

Reachstackers 45 tonnes



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Workshop Manual in original

WORKSHOP MANUAL

DRT 450



Workshop Manual

DRT 450

A Foreword

B Safety

C Preventive maintenance

0 Complete machine

1 Engine

2 Transmission

3 Driveline/axle

4 Brakes

5 Steering

6 Suspension

7 Load handling

8 Control system

9 Frame, body, cab and accessories

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A Foreword

About the Workshop Manual

General

Thank you for choosing Cargotec as your machine supplier. We hope that we will meet your expectations.

Conditions

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

Cargotec will not accept any responsibility in the event of a modification performed without permission from Cargotec. Further, Cargotec will not accept any responsibility if other lifting devices, tools or work methods are used other than those described in this manual.

Storage

NOTE

The workshop manual should be accessible to service personnel.

About machine version

The information in this publication corresponds with the machine's design and appearance on delivery from Cargotec. Deviations may arise due to customer adaptations.

Cargotec reserves the right to make changes to specifications and equipment without prior notice. All information and data in this manual are valid at the time of publication.



DANGER

External equipment may only be used if it is approved by Cargotec.

Extreme hazard to personal health and risk of property damage!

Only use equipment that is approved by Cargotec.

Copyright

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

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

Reading instructions

Warning information

Warnings provide information about potential dangers that, if the warnings are not followed, could result in injury or product damage.

**DANGER**

Situation that could lead to severe personal injury or death if regulation is not followed.

**WARNING**

Situation that could lead to personal injury if regulation is not followed.

**CAUTION**

Situation that could lead to product damage if regulation is not followed.

Important information

Important information is denoted with NOTE and is intended to facilitate the work process, handling or to increase understanding of the information.

NOTE

Important information not related to safety.

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

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Read the 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

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The workshop manual's contents

The workshop manual contains information to facilitate maintenance (part replacement) and is a supplement to the maintenance manual. Accompanying the workshop manual is supplier documentation for engine, transmission and drive axle. Where possible, the workshop manual provides reference to supplier documentation instead of printing the same information twice. Methods for preventive maintenance and certain checks are found in the maintenance manual, no references are given for these. Use the function groups to locate 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	Technical description, comprehensive function descriptions and a description of the function of components included in the machine, divided into function groups. The components used for each respective function are described under each subfunction. Consequently, common components are described in several locations, but in general under the first function to use the component. Together with the general description is a detailed description of what is unique about the specific subfunction. The next subfunction to use the same component only has a description what is unique for the new function. Work instructions for corrective maintenance (replacement of components).
1	Engine	
2	Transmission	
3	Power transmission	
4	Brakes	
5	Steering	
6	Suspension	
7	Load handling	
8	Control system	
9	Frame, body, cab and accessories	
10	Common hydraulics	
11	Common electrics	
12	Common pneumatics	
D	Error codes	Error code information and instructions for reading error code information.
E	Schematics	Wiring diagrams, hydraulic diagrams and list of electrical components.
F	Technical data	Technical data, conversion tables, information for conversion of units.
G	Terminology and index	General terminology and abbreviations, explanation of terms and abbreviations that can appear in the sections, index 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 Lifting/lowering. The third and fourth levels are used to break down functions into smaller parts (components).

The function groups' structure for main group and two-digit group level are common for all machines from Cargotec, e.g. 4.3 Power-assisted brake system. Machine-unique adaptations of function groups are made 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 jumps 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 in order 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 replacement.

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

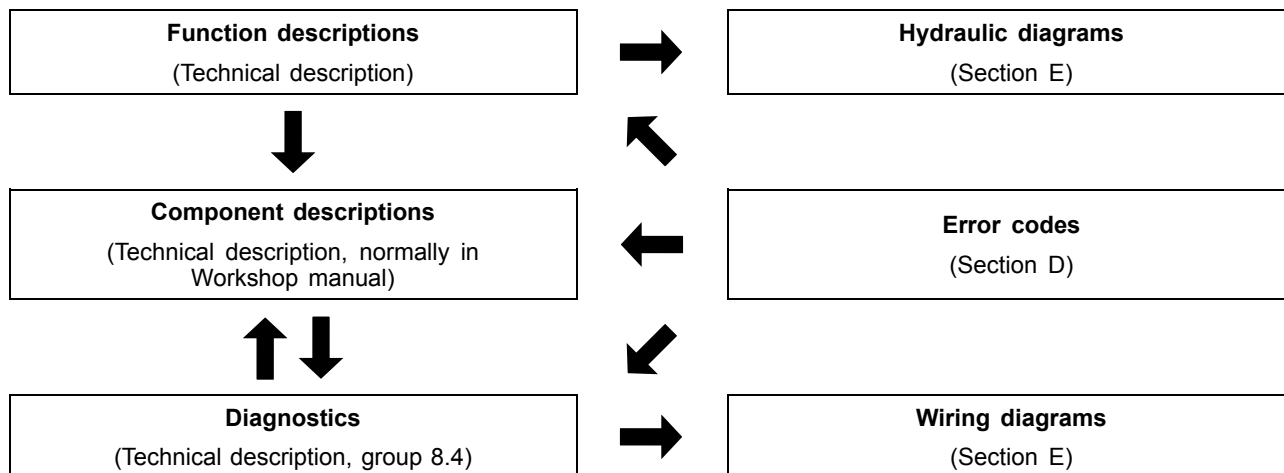
References between sections in the same manual are indicated with section and group number, e.g., "see section 4 *Brakes*, group 4.3.9 *Wheel brake*". References within a section are indicated with a page number, e.g. "see *Sensor fuel level, description page 24*".

References between Maintenance manual and Workshop manual are not given. If more information about a function group is required then the primary recommendation is to search under the same function group in the other manual. For more in-depth information on where different types of information are located and what references are made, see *References between different information types*, page A:7.

References between different information types

The maintenance manual and workshop manual are mainly divided into function groups, see *The workshop manual's contents*, page A:5. Certain parts are broken out as separate parts to increase usability, e.g. "Technical data".

The basic rule of searching for information is to use the function groups to find different types of information regarding the function or component in question. As a complement to this, there are references in accordance with 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 Diagnostics, to enable fast finding of the right diagnostic menu that can be used to check the component (only applies to electrical components).
- From Diagnostics to Wiring diagrams, to enable fast finding of the right circuit diagram for further troubleshooting.
- From Diagnostics 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 Diagnostics, 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 into modules. If a product alternative or optional equipment is fitted, handling may differ from that indicated in the modules depending on what is being described. See below.

Special equipment is not described in the manual. If uncertain as to what equipment is fitted to the machine, use the machine card to determine which information is relevant. See *Machine card*, page A:9.

Product alternative

Product alternative describes options that are fitted instead of a specific piece of standard equipment (e.g. engine alternative).

Equivalent information for different product alternatives is described consecutively in separate segments within the same function group. To indicate that there are different alternatives, "Product alternative" is added to the heading together with a simple description of the alternative, e.g. "(Product alternative Climate control system ECC)". In addition, the alternative that is an option is marked with the symbol for optional equipment.



Symbol for optional equipment

Optional equipment

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Optional equipment refers to options that can be added to standard equipment for more or improved functions.

Information on auxiliary equipment is described in separate segments together with the standard equipment as the basis. The optional equipment description covers how the equipment option affects the standard function and what additional components are involved.

Machine card

NOTE

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

IMPORTANT

Modifications made to the machine must be reported to Cargotec so that the machine card can be updated. A new updated machine card is sent when the customer requests this.

The machine card indicates of which drawings the machine consists. In many cases these can be associated with options and product alternatives. For more information about handling of product alternatives and optional equipment, see *Product alternatives and optional equipment*, page A:8. The machine card is supplied with the spare parts catalogue.

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

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

If the information on the machine card is not of any assistance, contact Cargotec.

NOTE

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

Function descriptions

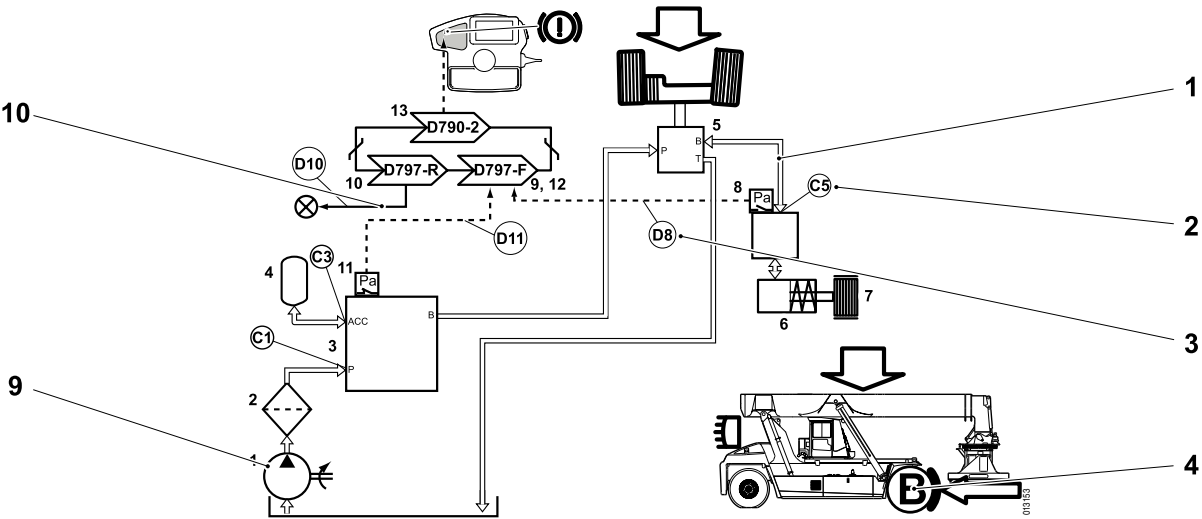
The function descriptions are schematic overviews that describe how a function works as well as which components and signals work together.

The 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.

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

4.3 Servobromssystem

Servobromssystem, funktionsbeskrivning



Pos	Förklaring	Signalbeskrivning	Hänvisning
1	Bromsoljepumpen pumpar olja från bromsoljetanken.	P = 20,5±1,0 MPa	Bromsoljetank, beskrivning, sida 36 Bromsoljepump, beskrivning, sida 6
2	Bromsoljefiltre renar oljan.	-	Bromsoljefiltre, beskrivning, sida 41
3	Akkumulatorladdningsventilen styr olja till laddning av akkumulatorerna eller genom bromssystemets kylkrets.	-	Akkumulatorladdningsventil, beskrivning, sida 10
4	Akkumulatorerna lagrar oljetryck.	Se trycksyft Akkumulatortryck bromssystem, på vänster rambalk.	Akkumulator, beskrivning, sida 13
5	Bromsventilen styr tryck från akkumulatorerna till bromscylinderna proportionellt mot pedaltrycket.	-	Bromsventil, beskrivning, sida 17
6	Bromscylinderna pressar samman lamellerna i bromsenheten.	Se trycksyft Bromstryck, på vänster rambalk.	Hjulbroms, beskrivning, sida 25
7	Hjulbromsarna bromsar maskinen.	-	Hjulbroms, beskrivning, sida 25

Example of function description

1. Hydraulic force (solid double line)

2. Flag measuring outlet (Check point), indicates that there is measuring outlet for checking the pressure signal

3. Flag diagnostic test, indicates that the signal can be checked with diagnostics, see section 8 Control system, group 8.4 Diagnostics

4. Illustration of function, (applied brake)

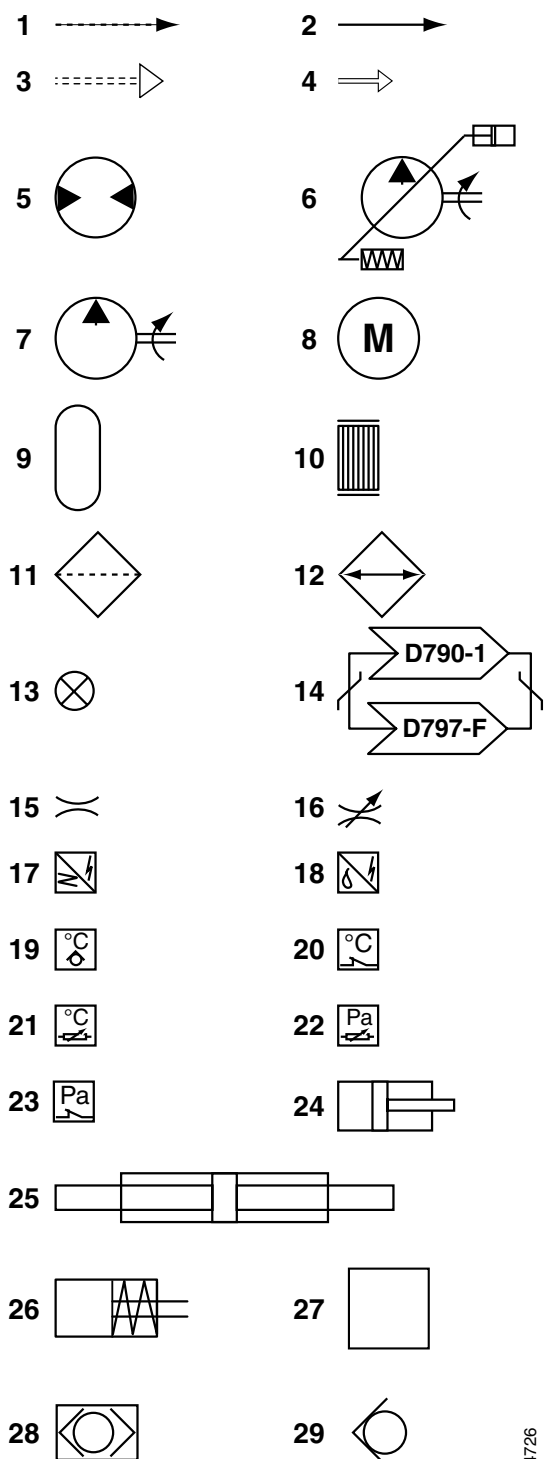
5. Reference to description of component
6. Signal description, reference value for signal out from component

7. Description of the 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 for 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 bypass 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

The documentation's parts

The documentation for the machine consists of the following parts:

Operator's manual

The operator's manual is delivered with the machine in the cab.

Documentation kit

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

Supplementary documentation

There is supplementary documentation that can be ordered for the machine.

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

Ordering documentation

Documentation is ordered from your Cargotec dealer.

Always indicate publication number when ordering.

For publication number, see machine card.

Feedback

Form for copying

Cargotec's 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. Thanks for your help!

To:	Cargotec Sweden AB Technical Documentation Torggatan 3 SE-340 10 Lidhult SWEDEN Fax: +46 372 263 93
From:	Company / Sender: Phone: E-mail: Date: - -
Manual information	Name / Publication number: Section / page number:
Suggestions, views, remarks, etc.	

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B 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 risks of damage to the machine or 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 intended for the work in question
- wear the correct clothing
- use common sense and work carefully. Do not take any risks!

In this publication Cargotec has documented and warned for situations and risks that may occur in connection with the use of, as well as service or repair of, the machine during normal circumstances.

For this reason it is important that all who work with the machine, or repair or service the machine, read and follow the information in the Maintenance Manual and Operator's Manual.

A near accident is a warning!

A near accident is an unanticipated event where no person is injured, nor is there any damage to the machine or property. However, near accidents show that there is an injury/damage risk and that actions must be taken to avoid the risk of injury/damage.

