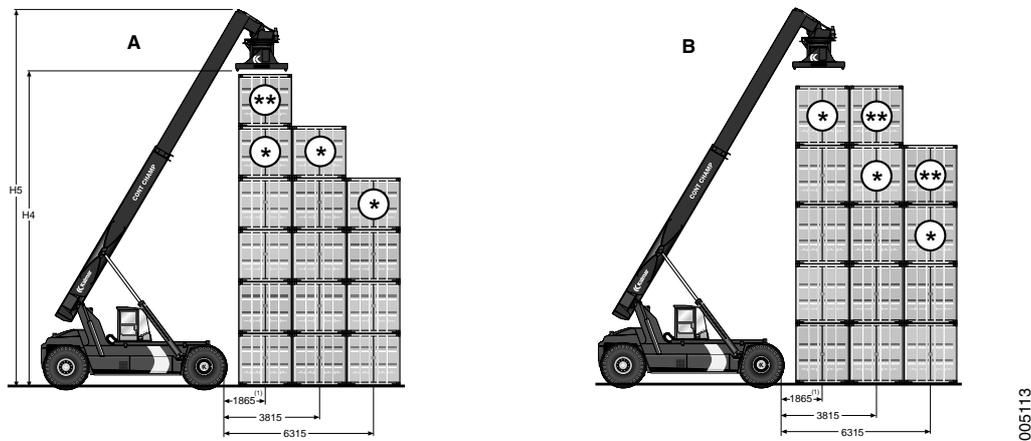
<b>7 Load handling</b>	
Planetary gear hydraulic motor attachment	1.6 l
Brake hydraulic motor attachment	0.6 l

<b>9 Frame, body, cab and accessories</b>	Volvo TWD1240VE	Volvo TAD1250VE	Cummins QSM11
Air conditioning, refrigerant	2000 g, R134a		
Air conditioning, lubricant	Pre-filled with correct volume.		1.7 dl ZXL100 (PAG oil)
Washer fluid	5 l		

<b>10 Common hydraulics</b>	
Hydraulic oil tank	600 l
Hydraulic system	940 l (total incl. tank)