Safety instructions

General

Read and observe the following safety instructions below before starting to work with the machine:

- *Service position*, page B:4
- *Hydraulic and brake systems, depressurising*, page B:5
- *Oils*, page B:6
- *Fuel system*, page B:7
- *Clothing, etc.*, page B:8
- *Several mechanics on the same machine*, page B:8
- *Working under the machine*, page B:8
- *Lifting heavy components*, page B:9
- *Vibration*, page B:9
- *Noise*, page B:10
- *Dissolvent*, page B:10
- *Fire and explosion risk*, page B:11
- *Fluid or gas under pressure*, page B:13
- *Coolant*, page B:13
- *Refrigerant*, page B:14
- *Air pollution*, page B:14
- *Tensioned springs*, page B:15
- *Electric motors*, page B:15
- *Rotating components and tools*, page B:15
- *Tyres and rims*, page B:16
- *Lifting equipment*, page B:17
- *Spare parts*, page B:17
- *Non-ionised radiation*, page B:18

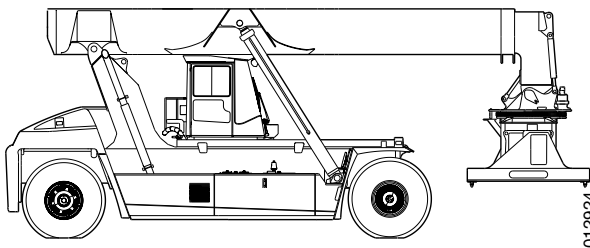
Service position

General

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

Service position entails:

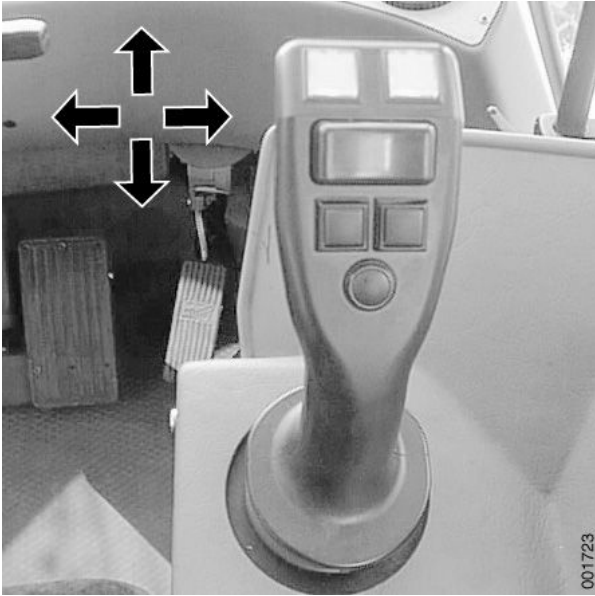
- The machine is parked, i.e. parking brake applied.
- Boom fully retracted and lowered to horizontal position.
- Engine off.
- System voltage switched off (with the battery disconnecter).



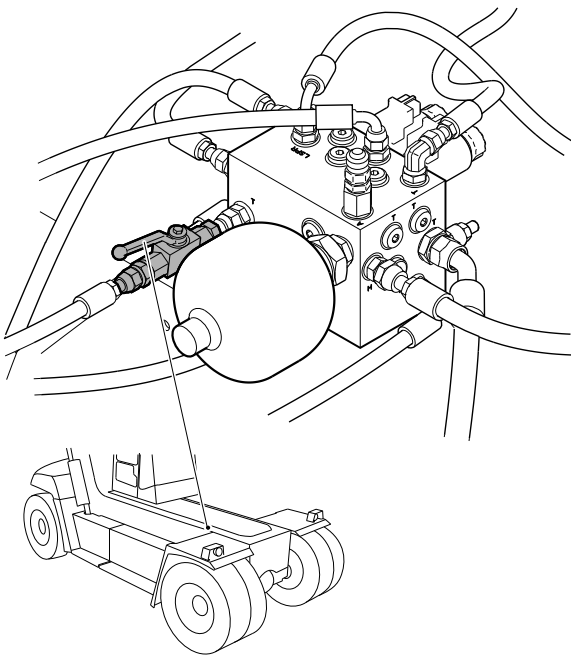
Machine with fully retracted and lowered boom

Hydraulic and brake systems, depressurising

- 1 Machine in service position.
- 2 Depressurise the hydraulic system.
Turn the start key to position I and activate extension out, a loud hissing noise is heard if there is pressure in the hydraulic system. Activate lift, extension and side shift several times.
- 3 Turn the start key to position 0 and switch off the system voltage.



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



The figure above shows open valve.

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CAUTION

Hydraulic oil may be directed the wrong way.

Risk of damage to the fine filter for hydraulic oil.

Check that the relief valve for top lift is closed before starting the engine.

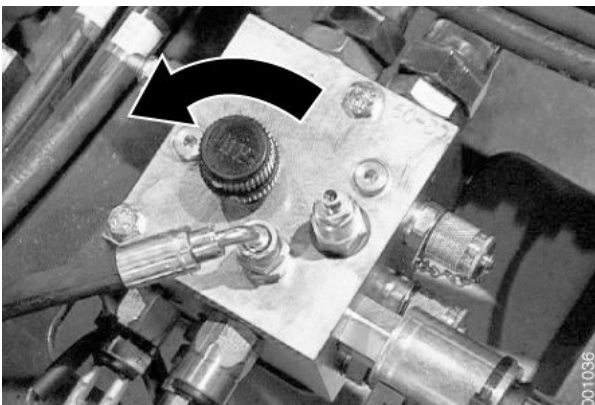
- 5 Depressurise the brake system by opening the drain valve on the accumulator charging valve.

NOTE

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

NOTE

After the work has been finished, close the drain valve and tighten the lock ring.



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Oils

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



WARNING

Hot and pressurised oil.

Always depressurise hydraulic and brake systems completely before starting to work in the systems. The hydraulic and brake systems are pressurised and the oil may cause personal injuries.

Avoid skin contact with the oil, use protective gloves. Hot 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 damage.

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

Always check that plugs are sealed tightly before receptacles are moved.

Handle all oil as environmentally hazardous waste. Oils freely discharged cause environmental damage and can also be a fire hazard. Waste oils/fluids must always be handled by an authorised company.

Fuel system

The following safety instructions must 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 must be avoided when the engine is warm since fuel can spill on hot surfaces and may ignite.

Make sure that open flames, sparks, or red-hot/glowing objects have been extinguished before starting work on or near the fuel system.

Do not smoke near the machine during work on the fuel system.



WARNING

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 injury.

Use protective gloves and protective safety glasses, avoid skin contact with fuel. If a component is being loosened then hold a rag over the connection as protection and collect the fuel. Fuel is corrosive to mucous membranes in e.g. the 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 damage.

IMPORTANT

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

Always check that plugs and connections are sealed tightly before receptacles are moved.

Handle the fuel as environmentally hazardous waste. Fuel freely discharged cause environmental damage and can also be a fire hazard. Fuel must always be handled by a company authorised for this activity.

Clothing, etc.

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

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

Long hair should be adequately gathered since it can easily get caught in moving parts. Exercise caution when working with welding or an naked flame since hair easily catches on fire.

Several mechanics on the same machine



WARNING

If several mechanics are working on the same vehicle, extra care must be taken so that accidental movements do not injure any other person. Communicate so that everyone knows where everyone is, 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 or injury.

Operations controlled from the operator's station, e.g. all movement of lifting equipment, may cause severe personal injury.

Safety precautions

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

Working under the machine

Working under the frame

A raised vehicle may not, for any reason, be supported or raised 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 may fall over or accidentally lower due to malfunctions or incorrect use.

Safety precautions

- 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 may lead to serious personal injury and material damage.

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

Risks

Unsuitable lifting straps, etc. may break or slide.

The centre of gravity of the component may shift while work is in progress, and the component may then make unexpected movements which may cause severe personal injury and material damage.

A component lifted with lifting equipment may start to turn if the centre of gravity shifts.

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

Lifting with lifting device. Use lifting tools or other tools, in particular when there are such tools available adapted 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 often good protection to reduce crushing and cutting injuries to fingers.
- Always use protective shoes.

Vibration

Use of vibrating tools, e.g. impact nut runner or grinder, for an extended period of time may cause injuries as vibration is transmitted from the tool to hands. In particular when fingers are cold.

Safety precautions

- Use heavy gloves that protect against the cold and the transfer of vibrations.
- Switch between work duties to give the body time to rest.
- Vary your work position and grip so that your body is not affected in only one position by the vibration.

Noise

Noise louder than 85 dB (A) that lasts for longer than 8 hours is considered to damage hearing. (Limit values may differ between different countries.) High pitches (high frequencies) do more damage than low pitches with the same sound level. Noise in the form of impulse sounds may also be damaging, e.g. hammer strikes.

Risks

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

Safety precautions

- Use hearing protection. Make sure that it's tested and protects against the right noise level.
- Limit noise with noise-absorbing screens, for example, noise-absorbing materials in roof and on walls.

Dissolvent

Fluids that (as opposed to water) dissolve grease, paint, lacquer, wax, oil, glue, rubber, etc. are called organic solvents. Example: Petroleum spirits, petrol, thinner, alcohols, diesel, xylene, trichloroethylene, toluene. Many solvents are flammable.

Risks

Products with solvents give off fumes that may cause dizziness, headache and nausea. They may also irritate mucous membranes in the throat and bronchi.

If solvent comes in direct contact with the skin it can dry and crack. Increased risk of skin allergies. 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, there may be damage to the central nervous system. This manifests itself in sleeping problems, depression, nervousness, poor memory and general tiredness. Continuous inhalation of petrol 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 a low content of aromatic substances. This reduces the risk of injury.
- Avoid skin contact.
- Use protective gloves.
- Make sure that work clothes are solvent-resistant.

Fire and explosion risk



DANGER

In the event of fire the operator's safety must not be compromised.

If given the opportunity, take the following action at the slightest sign of fire:

- 1. Stop the machine and turn the ignition key to stop position.**
- 2. Leave the cab.**
- 3. Switch off the system voltage with the battery disconnecter.**
- 4. Alert the rescue services.**
- 5. Try to extinguish the fire.**

If this is not possible, leave the machine and the risk area.



DANGER

Smoke can be extremely toxic.

Smoke subdues, suffocates and can kill people! Smoke can cause damage to lungs and respiratory organs even in small quantities.

Avoid breathing fumes, do not stand in the smoke. Use breathing apparatus for fire fighting and work with burnt material.

Examples of fire and explosion prone substances are oils, petrol, diesel fuel oil, organic solvents (paint, plastics, detergents), rust preventive agents, welding gas, gas for heating (acetylene), high concentrations of dust particles consisting of combustible materials. Rubber tyres are flammable and can cause fire with explosive development.

Risks

Examples of the cause of ignition are welding, cutting with gas flame, tobacco smoking, sparks when grinding with grinding machines, contact between hot engine parts and flammable materials, heat generation in rags soaked with oil or paint (linseed oil) and oxygen. Oxygen containers, lines and valves must be kept clean of oil and grease.

Fumes from e.g. fuel are heavier than air and may "run" down a slope, or down into a grease pit, where welding flames, grinding sparks or cigarette embers may cause an explosion. Vaporised fuel has a very powerful explosive effect.

Special cases

Diesel fuel oil with added petrol has a lower flashpoint. Risk of explosion even at room temperature. The explosion risk for heated diesel fuel oil is higher than for petrol.

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

Welding on or in the vicinity of the machine. If diesel or other oils have leaked and soaked rags, Absol/absorbing agents, paper or other porous material then glowing welding sparks can cause ignition and the explosive spread of fire.

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

There is a lot of electronic equipment on today's machines. When welding, the control units must be disconnected and the electric power must be switched off with the battery disconnecter. Powerful welding currents may otherwise short-circuit the electronics, destroy expensive equipment or cause an explosion or fire.

Never weld on painted surfaces (remove paint, by blasting at least 10 cm around the welding or cutting point). Use gloves, breathing protection and protective glasses. Also, welding work must not be done near plastic or rubber materials without first protecting them from the heat. Paints, plastics and rubber develop a number of substances when heated that may be hazardous to health. Exercise caution with machines that have been exposed to intense heat or fire.

Safety precautions



DANGER

Residue from fuel, oils, grease or other flammable materials on the engine or in the engine compartment is a fire hazard.

Fire hazard!

Remove residue of flammable materials in the engine compartment as soon as they are detected. Be extra careful on hot surfaces such as exhaust systems, manifolds or turbochargers. If leakage of oil, fuel or coolant is detected, the reason should be investigated and the fault corrected before starting the engine.

- Make it a habit to make a visual inspection of the engine and engine compartment before starting the engine and after operation, when the engine has been stopped. This helps to quickly detect if anything abnormal has happened or is about to happen. Look particularly closely for oil, fuel or coolant leakage, loose bolts, worn or poorly tensioned drive belts, loose connections, damaged hoses and electrical cables. The inspection only takes a few minutes and can prevent serious faults and costly repairs.
- Store a hazardous substance in an 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/injury in connection with work on:

- Hydraulic systems (e.g., working hydraulics and brake system).
- Fuel system.
- Tyre changing.
- Air conditioning.

Safety precautions

- Use protective goggles and protective gloves.
- Never work in a pressurised system.
- Never adjust a pressure limiting valve to a higher pressure than the manufacturer's recommendations.
- A hydraulic hose that swells, e.g. at a connection, shows evidence that it is about to rupture. Replace it as soon as possible! Check the connections thoroughly.
- Use fluid when checking for leaks.
- Never blow clothes clean with compressed air.
- A discarded pressure accumulator must first be depressurised and then punctured before it is discarded (to avoid risk of explosion). Carefully, drill a hole with 3 mm diameter after depressurising.
- 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 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 is at high pressure when the engine is warm. Hot coolant may jet out and cause scalding in the event of leaks or when the cap on the expansion tank (filling point) is opened.

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

Safety precautions

- Use protective gloves and protective safety glasses if there is a risk of splashing or spraying.
- First open the cap for the filling point slowly, so that the high pressure is released. Exercise caution. Hot steam and coolant may jet 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 in accordance with 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 precautions

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

Air pollution

Air pollutants are the impurities in the air around us and are regarded as hazardous to health. Certain impurities are more prevalent in certain environments.

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

- **Carbon monoxide (fumes)** is contained in exhaust gases. Odourless and therefore particularly dangerous.
- **Nitrogen oxides (nitrous gases)** are present in exhaust fumes.
- **Welding smoke** is particularly hazardous to health when welding on oily surfaces, galvanised or lacquered materials.
- **Oil mist** for example, is formed when applying anti-corrosion agent.
- **Grinding dust and gases** are 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

Sulphuric 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 present in aerosol) when cutting, grinding or welding. May give mucous membrane irritation with asthma-like symptoms as well as impaired lung function. Even brief exposure to high concentrations can give problems with permanent oversensitiveness.

Safety precautions

- Make sure of adequate ventilation with fresh air when welding, battery charging and other work when hazardous gases are formed.
- Use suitable protective gloves and breathing protection when there is a risk of oil mist. Make sure that the protection is oil-resistant.
- Apply oil-resistant protective lotion to unprotected skin.
- Make sure that an eyewash station is in the immediate vicinity when working with corrosive substances.
- Avoid unnecessary operation of the machine in the workshop. Connect extraction equipment to the exhaust pipe so that exhausts are routed out from the workshop.

Tensioned springs

Examples of tensioned springs:

1. Torque springs in, e.g. pedals
2. Thrust 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 amongst other things.

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

Electric motors

Safety precautions

Always switch 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
- Grinding machines

Risks

Rotating components, e.g. fans or shafts, can cause severe injury if touched.

Drills, lathes, grinders or other machines with rotating parts can cause severe accidents if clothing or hair gets caught and becomes wound into 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 jewellery from hands, arms and neck.

Tyres and rims



DANGER

Tyres should be regarded as pressure reservoirs. If handled incorrectly, they constitute fatal danger.

Parts could be thrown out with explosive force and cause severe injuries.

Never repair damaged tyres, wheel rims or lock rings. Tyre changes must be performed by authorised personnel.

Risks

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

Inflating of tyres: Tyres, rims or lock rings may be ejected.

Safety precautions

- Always deflate the tyre before starting to work on the wheel.
- Check that tyres, rims and lock rings are not damaged. Never repair damaged wheel 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 tyre explosion as well as catch the ejected parts.
- Use protective screen and protective safety glasses.

Lifting equipment

When working on the machine in general, and with the machine's lifting equipment in particular, the greatest care must be taken with regards to securing the boom and attachment.

Therefore, always make a habit of having the boom fully lowered and completely retracted when working on the machine.

Risks

If the machine's lifting equipment is not lowered or secured, there is a risk of crushing.

Risk of crushing is particularly great when depressurising the hydraulic system, see *Hydraulic and brake systems, depressurising*, page B:5.

Safety precautions

- If possible, do not start to work before the boom is completely lowered and fully retracted.

Spare parts



WARNING

For safety reasons, the following spare parts may only be replaced with genuine spare parts:

- Brake valve
- Drive axle
- Steering valve (Orbitrol)
- Steering valve incl. priority valve
- Steering axle
- Steering cylinder
- Rim
- Lift cylinder
- Tilt cylinder
- Twistlock
- Control breaker (for hydraulic function)
- Emergency stop
- Accumulator
- Main valve load handling
- Accumulator charging valve
- All control units

Non-ionised radiation



WARNING

Optional equipment such as two-way radio, telephone, etc. may emit non-ionising radiation.

Risk of interference with active or non-active medical products.

Use two-way radio, telephone, etc. when no persons with active or non-active medical products are in the vicinity.

NOTE

When persons with active or non-active medical products are not nearby, telephone and two-way radio may be used in the cab.

Equipment should not be used during operation or load handling as this takes away from the operator's concentration.

Cargotec will not assume any responsibility for installed optional equipment, which is not installed by Cargotec or an installer approved by Cargotec.

Environment

General

The ever-increasing industrialisation of our world is having a significant impact on our global environment. Nature, animals and people are subjected daily to risks in connection with various forms of chemical handling.

There are still no fully environmentally safe chemicals, such as oils and coolants, available on the market. Therefore, all who handle, perform service on or repair machines must use the tools, assisting devices and methods necessary to protect the environment in an environmentally sound manner.

By following the simple rules below, you will contribute to protecting our environment.

Recycling

Conscientious recycling of the machine is the starting point for the life cycle to come full circle, and for being able to recycle and make use of material in new products. According to calculations by Cargotec, the machine is more than 90% recyclable by weight.

Environmentally hazardous waste

Components such as batteries, oils, and various chemicals and other items that may constitute environmentally hazardous waste must be handled and taken care of in an environmentally safe and sound manner.

Discarded batteries contain substances hazardous to personal health and the environment. Therefore, handle batteries in an environmentally safe manner and according to national regulations.

Oils and fluids

Oils freely discharged cause environmental damage and can also be a fire hazard. Therefore, when emptying and draining oils or fuel, take appropriate action to prevent unnecessary spills.

Waste oils and fluids should always be taken care of by an authorised disposal company.

Pay close attention to oil leaks and other fluid leaks! Take immediate action to seal the leaks.

Air conditioning

The refrigerant in the air conditioning for the cab adds to the "greenhouse effect" if released into the open air. Special training is required for all service work on the air conditioning. Many countries also require certification by a governing authority for such work. When scrapping an air conditioning unit, the refrigerant shall be taken care of by a certified company.

Working in a contaminated area

The machine must be equipped for work in contaminated areas (environmentally polluted or health-hazardous area) before work is started. Also, there are special local rules in force for such handling and when servicing such a machine.

Declarations

The machine does not contain asbestos.

The machines contains lead in batteries and in electric cabling. In certain models, there are lead castings as counterweight.

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

C Preventive maintenance

The information is available in the Maintenance Manual

The information is available in the Maintenance Manual.

For information on how to order the Maintenance Manual, see the section *A Foreword*.

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0 Complete machine

Complete machine, description

The Kalmar DRT 450 is a "Reachstacker" for container handling. The machine has a lifting capacity of 45 tonnes.

It is powered by a six-cylinder, four-stroke diesel engine with direct injection.

The transmission is hydro-mechanical with gears constantly in mesh. It has four forward gears and four reverse gears. Engine power is transmitted using a torque converter.

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

The service brakes are wet multiple disc brakes which are attached to the drive wheel hub. The parking brake is the disc brake type and operates on the drive axle input shaft.

Steering operates on the rear wheels with a double acting hydraulic cylinder. The steering axle is suspended in the frame with pendulum suspension.

The wheels are fastened to the hub with clamps. Double wheels are fitted on the drive axle; single wheels on the steering axle.

Load handling comprises components and functions for handling loads. Loads are lifted with an attachment that is fitted on a liftable telescopic boom. Load handling is divided into lifting/lowering, extension, side shift, spreading, rotation, tilt, levelling and load carrier functions.

- Lifting/lowering is the function for lifting and lowering the boom.
- Extension is the function for extending and retracting the boom.
- Side shift is the function for moving the lift attachment laterally in relation to the machine.
- Spreading is the function for adjusting the width between the attachment's lifting points.
- Rotation is the function for rotating the load in relation to the machine.
- Load carriers comprise the function for holding a load securely.

The control system consists of functions for warning the operator of dangerous situations and machine faults. The control system has diagnostic resources that simplify troubleshooting.

The frame carries the machine. The frame houses the engine, transmission, drive axle and steering axle. The sides of the frame house tanks for fuel, hydraulic oil and brake system fluid. The cab is positioned centrally and can be moved longitudinally.

Troubleshooting, general work instructions

When troubleshooting, it is important that the work is structured and logical. The purpose of the troubleshooting described in the maintenance manual is to exclude components as the source of a fault so that the real source can be identified. A suggested structured work method is described below.

When troubleshooting, it is important to understand how the machine functions. Certain faults can be identified directly using function descriptions. Sections 0–12 contain descriptions of the various functions of the machine.

Troubleshooting procedure

- 1 Check that there is battery voltage available.
 - Battery disconnecter, 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 an error code, example*, page 0:5.

The error code lists contain recommended actions for every error code. Error code lists are available in section *D Error codes*.
- 5 If there is no error code or the problem persists, use the function description for the function affected in section 0–12.

The function description contains information on which components are involved in the function and how these components work together. In some cases, there is information on what conditions are required in order for it to be possible to activate the function. Measurement points are marked with flags (C for measuring outlet, D for diagnostic menu).

Troubleshooting without an error code, example

- 1 Choose suitable section 0–12 to locate the function and subfunction that have caused the symptom.
- 2 Read the 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 affected in order to locate where in the function chain that the signal or reaction is incorrect.
- 4 The fault is probably between the two units where the signal is incorrect. Start by checking the component that should be sending the signal.
- 5 If the component that is to send the signal seems to be intact, check the transmission of the signal (electric cables or hydraulic hoses).

For electric cables, see *Troubleshooting cable harnesses*, page 0:7.

For hydraulic hoses, see *Troubleshooting hydraulic hoses*, page 0:8.
- 6 If the cables or hoses between the components seem to be intact, then check the component that receives the signal.

Troubleshooting with an error code, example

Error codes are 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 is important to not draw conclusions too hastily based on an error code.

- 1 Read out error codes 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.

The error code lists are available in section *D Error codes*.

For detailed instructions for reading out error code, see section *D Error codes*.

Table Example of error code information in error code list

Cod-e	Description	Limitation	Action	Con-nec-tions and compo-nents	Diagnostic menu	Function group
34	Signal error from parking brake switch, indicates released and applied at same time or nothing at all.	Parking brake cannot be released.	Check cabling between the control unit and the component with diagnostic menu. Check component.	D791-1/K8:5 - S107, K8:13 - S107	HYD, menu 5	4.1.2 Parking brake control

- 3 Follow the instructions in the 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 *Schematics*.
- 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 faults 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 specified in the section C *Preventive maintenance*). Sometimes valves can be activated mechanically in order to determine if the malfunction is electric or hydraulic.
- 7 If the component's measurement values are correct, continue by troubleshooting electric cables and hydraulic hoses.
For electric cables, see *Troubleshooting cable harnesses*, page 0:7.
For hydraulic hoses, see *Troubleshooting hydraulic hoses*, page 0:8.
- 8 If the wiring is not defective, then connect the cable to the control unit.

NOTE

The system voltage must be switched off with the battery disconnecter!

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

Troubleshooting cable harnesses

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 system voltage with the battery disconnecter.
- 3 Unplug the connector at the control unit or component in question.



CAUTION

Wipe and re-grease the connectors.

Risk of corrosion on contact surfaces.

Clean all connectors loosened during troubleshooting using electronic cleaner 923836.0826 and re-grease them with connector grease 923836.0552.

- 4 Check if there is an 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 to 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 a short circuit to the frame:
 - a. Unplug the connector at both the control unit and the component in question.
 - b. Measure the resistance in one cable at a time. Measure between the cable and a frame-connected part of the machine.
 - c. The multimeter should show infinite resistance.

Troubleshooting hydraulic hoses



WARNING

Hot and pressurised oil.

Always depressurise hydraulic and brake systems completely before starting to work in the systems. The hydraulic and brake systems are pressurised and the oil may cause personal injuries.

Avoid skin contact with the oil, use protective gloves. Hot 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.



WARNING

Oil under high pressure!

Personal injury!

Always depressurise hydraulic and brake systems completely before starting to work in the systems.

- 1 Depressurise the hydraulic and brake systems, see section *B Safety*.
- 2 Study the hydraulic diagram in question, check between which components the suspect hose is connected and if, and if so 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.

Replace damaged hoses. When removing a hydraulic hose, O-ring replacement is always recommended on the hoses that have them fitted (ORFS).

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1 Engine

Engine, general

Engine alternative

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

- Yuchai YC6M360-30 (stage III in accordance with directive 2006/42EC)
- Cummins QSM11 (stage III in accordance with directive 97/68/EC)

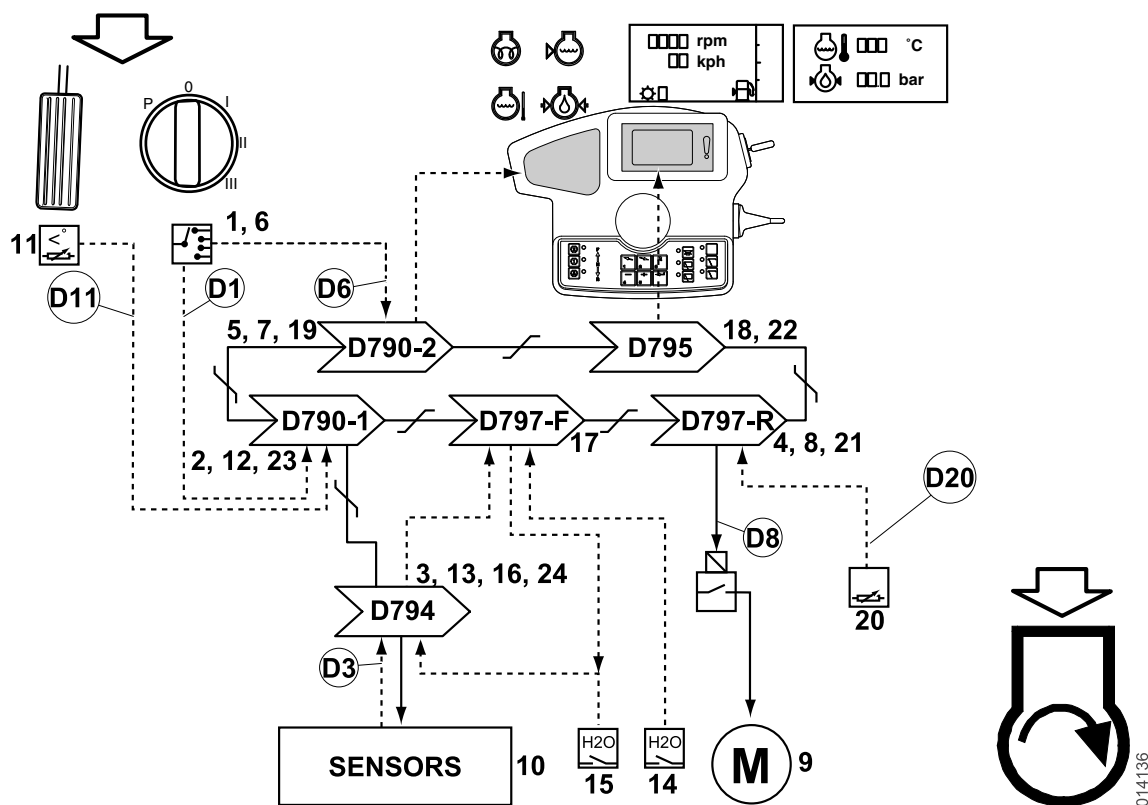
If there are differences between engine alternatives, this is written in brackets after headings or under figures in order to clarify what is being shown.

Component 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 the relevant supplier documentation.

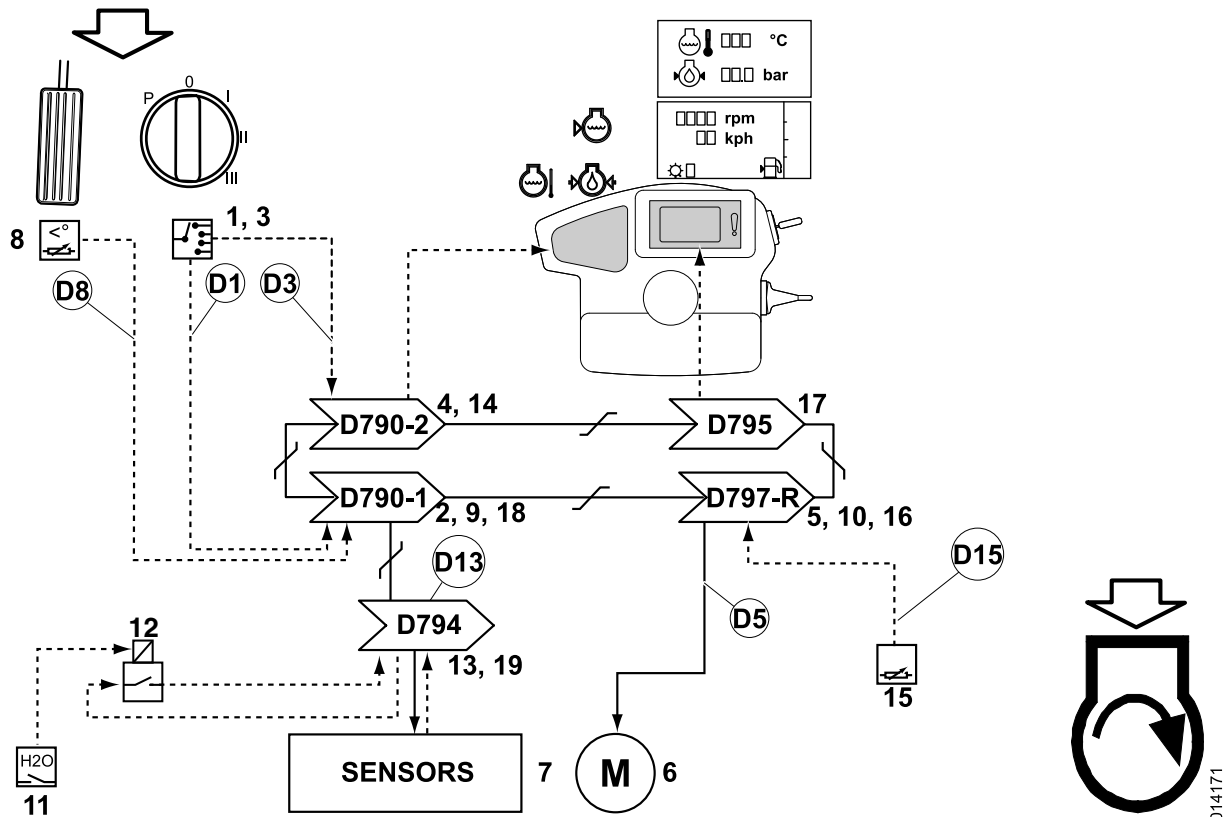
References to supplier documentation are only provided in exceptional cases. If information about a component is not found, the component supplier documentation should be used.