## Lift capacity and dimensions

### Capacity (tons)



A. Container 86

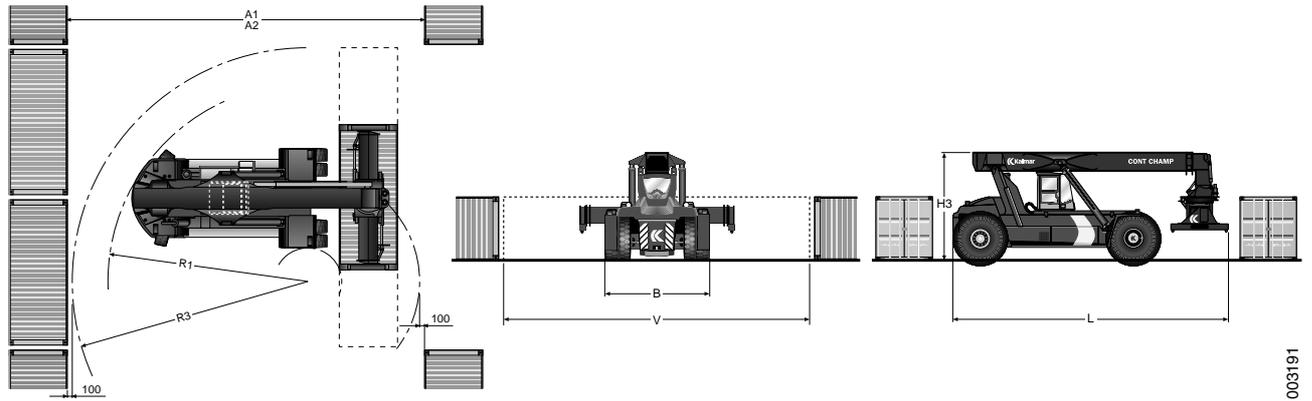
B. Container 96

005113

Model	Container 86			Container 96			Lift height top lift	
	Row 1	Row 2	Row 3	Row 1	Row 2	Row 3	H4 (mm)	H5 (mm)
DRF400-60C5	38*/40	25**	10**	37**/40*	25*	10*	14900	18100
DRF420-60S5	41*/42	25*	11*	40*/42	25*	11*	15100	18100
DRF450-60S5	43*/45	27*	13*	42*/45	27*	13*	15100	18100
DRF450-60S5X	43*/45	35*	18*	42*/45	35*	18*	15200	18200
DRF450-60C5X	42*/45	32**	14**	41**/44*/45	32*	14*	15000	18200
DRF420-65S5	41*/42	28*	13*	40*/42	28*	13*	15100	18100
DRF420-65S6	39**/41*/42	28*	13*	40*/42	28**	13**	16200	19250
DRF450-65S5	43*/45	30*	15*	42*/45	30*	15*	15100	18100
DRF450-65S6	42**/44*/45	30*	15*	43*/45	30**	15**	16200	19250
DRF450-65S5X	45*	36*/38*	21*	43*/45	37*/38	21*	15200	18200
DRF450-65C5X	42*/45	33**/34*	16**	41**/44*/45	34*	16*	15000	18200
DRF450-65S6X	42**/45*	35*/38	21*	43*/45	34**/36*/38	21**	16300	19350
DRF420-70S5	41*/42	30*	15*	40*/42	30*	15*	15100	18100
DRF450-70S5X	45*	39*/41	23*	45*	40*/41	23*	15100	18200
DRF450-70S5XS	45*	39*/41	23*/(31*)	45*	40*/41	23*/(31*)	15100	18200
DRF450-70C5XS	45*	36**/38*	20**/(27**)	43**/45*	37*/38	20*/(27*)	14900	18200
DRF450-75S5XS	45*	43*/45	26*/(34*)	45	45*	26*/(34*)	15200	18400
DRF450-75C5XS	45*	40**/42*/43	24**/(32**)	45**	41*/43	24/(32*)	15000	18400

( ) = Support jacks down

Dimensions (mm)



003191

Model	Operating width		Turning radius		Main dimensions						Operating weight (kg)
	A1-20'	A2-40'	R1-20'	R3-40'	B	V	L	H3	Ground clearance	Tyres	
DRF400-60C5	11200	13600	8100	9400	4150	6055-12185	11200	4500	250	18.00x25/40	72700
DRF420-60S5	11200	13600	8100	9400	4150	6055-12185	11200	4500	250	18.00x25/36	64500
DRF450-60S5	11200	13600	8100	9400	4150	6055-12185	11200	4500	250	18.00x25/40	66400
DRF450-60S5X	11200	13600	8100	9400	4150	6055-12185	11200	4600	300	18.00x33/36	76500
DRF450-60C5X	11200	13600	8100	9400	4150	6055-12185	11200	4600	300	18.00x33/36	81100
DRF420-65S5	11600	13600	8500	9400	4150	6055-12185	11700	4500	250	18.00x25/36	65000
DRF420-65S6	11900	13900	8500	9450	4150	6055-12185	12000	4500	250	18.00x25/36	66200
DRF450-65S5	11600	13600	8500	9400	4150	6055-12185	11700	4500	250	18.00x25/40	66800
DRF450-65S6	11900	13900	8500	9450	4150	6055-12185	12000	4500	250	18.00x25/40	67800
DRF450-65S5X	11600	13600	8500	9400	4150	6055-12185	11700	4600	300	18.00x33/36	76300
DRF450-65C5X	11600	13600	8500	9400	4150	6055-1258	11700	4600	300	18.00x33/36	80500
DRF450-65S6X	11900	13900	8500	9450	4150	6055-12185	12000	4600	300	18.00x33/36	77200
DRF420-70S5	12100	13600	9000	9400	4150	6055-12185	12200	4500	250	18.00x25/36	65800

Model	Operating width		Turning radius		Main dimensions						Operating weight (kg)
	A1-20'	A2-40'	R1-20'	R3-40'	B	V	L	H3	Ground clearance	Tyres	
DRF450-70S5X	12100	13600	9000	9400	4150	6055-12185	12200	4700	300	18.00x33/36	77800
DRF450-70S5XS	12100	13600	9000	9400	4150	6055-12185	12200	4700	300	18.00x33/36	79300
DRF450-70C5XS	12100	13600	9000	9400	4150	6055-12185	12200	4700	300	18.00x33/36	84200
DRF450-75S5XS	12500	13600	9400	9400	4150	6055-12185	12700	4750	300	18.00x33/36	82100
DRF450-75C5XS	12500	13600	9400	9400	4150	6055-12185	12700	4750	300	18.00x33/36	88100



\*) The lubrication oil must meet both standards. **NOTE!** API: CH-4 or CH-4 are approved for markets outside of Europe (Instead of ACEA E5).

\*\*) Same oil as for Volvo TWD1240VE may be used on the condition that the change interval is reduced to 400 hours.

\*\*\*) The oil in the brake system must meet one of the quality standards as well as be a UTTO-oil (Universal Tractor Transmission Oil).

ACEA = Association des Constructeurs Européenne d'Automobiles

API = American Petroleum Institute

VDS = Volvo Drain Specification

### Grease

Use a universal grease type EP acc. to NLGI Grade 2 with 3-5 % molybdenum sulfide content for all grease points except for slide plates and pins/axles with bearings not requiring greasing.

For slide plates, use lubrication paste Gleitmo 805 or its equivalent.

For pins/axles with bearings not requiring greasing, use aluminium paste Loctite 8150 or its equivalent.

For electrical contacts, Electrical connector grease 923836.0552 shall be used.

### Sealant silicone

Use Loctite 5972 or Loctite 598 (or equivalent). If uncertain, contact Kalmar Industries.

## Tightening torques, recommendations

The tightening torques in the following table are recommendations when tightening bolts and nuts.

When torquing using a machine, for example, bolt runner, the tightening torque should be reduced by approx. 5%.

For mild surfaces (hardness below 200 HB), washer shall be used under both bolt head and nut. Alternatively, use flange bolt or flange nut.

Tighten to the prescribed torque without stopping.

Recommended tightening torque may vary depending on surface treatment. Certain combinations of nut and bolt require lubrication according to the table below.

State	Bolt	Nut	Lubrication
1	untreated	untreated	oil
2	bright-galvanized	untreated or bright-galvanized	dry or oil
3	hot-galvanized	untreated	dry or oil

Quality	8.8			10.9	12.9
State	1	2	3	1	1
<b>Fine M-thread</b>					
M81	27 Nm	24 Nm	30 Nm	39 Nm	46 Nm
M101,25	54 Nm	48 Nm	61 Nm	78 Nm	91 Nm
M121,25	96 Nm	85 Nm	108 Nm	135 Nm	162 Nm
M161.5	230 Nm	205 Nm	260 Nm	323 Nm	388 Nm
M181.5	330 Nm	294 Nm	373 Nm	466 Nm	559 Nm
<b>M-thread</b>					
M4	3.2 Nm	2.9 Nm	3.6 Nm	4.6 Nm	5.5 Nm
M5	6.4 Nm	5.7 Nm	7.2 Nm	9.1 Nm	11 Nm
M6	11 Nm	9.8 Nm	12.5 Nm	16 Nm	19 Nm
M8	26 Nm	24 Nm	30 Nm	38 Nm	45 Nm
M10	52 Nm	47 Nm	59 Nm	74 Nm	89 Nm
M12	91 Nm	81 Nm	103 Nm	128 Nm	154 Nm
M16	220 Nm	198 Nm	250 Nm	313 Nm	375 Nm
M20	430 Nm	386 Nm	490 Nm	620 Nm	732 Nm
M24	750 Nm	668 Nm	848 Nm	1050 Nm	1270 Nm
M30	1480 Nm	1317 Nm	1672 Nm	2080 Nm	2500 Nm
<b>UNC-thread</b>					
1/4	12.5 Nm	11.1 Nm	14.1 Nm	17.6 Nm	20 Nm
5/16	25 Nm	22.3 Nm	28.3 Nm	35 Nm	42 Nm
3/8	44 Nm	39 Nm	50 Nm	62 Nm	73 Nm
7/16	70 Nm	62 Nm	79 Nm	100 Nm	118 Nm
1/2	107 Nm	95 Nm	121 Nm	151 Nm	178 Nm
9/16	153 Nm	136 Nm	173 Nm	216 Nm	255 Nm
5/8	210 Nm	187 Nm	237 Nm	298 Nm	353 Nm
3/4	370 Nm	390 Nm	418 Nm	524 Nm	619 Nm
7/8	594 Nm	528 Nm	671 Nm	839 Nm	990 Nm
1	889 Nm	791 Nm	1005 Nm	1260 Nm	1480 Nm
1 1/8	1260 Nm	1120 Nm	1424 Nm	1780 Nm	2100 Nm
1 1/4	1760 Nm	1565 Nm	1990 Nm	2490 Nm	2940 Nm
1 3/8	2320 Nm	2065 Nm	2620 Nm	3280 Nm	3870 Nm
1 1/2	3060 Nm	2720 Nm	3455 Nm	4320 Nm	5100 Nm