Engine alternative Yuchai YC6M360-30, function description



Pos	Explanation	Signal description	Reference
1	The ignition key lock sends a voltage signal to Control unit, cab (D790-1) when the ignition key is turned to position 1.	U = 24 V	<i>Ignition key lock, description, page 1:19</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 on via the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
3	When required, the Control unit, engine (D794) activates the preheating coil. Status signal is also sent to Control unit, frame rear (D797-R).	U = 24 V	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, rear</i> D3: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.5 <i>ENGINE</i> menu 5
4	Control unit, frame rear (D797-R) sends preheating active on the CAN bus.	Checked by control system, error shown with error code.	D3: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.5 <i>ENGINE</i> menu 5
5	Control unit KIT (D790-2) activates indicator light, preheating.	-	Section 11 <i>Common electrics</i> , group 11.5.3.11 <i>Control unit, KIT</i>
6	The ignition key lock sends a voltage signal to Control unit KIT (D790-2) when the ignition key is turned to start position.	U = 24 V	<i>Ignition key lock, description, page 1:19</i> D6: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.4 <i>ENGINE</i> menu 4
7	Control unit KIT (D790-2) sends a start signal on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.11 <i>Control unit, KIT</i>
8	Control unit, frame rear (D797-R) supplies voltage to Relay, starter motor (K360) on the starter motor.	U = 24 V	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame rear (D797-R)</i> D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.5 <i>ENGINE</i> menu 5
9	The starter motor cranks the engine.	-	<i>Starter motor, description, page 1:31</i> D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.5 <i>ENGINE</i> menu 5
10	The engine's sensor sends signals to Control unit, engine (D794) that controls the injectors so the engine starts.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.10 <i>Control unit, engine</i>
11	The accelerator pedal sends a voltage signal proportional 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 is used to detect faults in cable harnesses and controls.	Section 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instruments</i> D11: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.1 <i>ENGINE</i> menu 1
12	Control unit, cab (D790-1) sends a message with the rpm request on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
13	Control unit, engine (D794) increases the engine speed.	-	Section 11 <i>Common electrics</i> , group 11.5.3.10 <i>Control unit, engine</i>
14	Make-contact (closing switch) coolant level sends a voltage signal to Control unit, frame front (D797-F) if the coolant level is low in the expansion tank.	Low level: U = 24 V	<i>Cooling system, description, page 1:23</i>
15	Make-contact (closing switch) water in fuel (B760) sends a ground signal to Control unit, engine (D794) if there is too much water in the fuel prefilter. Control unit, frame front (D797-F) is used to supply voltage for the signal.	Water in fuel: U = 0 V	<i>Make-contact (closing switch) water in fuel, description (engine alternative Yuchai YC6M360-30), page 1:20</i>

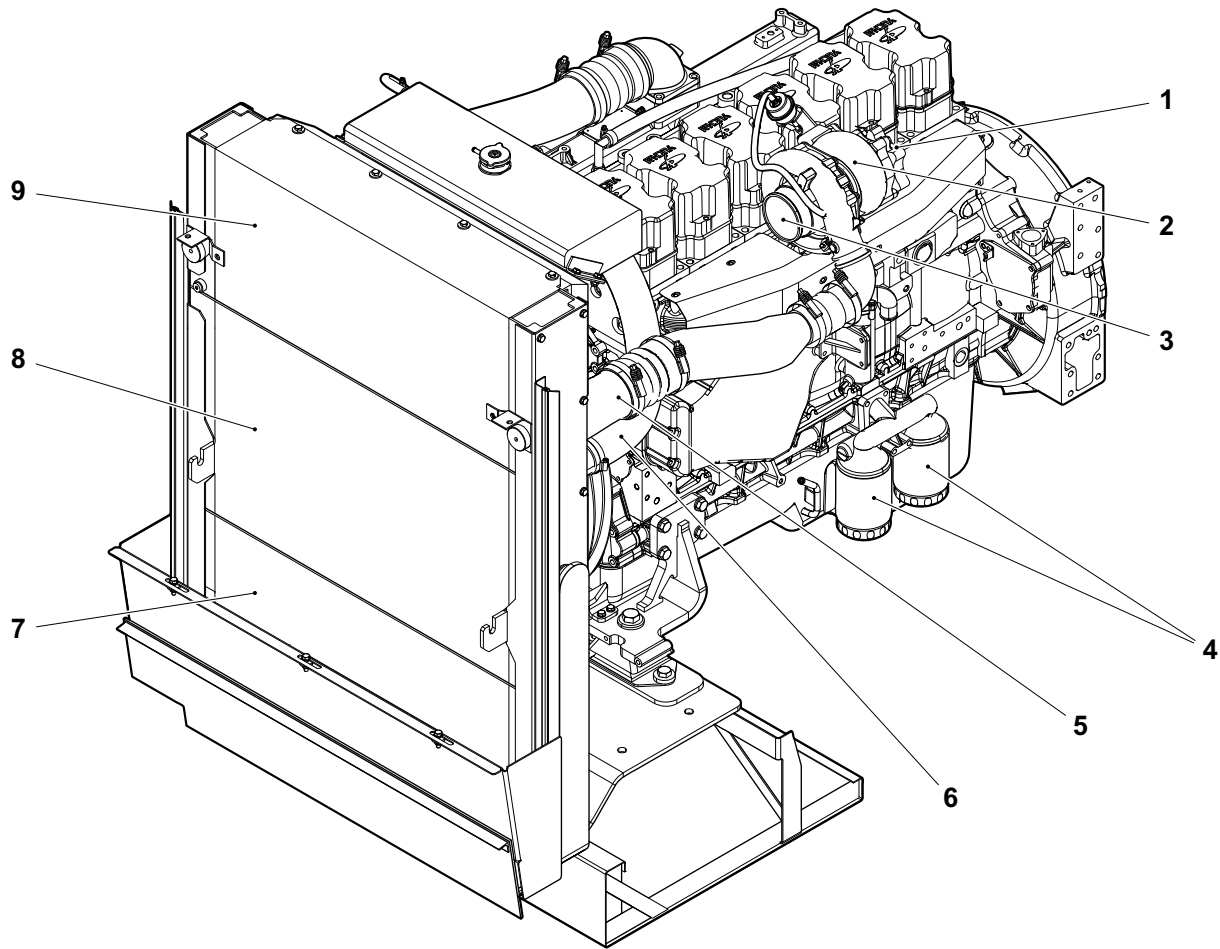
Pos	Explanation	Signal description	Reference
16	Control unit, engine (D794) sends engine data and warning messages on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.10 <i>Control unit, engine</i> D14: Diagnostic menu, see section 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
17	Control unit, frame front (D797-F) sends lamp information on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame front</i>
18	Control unit KID (D795) shows engine data via display figures.	-	Section 11 <i>Common electrics</i> , group 11.5.3.12 <i>Control unit, KID</i>
19	Control unit KIT (D790-2) activates warning lamps when necessary.	-	Section 11 <i>Common electrics</i> , group 11.5.3.11 <i>Control unit, KIT</i>
20	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 is used to detect faults in cable harnesses and controls.	<i>Sensor, fuel level, description</i> , page 1:20 D20: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.3.7 <i>CAB</i> , menu 7
21	Control unit, frame rear (D797-R) sends fuel level on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame rear</i>
22	Control unit KID (D795) shows the fuel level in the operating menu for the engine.	-	Section 11 <i>Common electrics</i> , group 11.5.3.12 <i>Control unit, KID</i>
23	If the rotation speed of the output shaft is so high that it corresponds with the limit for the machine's speed limitation then Control unit, cab (D790-1) sends reduce engine speed on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
24	Control unit, engine (D794) limits the engine speed.	-	Section 11 <i>Common electrics</i> , group 11.5.3.10 <i>Control unit, engine</i>



Pos	Explanation	Signal description	Reference
1	The ignition key lock sends a voltage signal to Control unit, cab (D790-1), when the ignition key is turned to position 1.	U = 24 V	<i>Ignition key lock, description</i> , page 1:19 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 on as a start message on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
3	The ignition key lock sends a voltage signal to Control unit KIT (D790-2), when the ignition key is turned to start position.	U = 24 V	<i>Ignition key lock, description</i> , page 1:19 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 a start signal on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, KIT</i>
5	Control unit, frame rear (D797-R) supplies voltage to the starter motor.	U = 24 V	<i>Starter motor, description</i> , page 1:31 D5: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.5 <i>ENGINE</i> menu 5
6	The starter motor cranks the engine.	-	<i>Starter motor, description</i> , page 1:31
7	The engine's sensor sends signals to Control unit, engine (D794) that controls the injectors so the engine starts.	-	Section 11 <i>Common electrics</i> , group 11.5.3.10 <i>Control unit, engine</i>

Pos	Explanation	Signal description	Reference
8	The accelerator pedal sends a voltage signal proportional 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 is used to detect faults in cable harnesses and controls.	Section 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instruments</i> D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.1 <i>ENGINE menu 1</i>
9	Control unit, cab (D790-1) sends a message with the rpm request on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
10	Control unit, engine (D794) controls the engine speed.	-	Section 11 <i>Common electrics</i> , group 11.5.3.10 <i>Control unit, engine</i>
11	Make-contact (closing switch) coolant level grounds the control terminal of Relay coolant level (K322) if the coolant level is low in the expansion tank.	Low coolant level: U _{K322:85} = 0 V	<i>Cooling system, description</i> , page 1:23
12	Relay coolant level (K322) opens the circuit to Control unit, engine (D794) if the coolant level is low in the expansion tank.	-	<i>Cooling system, description</i> , page 1:23
13	Control unit, engine (D794) sends engine data and warning messages on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.10 <i>Control unit, engine</i> D13: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.6 <i>ENGINE, menu 6</i> and 8.4.6.7 <i>ENGINE, menu 7</i>
14	Control unit KID (D795) shows engine data via display figures.	-	Section 11 <i>Common electrics</i> , group 11.5.3.12 <i>Control unit, KID</i>
15	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 is used to detect faults in cable harnesses and controls.	<i>Sensor, fuel level, description</i> , page 1:20 D15: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.3.7 <i>CAB, menu 7</i>
16	Control unit, frame rear (D797-R) sends fuel level on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.3 <i>Control unit, frame rear</i>
17	Control unit KID (D795) shows the fuel level in the operating menu for the engine.	-	Section 11 <i>Common electrics</i> , group 11.5.3.12 <i>Control unit, KID</i>
18	If the speed is at the limit for the machine's speed limitation, Control unit, cab (D790-1) transmits an engine speed reduction request on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
19	Control unit, engine (D794) limits the engine speed.	-	Section 11 <i>Common electrics</i> , group 11.5.3.10 <i>Control unit, engine</i>

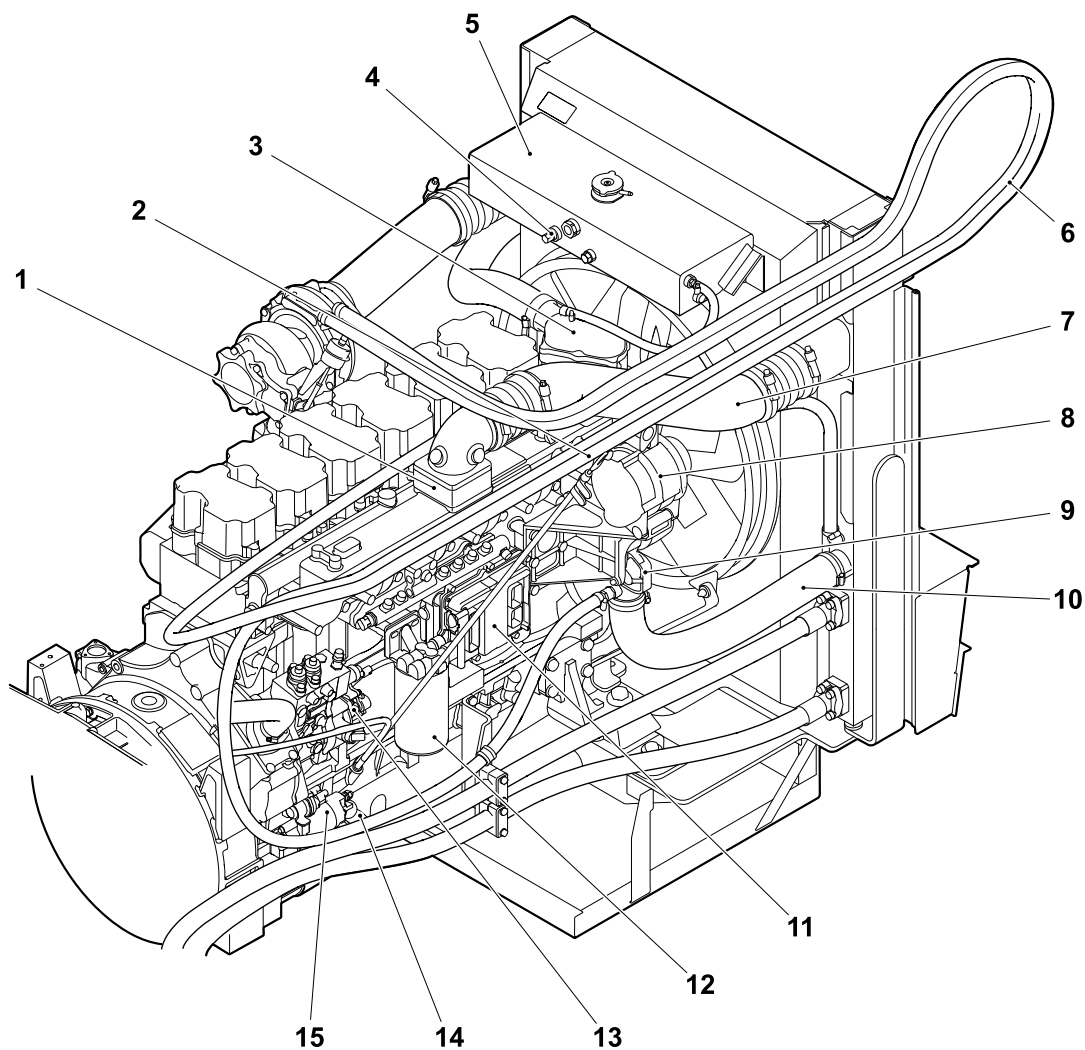
Engine alternative Yuchai YC6M360-30, component location



Engine right-hand side (in the machine's direction of travel)

- | | |
|------------------------------|----------------------------|
| 1. Connection exhaust system | 6. Connection radiator |
| 2. Turbocharger | 7. Transmission oil cooler |
| 3. Air cleaner connection | 8. Radiator |
| 4. Oil filter | 9. Intercooler |
| 5. Connection intercooler | |

013904

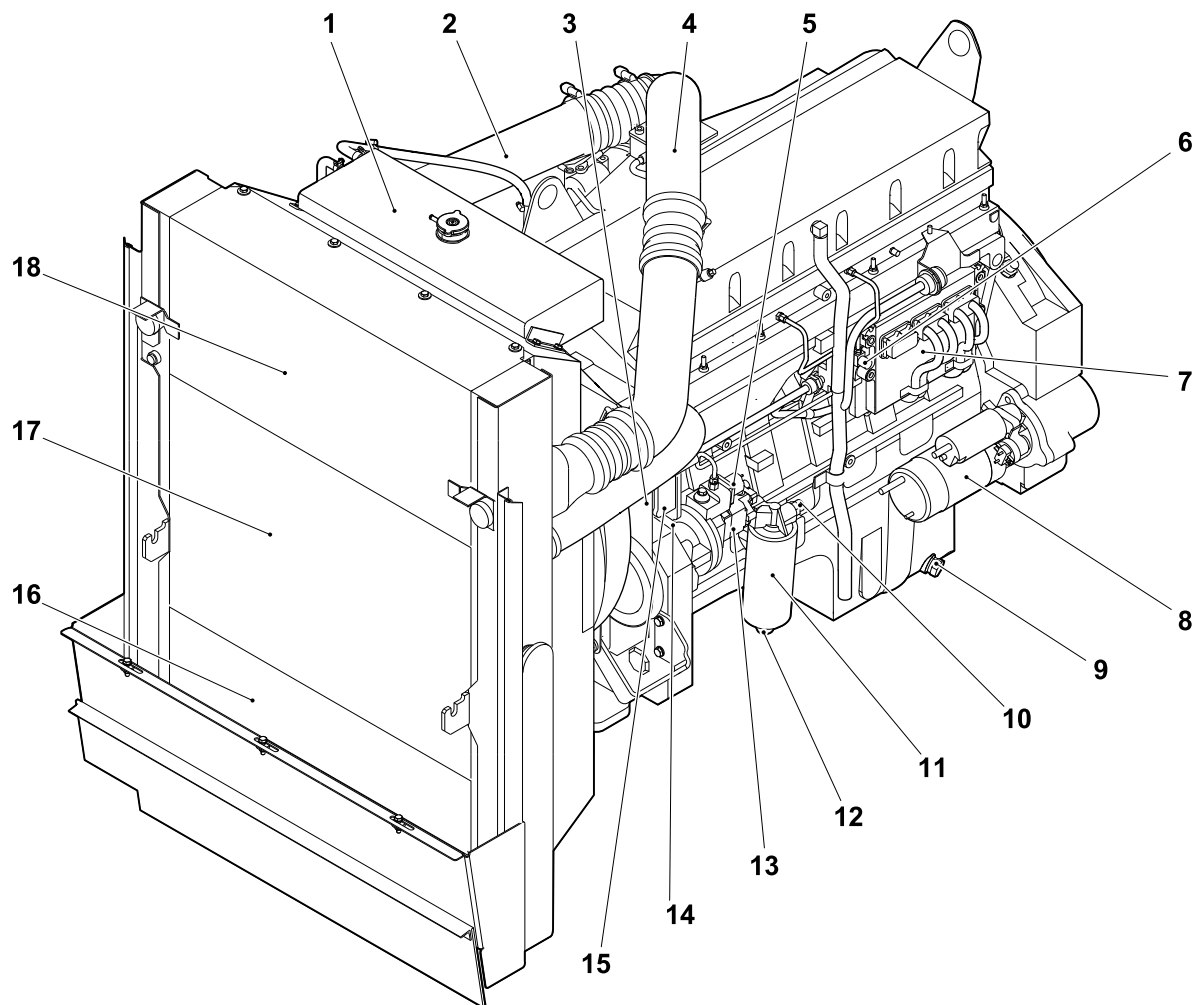


Engine left-hand side (in the machine's direction of travel)

- | | |
|--|---------------------------------|
| 1. Preheating coil (E8000) | 8. Alternator |
| 2. Relay, preheating (K312) | 9. Coolant pump |
| 3. Thermostat housing | 10. Connection Radiator outlet |
| 4. Make-contact (closing switch), low coolant level (B759) | 11. Control unit, engine (D794) |
| 5. Expansion tank | 12. Fuel filter |
| 6. Connection cab heating | 13. Fuel pump |
| 7. Connection intercooler | 14. Starter motor (M654) |
| | 15. Relay, starter motor (K360) |

013905

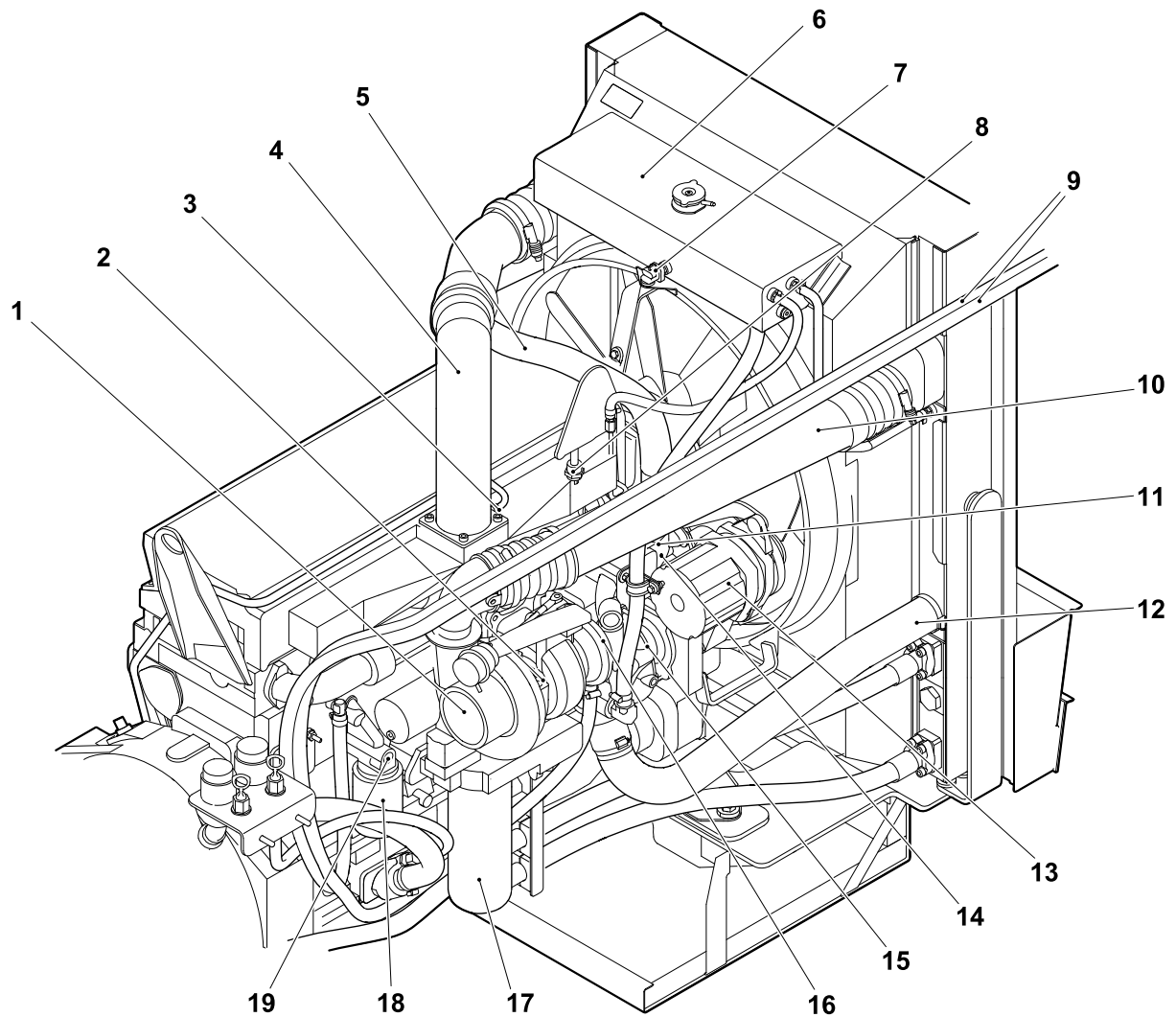
Engine alternative Cummins QSM11, component location



014167

Engine alternative Cummins, right-hand side (in the machine's direction of travel)

- | | |
|---|---|
| 1. Expansion tank | 10. Fuel pressure sensor |
| 2. Connection intercooler (intake) | 11. Fuel filter |
| 3. Location for air conditioning compressor | 12. Drain condensate fuel filter and water in fuel sensor |
| 4. Connection intercooler (outlet) | 13. Fuel pump |
| 5. Fuel connection (intake) | 14. Sensor oil pressure and oil temperature |
| 6. Fuel connection (outlet) | 15. Sensor crankshaft position |
| 7. Control unit, engine (D794) | 16. Transmission oil cooler |
| 8. Starter motor | 17. Water cooler |
| 9. Drain plug engine oil | 18. Intercooler |

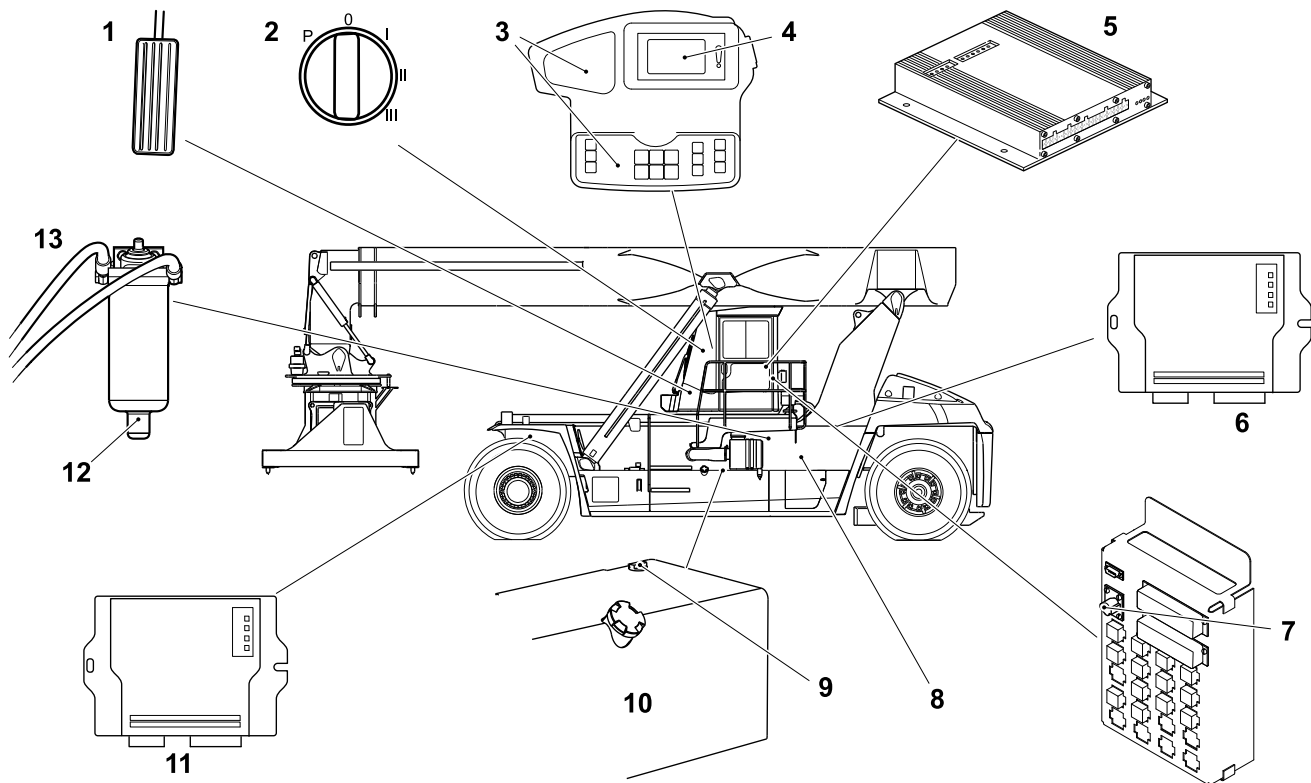


Engine alternative Cummins, left-hand side (in the machine's direction of travel)

- | | |
|--|-------------------------------------|
| 1. Air cleaner connection | 10. Connection intercooler (intake) |
| 2. Turbocharger | 11. Thermostat housing |
| 3. Sensor intake temperature | 12. Intake intercooler |
| 4. Connection intercooler (outlet) | 13. Alternator |
| 5. Connection radiator (outlet) | 14. Sensor coolant temperature |
| 6. Expansion tank | 15. Coolant pump |
| 7. Make-contact (closing switch), low coolant level (B759) | 16. Connection exhaust system |
| 8. Sensor boost pressure | 17. Oil filter |
| 9. Connection cab heating | 18. Coolant filter |
| | 19. Shut-off cock coolant |

014166

Components on the machine, component location



014137

- | | |
|--------------------------------------|---|
| 1. Accelerator pedal (B690) | 8. Diagnostic socket engine (X281) (engine alternative Yuchai YC6M360-30) |
| 2. Ignition key lock (S150) | 9. Sensor fuel level (B757) |
| 3. Control unit KIT (D790-2) | 10. Fuel tank |
| 4. Control unit, KID (D795) | 11. Control unit, frame front (D797-F) |
| 5. Control unit, cab (D790-1) | 12. Sensor water in fuel (B760) (engine alternative Yuchai YC6M360-30) |
| 6. Control unit, frame rear (D797-R) | 13. Fuel prefilter (engine alternative Yuchai YC6M360-30) |
| 7. Diagnostic socket drive-train | |

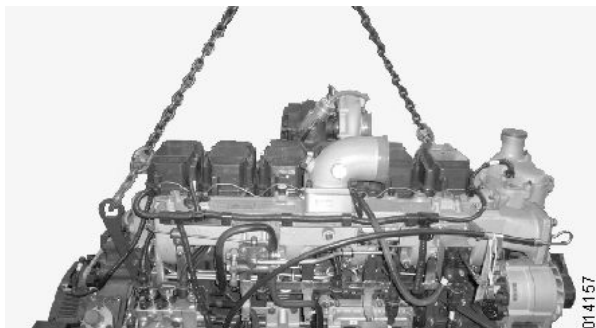
Engine and transmission, separation (engine alternative Yuchai YC6M360-30)

Separation

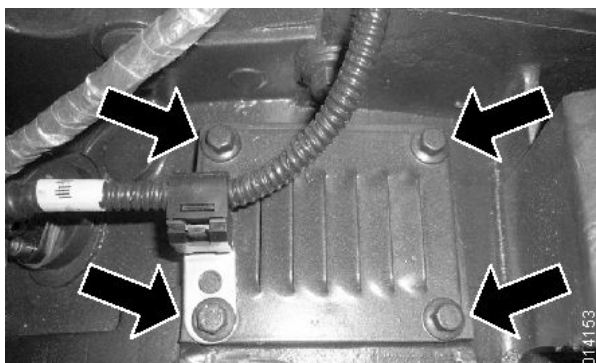
- 1 Machine in service position, see section *B Safety*.
- 2 Attach hoisting equipment to the engine.
- 3 Disconnect the requisite hoses and cables before separating engine and transmission.

NOTE

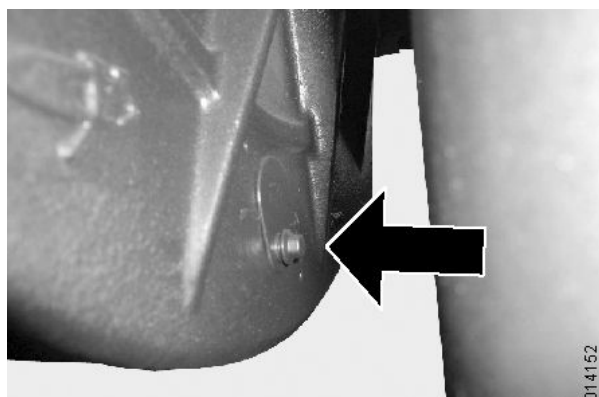
Drain and collect liquids before detaching hoses.



- 4 Use a jack to secure the transmission.



- 5 Remove the cover washer on the clutch housing so that the flex plate's attaching bolts are accessible.



- 6 Remove the cover washer.
- 7 Rotate the engine so that the bolts in the flex plate can be removed.
- 8 Remove the screws for the flex plate.
The flex plate has eight attachment points to be connected with the flywheel on the engine.
- 9 Take up the slack in the hoisting equipment.

NOTE

Do not lift the engine.

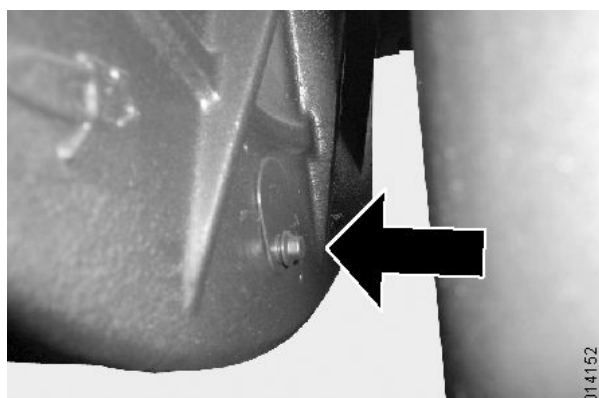
- 10 Remove the bolts between engine and transmission.
- 11 Loosen the engine and transmission brackets.
- 12 Withdraw the engine rearwards to separate it from the transmission.

Assembly

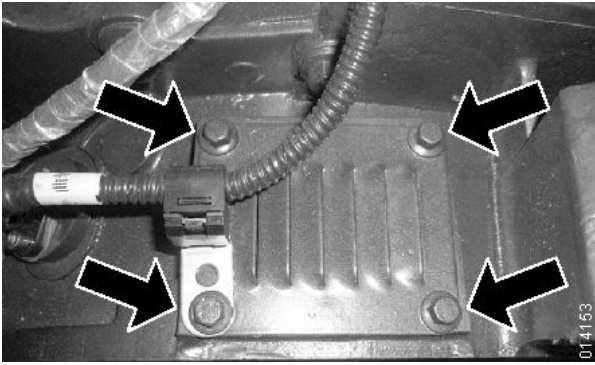
- 13 Rotate the engine so that the holes in the flywheel are just in front of the attachment points on the flex plate.
The flex plate has eight attachment points to be connected with the flywheel on the engine.
- 14 Fit the bolts to the engine mounts and transmission brackets.
Tighten to a torque of:
Engine mount, **330 Nm**.
Transmission bracket, **280 Nm**.
- 15 Connect the engine to the transmission.
- 16 Fit the bolts between engine and transmission.
Tighten to a torque of:
M12: 100–120 Nm.
M14: 140–160 Nm.
- 17 Fit the flex plate's attaching bolts. Tighten to a torque of **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.



- 18 Fit the cover plate in front of the flywheel.



- 19 Fit the cover plate on the clutch housing.
- 20 Remove the hoisting equipment from the engine.
- 21 Remove the jack from underneath the transmission.
- 22 Connect the requisite hoses and cables for the engine and transmission. Check and fill fluids as required.