## Tightening torque, ORFS connections

### Pipe and hose fitting

Pipe diameter		Tightening torque
mm	inch	Nm
6	1/4	23-25
8	5/16	33-38
10	3/8	
12	1/2	51-57
14	-	80-90
15	-	
16	5/8	
18	3/4	120-130
20	-	
22	7/8	150-170
25	1"	
28	-	
30	-	180-200
32	1"1/4	
35	-	200-240
38	1"1/2	

Wrench size		Tightening torque
mm	inch	Nm
17	11/16	23-25
22	13/16	33-38
24	15/16	51-57
36	1 3/8	120-130
41	1 5/8	150-170

**Goods coupling**

<b>UNF-UN</b>		<b>Metric-ISO</b>		<b>BSSP</b>	
Thread (inch)	Tightening torque (Nm)	Thread (mm)	Tightening torque (Nm)	Thread (inch)	Tightening torque (Nm)
7/16-20	21	10x1	20	1/8-28	20
1/2-20	27	12x1.5	35	1/4-19	35
9/16-18	40	14x1.5	45	3/8-19	70
3/4-16	78	16x1.5	55	1/2-14	100
7/8-14	110	18x1.5	68	3/4-14	190
1"1/16-12	180	20x1.5	80	1"-11	300
1"3/16-12	230	22x1.5	98	1"1/4-11	330
1"5/16-12	285	26x1.5	170	1"1/2-11	400
1"5/8-12	320	27x2	180		
1"7/8-12	400	33x2	310		
		42x2	330		
		48x2	400		

**Unit explanations**

Unit	Abbreviation
Newton metre	Nm
Kilo pound metre	kpm
Kilo pascal	kPa
Mega pascal	MPa
Kilowatt	kW
kilojoule	kJ
British termel unit	Btu
Calorie	ca
Inch	in
Feet	ft
Yard	yd
Mile	mile
Centimetre	cm
Metre	m
Kilometre	km

## Conversion table, SI-units

SI-unit	Recalculation factor	Non-SI	Recalculation factor	SI
<b>Torque</b>				
Nm	x 10,2	= kg·cm	x 0,8664	= lb·in
Nm	x 0,74	= lbf·ft	x 1,36	= Nm
Nm	x 0,102	= kg·m	x 7,22	= lb·ft
<b>Pressure (Pa = N/m<sup>2</sup>)</b>				
kPa	x 4,0	= in.H <sub>2</sub> O	x 0,249	= kPa
kPa	x 0,30	= in.Hg	x 3,38	= kPa
kPa	x 0,145	= psi	x 6,89	= kPa
bar	x 14,5	= psi	x 0,069	= bar
kp/cm <sup>2</sup>	x 14,22	= psi	x 0,070	= kp/cm <sup>2</sup>
N/mm <sup>2</sup>	x 145,04	= psi	x 0,069	= bar
MPa	x 145	= psi	x 0,00689	= MPa
<b>Power (W = J/s)</b>				
kW	x 1,36	= hp (cv)	x 0,736	= kW
kW	x 1,34	= bhp	x 0,746	= kW
kW	x 0,948	= Btu/s	x 1,055	= kW
W	x 0,74	= ft·lb/s	x 1,36	= W
<b>Energy (J = Nm)</b>				
kJ	x 0,948	= Btu	x 1,055	= kJ
J	x 0,239	= calorie	x 4,19	= J
<b>Speed and acceleration</b>				
m/s <sup>2</sup>	x 3,28	= ft/s <sup>2</sup>	x 0,305	= m/s <sup>2</sup>
m/s	x 3,28	= ft/s	x 0,305	= m/s
km/h	x 0,62	= mph	x 1,61	= km/h
<b>Horsepower/torque</b>				
Bhp x 5252 rpm= TQ (lb·ft)			TQ x rpm 5252 = bhp	
<b>Temperature</b>				
°C = (°F – 32)/1,8	°F = (°C x 1,8) + 32			
<b>Flow factor</b>				
l/min (dm <sup>3</sup> /min)	x 0,264	= US gal/min x 3,785		= liter/min

## Conversion table, length

Unit	cm	m	km	in	ft	yd	mile
cm	1	0,01	0,00001	0,3937	0,03281	0,01094	0,000006
m	100	1	0,001	39,37	3,2808	1,0936	0,00062
km	100000	1000	1	39370,7	3280,8	1093,6	0,62137
in	2,54	0,0254	0,000025	1	0,08333	0,02777	0,000015
ft	30,48	0,3048	0,000304	12	1	0,3333	0,000189
yd	91,44	0,9144	0,000914	36	3	1	0,000568
mile	160930	1609,3	1,6093	63360	5280	1760	1

1 mm = 0,1 cm - 1 mm = 0,001 m

## Conversion table, area

Unit	cm <sup>2</sup>	m <sup>2</sup>	km <sup>2</sup>	a	ft <sup>2</sup>	yd <sup>2</sup>	in <sup>2</sup>
cm <sup>2</sup>	1	0,0001	-	0,000001	0,001076	0,000012	0,155000
m <sup>2</sup>	10000	1	0,000001	0,01	10,764	1,1958	1550,000
km <sup>2</sup>	-	1000000	1	10000	1076400	1195800	-
a	0,01	100	0,0001	1	1076,4	119,58	-
ft <sup>2</sup>	-	0,092903	-	0,000929	1	0,1111	144,000
yd <sup>2</sup>	-	0,83613	-	0,008361	9	1	1296,00
in <sup>2</sup>	6,4516	0,000645	-	-	0,006943	0,000771	1

1 ha = 100 a - 1 mile<sup>2</sup> = 259 ha = 2,59 km<sup>2</sup>

## Conversion table, volume

Unit	cm <sup>3</sup> = cc	m <sup>3</sup>	l	in <sup>3</sup>	ft <sup>3</sup>	yd <sup>3</sup>
cm <sup>3</sup> = ml	1	0,000001	0,001	0,061024	0,000035	0,000001
m <sup>3</sup>	1000000	1	1000	61024	35,315	1,30796
dm <sup>3</sup> (l)	1000	0,001	1	61,024	0,035315	0,001308
in <sup>3</sup>	16,387	0,000016	0,01638	1	0,000578	0,000021
ft <sup>3</sup>	28316,8	0,028317	28,317	1728	1	0,03704
yd <sup>3</sup>	764529,8	0,76453	764,53	46656	27	1

1 gal (US) = 3785,41 cm<sup>3</sup> = 231 in<sup>3</sup> = 0,83267 gal (UK)

## Conversion table, weight

Unit	g	kg	t	oz	lb
g	1	0,001	0,000001	0,03527	0,0022
kg	1000	1	0,001	35,273	2,20459
t	1000000	1000	1	35273	2204,59
oz	28,3495	0,02835	0,000028	1	0,0625
lb	453,592	0,45359	0,000454	16	1

1 ton (metric) = 1,1023 ton (US) = 0,9842 ton (UK)

## Conversion table, pressure

Unit	kp/cm <sup>2</sup>	bar	Pa = N/m <sup>2</sup>	kPa	lbf/in <sup>2</sup>	lbf/ft <sup>2</sup>
kp/cm <sup>2</sup>	1	0,98067	98066,5	98,0665	14,2233	2048,16
bar	1,01972	1	100000	100	14,5037	2088,6
Pa = N/m <sup>2</sup>	0,00001	0,001	1	0,001	0,00015	0,02086
kPa	0,01020	0,01	1000	1	0,14504	20,886
lbf/in <sup>2</sup>	0,07032	0,0689	6894,76	6,89476	1	144
lbf/ft <sup>2</sup>	0,00047	0,00047	47,88028	0,04788	0,00694	1