Engine and transmission, separation (engine alternative Cummins QSM11)



Separation

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

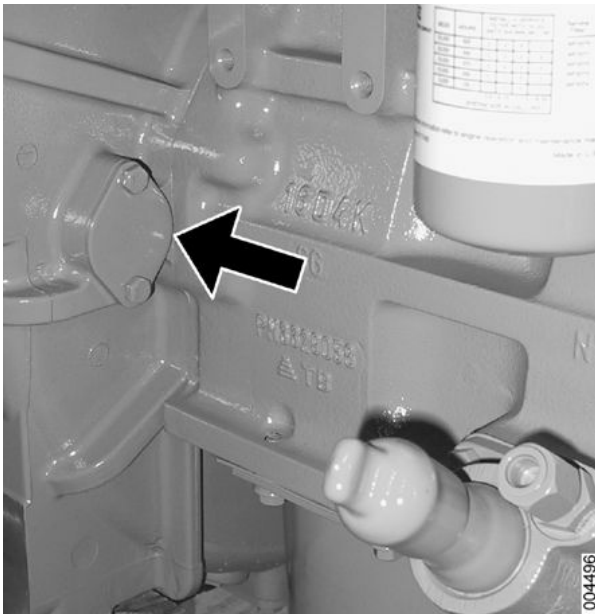
NOTE

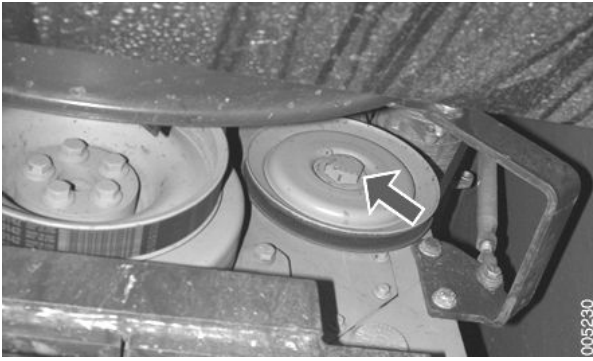
Drain and collect liquids before detaching hoses.

- 4 Use a jack to secure the transmission.



- 5 Remove the cover washer.

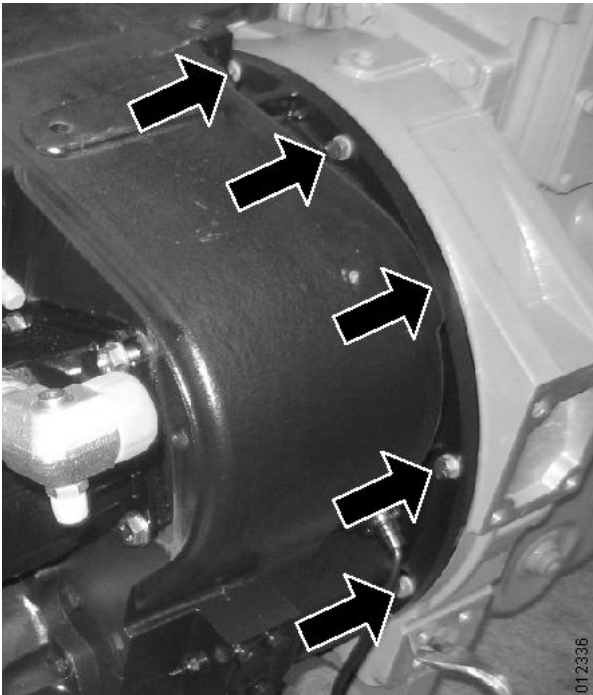




- 6 Rotate the engine for each bolt in the flex plate that has to be removed.
- 7 Remove the screws for the flex plate through the hole under the cover washer.
- 8 Take up the slack in the hoisting equipment.

NOTE

Do not lift the engine.

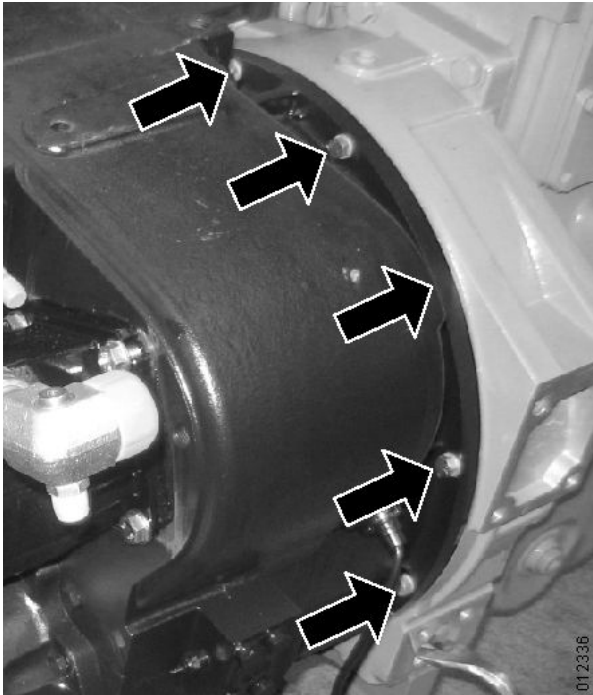


- 9 Remove the bolts between engine and transmission.
- 10 Loosen the engine and transmission brackets.
- 11 Withdraw the engine rearwards to separate it from the transmission.



Assembly

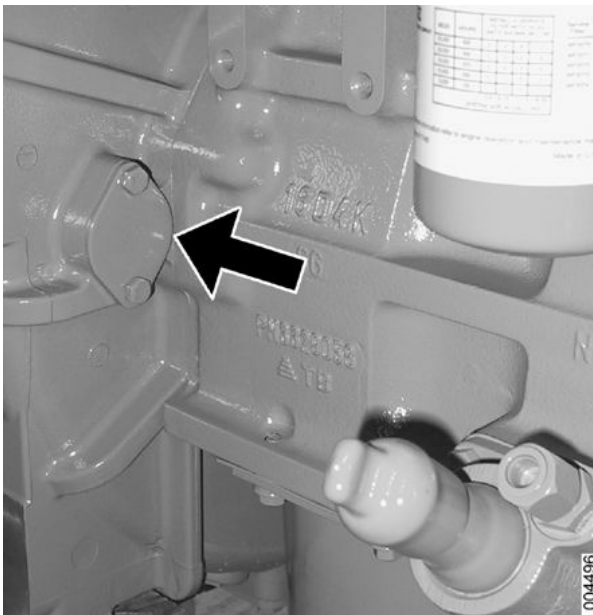
- 12 Rotate the engine so that the holes in the flywheel are just in front of the attachment points on the flex plate.
The flex plate has eight attachment points to be connected with the flywheel on the engine.



- 13 Fit the bolts to the engine mounts and transmission brackets. Tighten to a torque of **168 Nm**.
- 14 Connect the engine to the transmission.
- 15 Fit the bolts between engine and transmission. Tighten to a torque of **52 Nm**.
- 16 Fit the flex plate's attaching bolts. Tighten to a torque of **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.

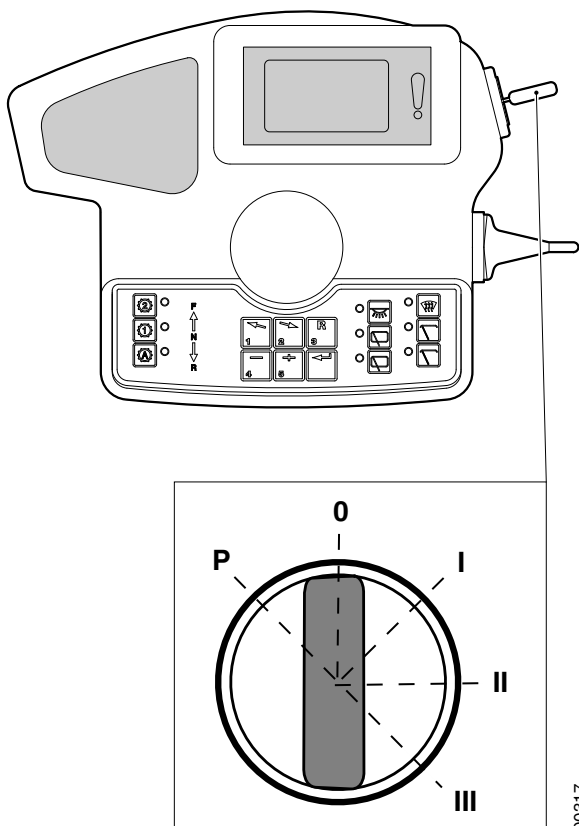


- 17 Fit the cover washer in front of the flywheel.
- 18 Remove the hoisting equipment from the engine.
- 19 Remove the jack from underneath the transmission.
- 20 Connect the requisite hoses and cables for the engine and transmission. Check and fill fluids as required.

1.1 Controls and instruments

1.1.1 Ignition

Ignition key lock, description



- P No function.
- 0 Stop position. Everything switched off, the key can be removed.
- I Operating position.
Voltage to all electrical functions. The control units for engine and transmission are now ready to be started.
The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.1.4 *CAN/POWER*, menu 4.
- II Preheating position.
The preheating is controlled automatically by Control unit, engine (D794).
- III Start position.
Engagement of starter motor for engine start.

NOTE

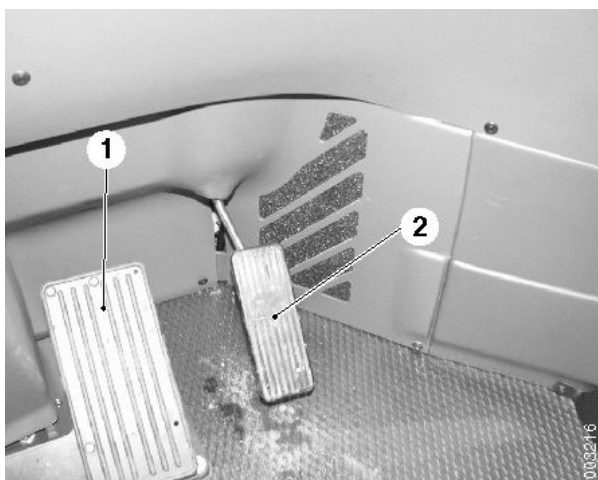
The machine is equipped with an electric restart interlock, which prevents engagement of the starter motor when the engine is rotating.

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

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.6.4 *ENGINE*, menu 4.

1.1.2 Accelerator

Accelerator pedal, replacement



- 1. Brake pedal
- 2. Accelerator

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

Accelerator pedal, calibration

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

1.2 Fuel system

Fuel system, description

The fuel system distributes fuel between the cylinders and thereby controls the engine output power and rpm.

When the engine is started, the fuel pump draws fuel from the tank through the fuel filter and forces it to the unit injectors. The unit injectors spray in the fuel and atomises the fuel to the engine's combustion chamber.

1.2.1 Fuel tank

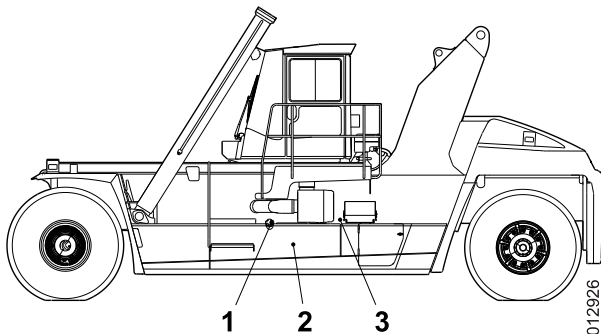
Fuel tank, description

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

1.2.2 Sensor fuel level

Sensor, fuel level, description

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.3.7 *CAB, menu 7*.



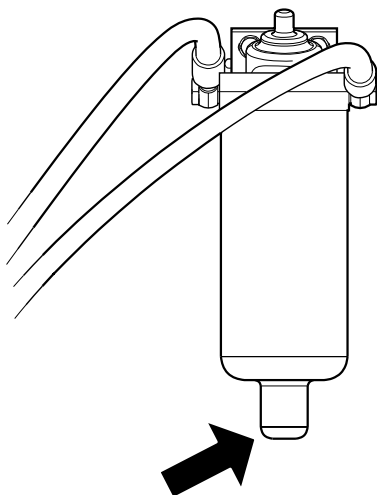
1. Filling point fuel
2. Fuel tank
3. Fuel level sensor (behind air filter)

1.2.5 Make-contact (closing switch) water in fuel

Make-contact (closing switch) water in fuel, description (engine alternative Yuchai YC6M360-30)

Make-contact (closing switch) water in fuel (B760) is fitted in the bottom of the fuel prefilter and closes when it is time to drain the fuel prefilter of water.

Make-contact (closing switch) water in fuel (B760) sends a ground signal to Control unit, Engine (D794) when the filter should be drained. The contact voltage is fed in parallel on the signal line of Control unit (D797-F) across a resistor (a so-called "pull up" voltage).

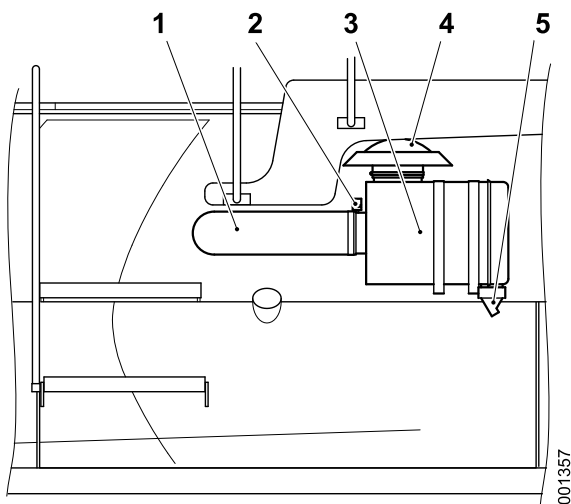


1.6 Air intake and exhaust outlet

1.6.1 Air cleaning system

Air cleaning system, description

Combustion in the engine requires air. Free unobstructed flow for fresh air and exhaust gases is essential for efficient engine operation.



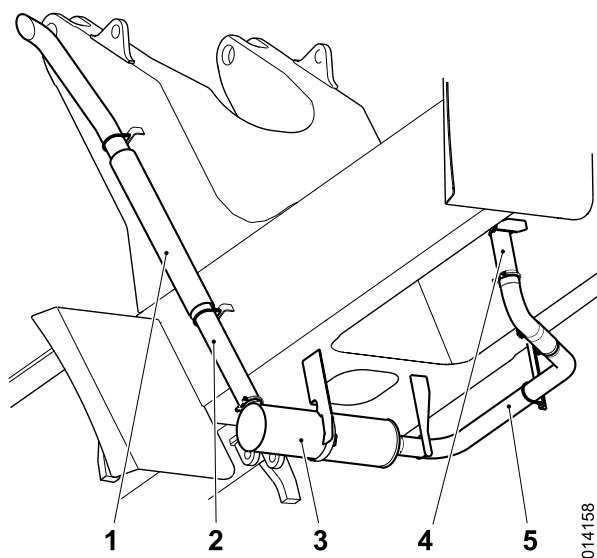
Air cleaning system, overview

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

1.6.3 Exhaust system

Exhaust system, description

The exhaust system is mounted in the chassis. Heat protection is fitted between the engine and exhaust system to protect cables, etc. A flex pipe between the turbo and silencer takes up engine movement. On the outside of the machine, there is heat protection fitted over the exhaust system.



1. Heat protection
2. End pipe
3. Silencer
4. Flex pipe
5. Exhaust pipe



WARNING

Hot exhaust system!

Risk of burn injuries!

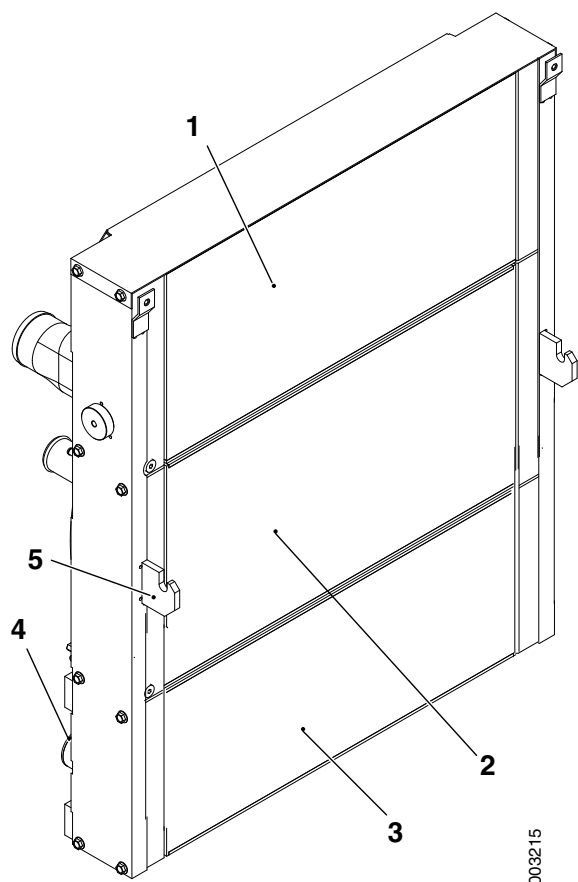
Never touch the turbo or silencer when the machine is running or just after it has been turned off!

1.6.4 Intercooler

Intercooler, description

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

See also *Cooling system, description*, page 1:23.



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

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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

Engine cooling work as follows:

1. Coolant is circulated through the cylinder head, engine block and oil cooler by the 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 the thermostat directs it back through the engine.
When the coolant is warmer than the thermostat opening temperature the thermostat directs it 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

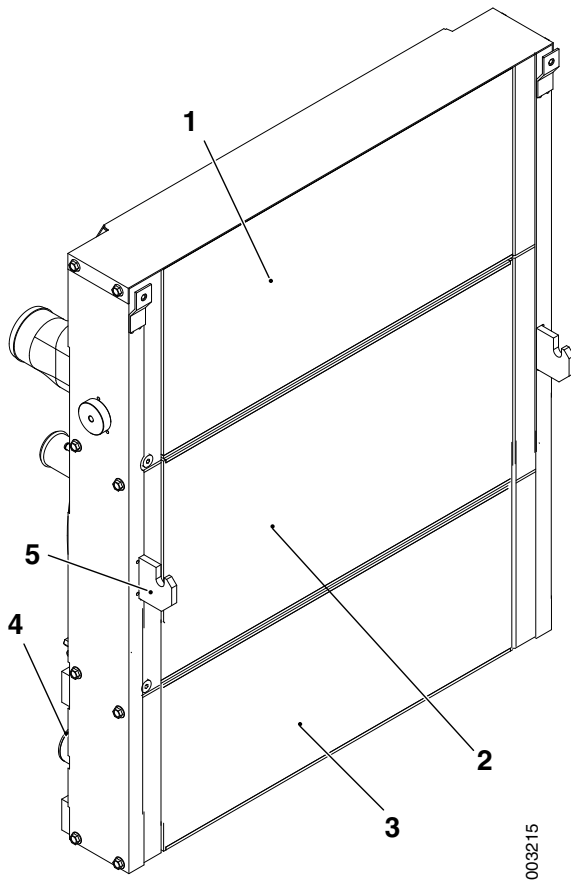
The engine's radiator is included in the cooler unit which is fitted behind the engine.

The function of the cooler unit is to cool:

- Engine coolant.
- Transmission oil (cooled in the lower part of the cooler unit), see also section 2 *Transmission*, group 2.6.3 *Oil cooler*.
- Charge air (cooled in the upper part of the cooler unit), see also *Intercooler, description*, page 1:22.

See also *Cooling system, description*, page 1:23.

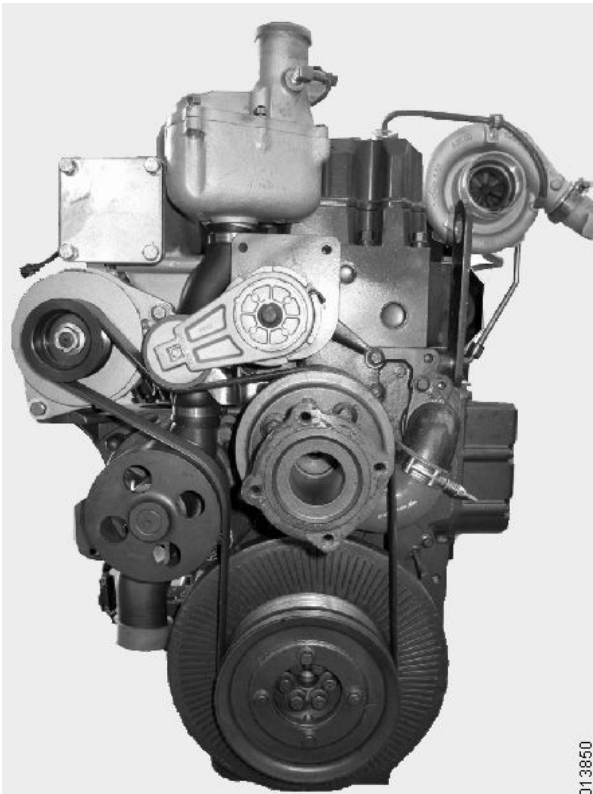
For more information, see *supplier documentation, engine*.



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

1.7.5 Cooling fan

Fan belt, replacement (engine alternative Yuchai YC6M360-30)



The figure shows engine without cooling fan.

- 1 Position the cab in the front position.
- 2 Machine in service position, see section *B Safety*.
- 3 Remove the cover plates over the engine and radiator.
- 4 Release the tension on the fan belt and release it from the belt pulley on the belt tensioner.
- 5 Remove the fan belt.
- 6 Fit the new fan belt as illustrated.
- 7 Reset the cab to the rear position and secure the cab on both sides with the locking catches.



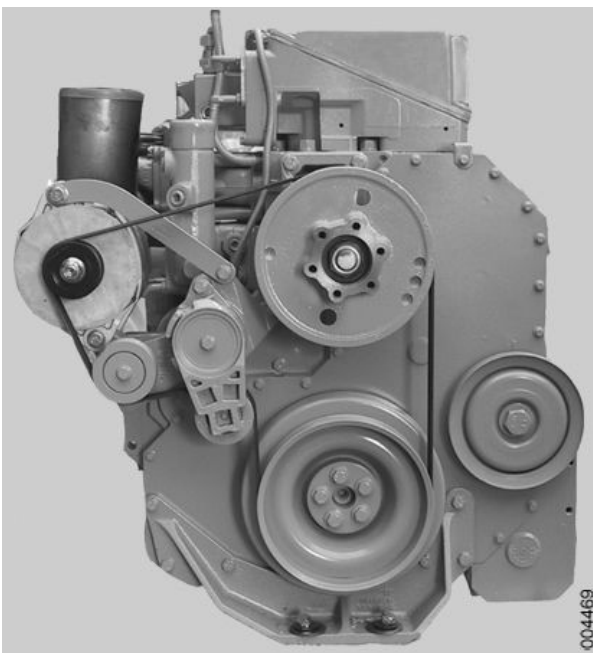
DANGER

The cab is very heavy and the machine must not be moved without first securing the cab.

Extreme danger! Risk of crushing!

Secure the cab on both sides, with the locking catches and pins before starting to operate the machine.

Fan belt, replacement (engine alternative Cummins)



- 1 Position the cab in the front position.
- 2 Machine in service position, see section *B Safety*.
- 3 Remove the cover plates over the engine and radiator.
- 4 Loosen the belt tensioner.
- 5 Remove the fan belt.
- 6 Fit a new fan belt.
- 7 Tension the fan belt with the belt tensioner.
- 8 Reset the cab to the rear position and secure the cab on both sides with the locking catches.



DANGER

The cab is very heavy and the machine must not be moved without first securing the cab.

Extreme danger! Risk of crushing!

Secure the cab on both sides, with the locking catches and pins before starting to operate the machine.

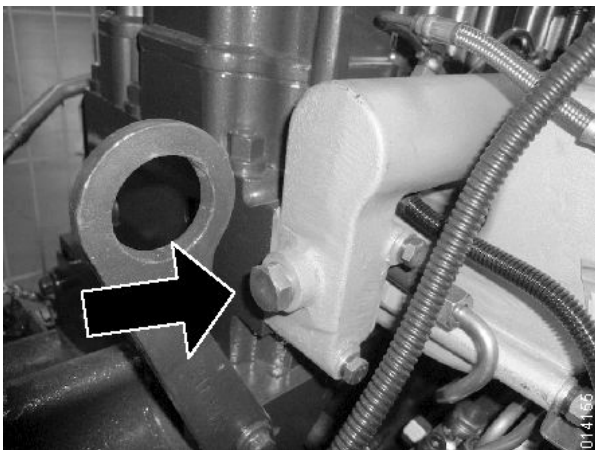
1.7.7 Coolant

Coolant, changing (engine alternative Yuchai YC6M360-30)

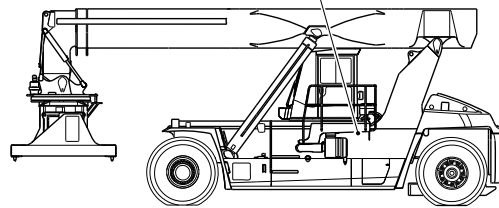
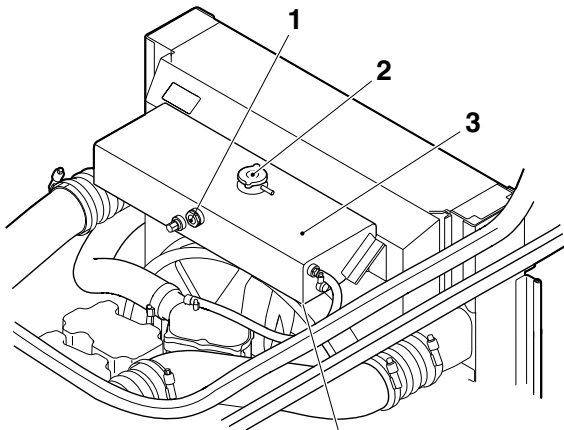
NOTE

Read the safety instructions for coolant before starting work, see section B Safety.

- 1 Machine in service position, see section B Safety.
- 2 Position the cab in the front position.
- 3 Remove the cap on the expansion tank.
- 4 Place a receptacle under the radiator and engine. (The cooling system holds about 40 l.)
- 5 Drain the cooling system.
Open the drain cock on the bottom of the radiator. Collect the coolant in the receptacle.



- 6 Open the drain cock on the engine.
- 7 Once all the coolant has drained out, close drain cocks.



1. Sight glass, level check
2. Filling point
3. Coolant reservoir (expansion tank)

- 8 Fill the new premixed coolant of the correct type in the expansion tank. For volume and quality, see section *F Technical data*.



CAUTION

Different types of coolant may not be mixed.

Risk of engine damage and damage to the cooling system if different types of coolant are mixed.

When changing and topping up coolant, the same type of coolant must be used as was used before.

- 9 Switch on the system voltage and start the engine.
- 10 Set cab heating to max.
- 11 Run the engine to operating temperature so the thermostat opens and coolant is pumped around the whole system. Do not operate the machine.



DANGER

The cab is very heavy and the machine must not be moved without first securing the cab.

Extreme danger! Risk of crushing!

Secure the cab on both sides, with the locking catches and pins before starting to operate the machine.

- 12 Check the level in the expansion tank, fill if necessary.
- 13 Reset the cab to the rear position and secure the cab on both sides with the locking catches.



DANGER

The cab is very heavy and the machine must not be moved without first securing the cab.

Extreme danger! Risk of crushing!

Secure the cab on both sides, with the locking catches and pins before starting to operate the machine.

- 14 Check the coolant level again after 10 operating hours.

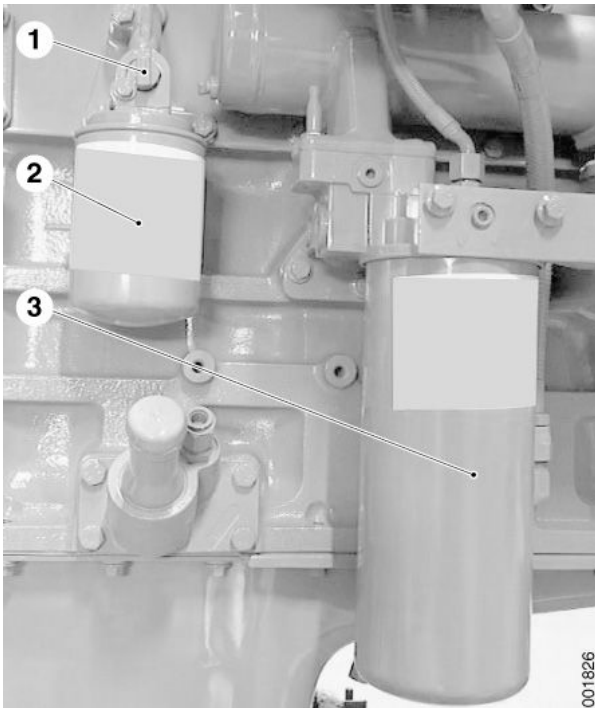
Coolant, changing (engine alternative Cummins QSM11)



NOTE

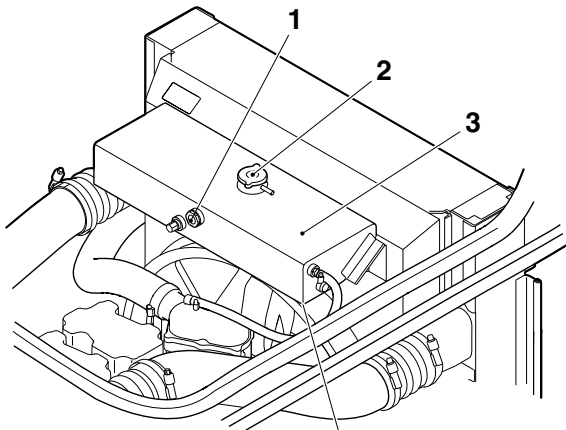
Read the safety instructions for coolant before starting work, see section B Safety.

- 1 Machine in service position, see section B Safety.
- 2 Remove the cap on the expansion tank.
- 3 Place a receptacle under the radiator and engine. (The cooling system holds about 40 l.)
- 4 Drain the cooling system.
Open the drain cock on the bottom of the radiator. Collect the coolant in the receptacle.

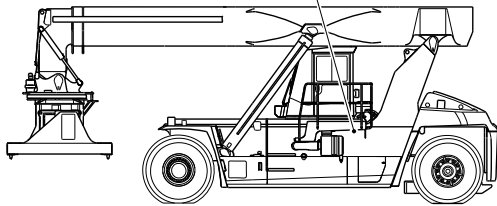


- 5 Open the drain cock on the engine.
- 6 Once all the coolant has drained out, close drain cocks.

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



1. Sight glass, level check
2. Filling point
3. Coolant reservoir (expansion tank)



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- 7 Fill the new premixed coolant of the correct type in the expansion tank. For volume and quality, see section *F Technical data*.



CAUTION

Different types of coolant may not be mixed.

Risk of engine damage and damage to the cooling system if different types of coolant are mixed.

When changing and topping up coolant, the same type of coolant must be used as was used before.

- 8 Turn on the main electric power and start the engine.
- 9 Turn on max. heat in the cab.
- 10 Run the engine to operating temperature so the thermostat opens and coolant is pumped around the whole system.
- 11 Check the level in the expansion tank, fill if necessary.
- 12 Reset the cab to the rear position and secure the cab on both sides with the locking catches.



DANGER

The cab is very heavy and the machine must not be moved without first securing the cab.

Extreme danger! Risk of crushing!

Secure the cab on both sides, with the locking catches and pins before starting to operate the machine.

- 13 Check the coolant level again after 10 operating hours.

1.9 Control system, engine

1.9.1 Engine control unit

Control unit, engine, general

See section *11 Common electrics*, group *11.5.3.10 Control unit, engine* and *supplier documentation, engine*.

1.11 Start/stop

1.11.1 Starter motor

Starter motor, description

The starter motor cranks 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 (D797-R).

For more information, see *supplier documentation, engine*.

1.11.2 Stopping device

Stopping device, description

The engines have electrically regulated 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 via the ignition key lock.

NOTE

The battery disconnecter must not be used for emergency stop!

For more information, see *supplier documentation, engine*.

 Automatic engine shutdown is available as an option. This means that the engine shuts off automatically after 3-30 minutes (depending on customer setting) if the machine is stationary at idle.