kg/cm<sup>2</sup> = 735,56 Torr (mmHg) = 0,96784 atm

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# Terminology and index

## Terminology

Term	Description
Accumulator	Reservoir that stores (accumulates) pressure for i.e. hydraulic functions.
Anti-corrosion compound	Prevents oxidation, in simple terms, rustproofing.
Attachment	Part of the machine that grabs the load when lifting.
Axle distance	Distance between drive axle and steering axle.
Bar	Unit to express pressure.
Battery disconnecter	Cuts off current from battery.
Boom	Lift beam moveable vertically and in-out. Bracket for attachment.
Bottom lift attachment	“Lift legs” that can be raised/lowered for handling loads. Grabs load from below.
Buzzer	Acoustic alarm to catch the operator’s attention.
Control valve	Valves that can be used to control something, for example, to release pressure and thus lower a boom or a fork. See also control valve.
Daily inspection	The actions that should be performed daily to ensure the machine’s functionality.
Decitonne	Tenth of a tonne, measure of the machine’s lift capacity.
Display	“Window” showing digital information on steering wheel panel in cab.
Drive axle	Driving axle that receives the torque from the drivetrain.
Drivetrain	Parts in machine involved in power transmission; engine, torque converter, transmission, propeller shaft and drive axle with differential and hub reduction.
Dust reservoir	The air filter collects the coarsest particles in a dust reservoir, emptied automatically during operation.
ECC	Electric Climate Control. Climate unit with thermostat-controlled cooling, dehumidification and heating.
EHC	Electric Heat Control. Heater unit with automatic heat control.
Electrolyte level	Fluid level in battery cells.
Environmental waste	Used oils, filters, etc., must be handled according to governing national laws and regulations.
Expansion tank	Tank for coolant.
Fixed displacement	Pump with fixed pump volume.
Hanging load	Lifted load.
Hub reduction	Type of final drive (often next to drive wheel) that reduces rpm and increases torque from the drivetrain.
Hydraulic oil	Oil for hydraulic system. See specifications in section <i>F Technical data</i> .
Hydraulic oil pump	Pump in hydraulic system.

<b>Term</b>	<b>Description</b>
Hydraulic system	System that uses oil pressure to transfer power to different functions.
Indicator	Manual “sensor”, for example, shows that a filter is clogged and needs to be changed.
LC	Load centre.
Levelling	Attachment is tilted, for example, if load stands on uneven ground.
Lift capacity	Indicates machine’s maximal lift capacity.
Lifting point	Attaching point for lift device when lifting an object.
Low-emission engine	Engine with low emissions of hazardous substances. Manufactured according to regulations.
Machine model	Machine type. Indicated, for example: DRF 400-450. See also type designation.
Main fuse	Located by battery. Cuts off current all systems in machine.
Maintenance	Periodic maintenance actions so that machine functions safely and for long life.
OP	Overload Protection. Overload system to warn when machine is overloaded.
Operating hours	Number of hours machine has been in operation, shown on hour meter in cab.
Option	Optional equipment for machine.
Overload system	See OP (Overload Protection).
Pilot oil pressure	A low control pressure to, for example, a valve.
Planetary gear	Type of transmission with gears in constant engagement.
Product alternative	One of several alternatives is selected for a machine, i.e. engine alternative.
Proportional valve	An electro-magnetically controlled valve. If a current is applied, the valve is activated in proportion to the current’s amplitude. In simple terms, infinitely variable valve, as opposed to on/off valve. For example, on transmission’s valve housing.
Reachstacker	Machine with special top lift attachment for containers.
Refrigerant	Fluid/gas in air conditioning. May only be handled by authorized trained person.
Rotation yoke	Rotating unit on attachment, rotates attachment in relation to lift boom.
Securing machine for transport	Actions before transporting machine.
Serial number	Unique machine designation. On machine plate.
Service position	How machine should be safely positioned before service may be started.
Servo	A small user movement results in a big machine movement, i.e. power steering.
Servo pressure	A low control pressure to control a higher pressure, for example, to a valve.
Sideshift	Parallel sideways movement of attachment.
Solenoid valve	An electro-magnetically controlled valve. See also proportional valve.
Spirit Delta	Enclosed type of cab.
Spreading	Widening of attachment.
Start up	Start procedure for control and monitoring system (from powerless to supplied with voltage).

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<b>Term</b>	<b>Description</b>
Steering axle	Wheel axle with steering.
Tilting	Load is leaned forward or backward.
Torque converter	Hydraulic, variable clutch.
Transmission oil	Oil for transmission and torque converter. See specifications in section <i>F Technical data</i> .
Twistlocks	Four lock pins, one in each corner of the attachment, pushed down in corresponding holes in container and twisted to lock the container when lifting.
Type designation	Indicates machine type and capacity. See also machine model.
Valve slide	Moveable part in valve. Determines oil's path.
Variable displacement	Adjustable volume (capacity) of a pump.
Variable pump	Pump with adjustable flow rate.
Wet brakes	Brake discs in oil-bath.
Working hydraulics	All load handling functions, i.e. lift and lower, tilt, sideshift, spreader and levelling.

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