Contents 2 Transmission

2	Transmission	2:3
2.1	Controls and instruments	2:9
2.1.1	Gear selector and multi-function lever.....	2:9
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2.2.1	Flex plates	2:10
2.6	Lubrication system	2:13
2.6.3	Oil cooler	2:16
2.7	Cooling system	2:18
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2 Transmission

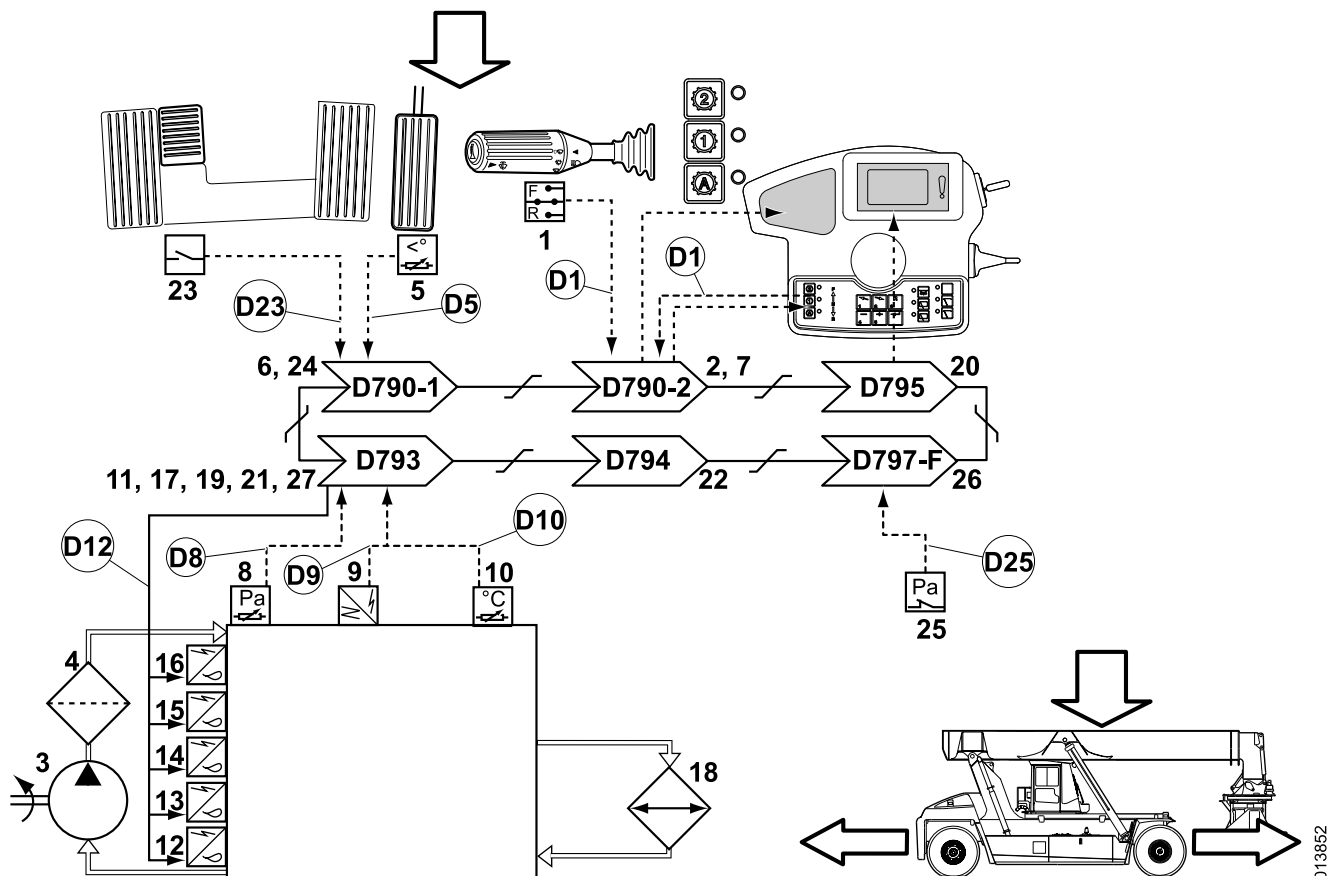
Transmission, general

Component supplier documentation

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

References to supplier documentation are only provided in exceptional cases. If information about a component is not found, the component supplier documentation should be used.

Transmission, function description



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Pos	Explanation	Signal description	Reference
1	The gear selector sends a voltage signal to Control unit KIT (D790-2).	Forward, Conn. F: U = 24 V Reverse, Conn. R: U = 24 V	Section 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instruments</i> D1: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.2, <i>TRANSM menu 2</i>
2	Control unit KIT (D790-2) transmits the selected direction of travel (forward or reverse) on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.11 <i>Control unit, KIT</i> D1: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.2, <i>TRANSM menu 2</i>
3	The transmission's oil pump pumps oil when the engine is running.	-	-

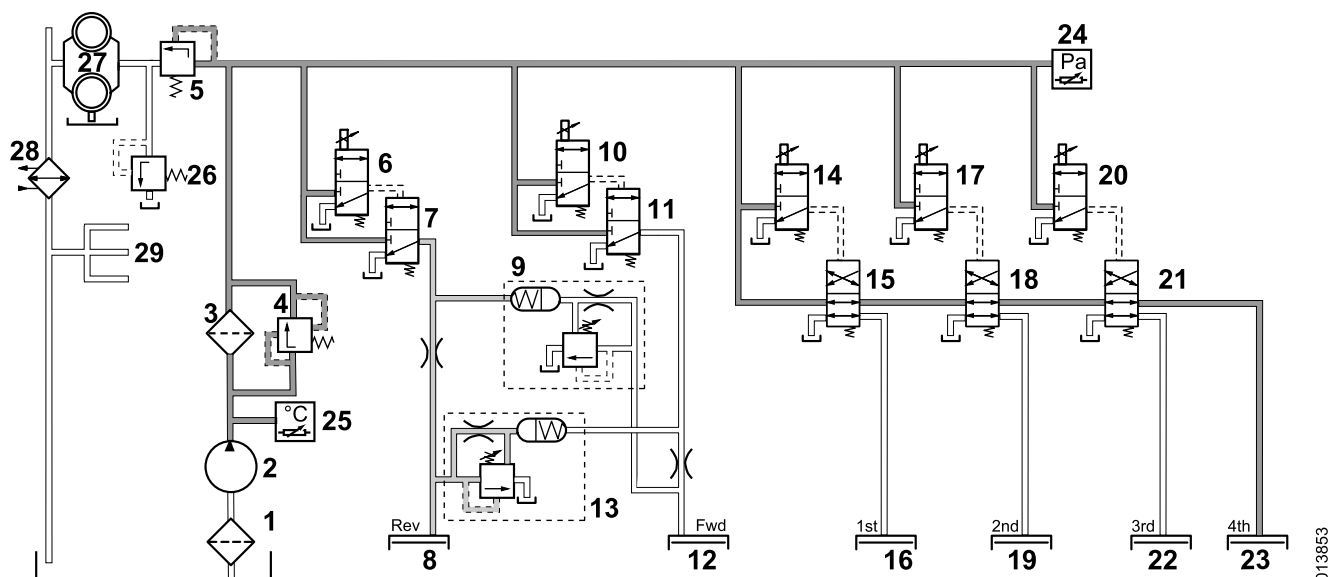
Pos	Explanation	Signal description	Reference
4	The transmission's oil filter cleans the oil from impurities.	-	-
5	The accelerator pedal transmits a signal to Control unit, cab (D790-1).	U = 0.5-4.5 V	Section 1 <i>Engine</i> , group 1.1.2 <i>Accelerator pedal</i> D5: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.6.1 <i>ENGINE menu 1</i>
6	Control unit, cab (D790-1) transmits the desired throttle application on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
7	Control unit KIT (D790-2) sends the selected shifting program on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.11 <i>Control unit, KIT</i>
8	Sensor, oil pressure transmission (B765) sends a voltage signal proportional to the oil pressure to Control unit, transmission (D793).	Checked by Control unit, transmission, error shown with error code.	<i>Transmission, component location</i> , page 2:8
9	Sensor, turbine speed (B751) sends Control unit, transmission (D793) a pulse signal with frequency proportional to turbine speed.	Checked by Control unit, transmission, error shown with error code.	<i>Transmission, component location</i> , page 2:8
10	Sensor, oil temperature (B766) sends a voltage signal proportional to the transmission oil temperature to Control unit, transmission (D793).	Checked by Control unit, transmission, error shown with error code.	<i>Transmission, component location</i> , page 2:8
11	Control unit, transmission (D793) supplies voltage to the solenoid and servo valves in order to obtain the desired function.	Checked by Control unit, transmission, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.9 <i>Control unit, transmission</i>
12 13 14 15 16	Solenoid valve clutch forward, (Y630) or Solenoid valve clutch reverse (Y631) is activated to select direction of travel. Solenoid valve clutch gear 1 (Y6067-1), Solenoid valve clutch gear 2 (Y6069) or Solenoid valve clutch gear 3 (Y6067-3) is activated to select the gear position. If no solenoid valve is activated then gear 4 is selected. Engine power is transferred to the transmission's output shaft.	Checked by Control unit, transmission, error shown with error code. See also, <i>Actuated valves in selected gear</i> , page 2:5	<i>Transmission, component location</i> , page 2:8
17	Control unit, transmission (D793) controls gear shifting according to selected shifting program.	Checked by Control unit, transmission, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.9 <i>Control unit, transmission</i>
18	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</i> , page 2:18
19	Control unit, transmission (D793) transmits temperature and speed data on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.9 <i>Control unit, transmission</i>
20	Control unit KID (D795) shows transmission information in operating menus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.12 <i>Control unit, KID</i>
21	Sensor, turbine speed (B751) indicates that the machine's speed exceeds the speed limit, sends Control unit, transmission (D793) requests for reduced engine speed on the CAN bus.	-	<i>Transmission, component location</i> , page 2:8

Pos	Explanation	Signal description	Reference
22	Control unit, engine (D794) reduces the engine speed.	-	Section 11 <i>Common electrics</i> , group 11.5.3.10 <i>Control unit, engine</i>
23	If the declutch pedal (S220-1) is depressed, it sends a voltage signal to Control unit, cab (D790-1).	U = 24 V	Section 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instruments</i> D23: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.1, <i>TRANSM menu 1</i>
24	Control unit, cab (D790-1) transmits declutch drive on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
25	Break contact (opening switch) declutch (S220-2) sends a voltage signal to Control unit, frame front (D797-F) if the brake pressure is high enough to allow declutch of the 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>Break contact (opening switch) declutch, description</i> , page 2:19 D25: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.7.1, <i>TRANSM menu 1</i>
26	Control unit, frame front (D797-F) sends declutch approved on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame front</i>
27	Control unit, transmission (D793) supplies voltage to valve block transmission control so that drive is declutched.	Checked by Control unit, transmission, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.9 <i>Control unit, transmission</i>

Table Actuated valves in selected gear

	Y6067-1	Y6069	Y6067-3
Gear 1	On	On	On
Gear 2	Off	On	On
Gear 3	Off	Off	On
Gear 4	Off	Off	Off

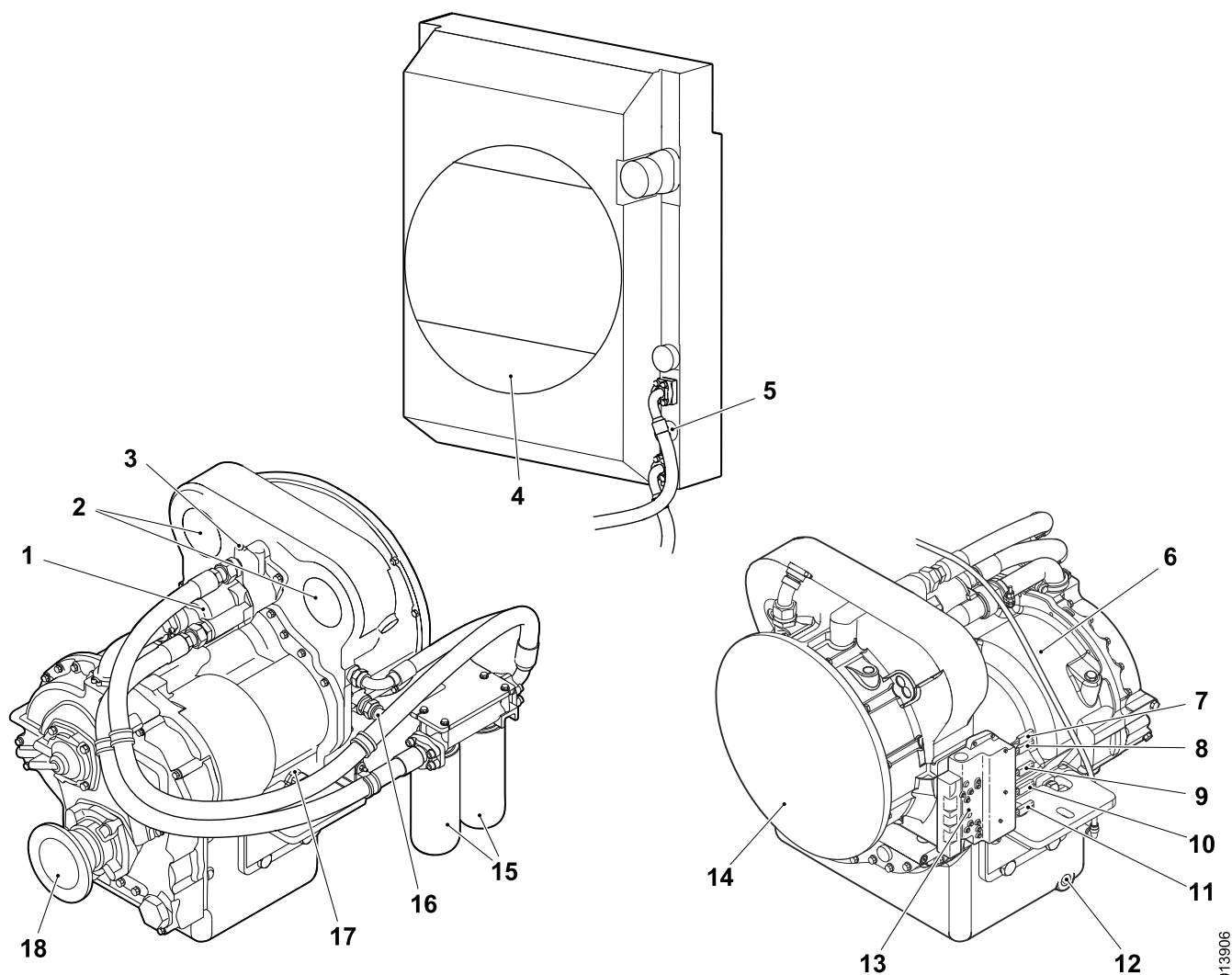
Shifting transmission, function description



Pos	Explanation	Signal description	Reference
1	Bottom strainer oil sump, separates particles from the oil before the pumps.	-	-
2	The transmission's oil pump feeds the transmission with control pressure for control of the transmission.	30.4 l/min at 685 rpm	-
3	The oil filter cleans the oil.	-	-
4	The bypass valve in the filter bracket leads the oil past the filter if the resistance through the filter becomes too high.	Opening pressure: 410-450 kPa	-
5	The pressure regulator releases pressure to the torque converter if the pressure becomes too high.	Opening pressure: 2200 kPa	-
6	When the reverse direction of travel is selected Solenoid valve, clutch reverse (Y631) is supplied with voltage. The solenoid valve opens and directs pressure to valve slide clutch reverse.	-	<i>Transmission, component location, page 2:8</i>
7	Valve slide clutch reverse pressurises drive clutch reverse and modulation valve forward.	-	-
8	Drive clutch reverse locks the transmission in reverse drive when the clutch is pressurised.	-	-
9	Modulation valve forward drains the pressure to drive clutch forward at the same rate as the driving clutch reverse is pressurised.	Drive reverse: 2200-2600 kPa	-
10	When the forward direction of travel is selected Solenoid valve, clutch forward (Y630) is supplied with voltage. The solenoid valve opens and directs pressure to valve slide clutch forward.	-	<i>Transmission, component location, page 2:8</i>
11	Valve slide clutch forward pressurises drive clutch forward and modulation valve reverse.	-	-
12	Drive clutch forward locks the transmission in forward drive when the clutch is pressurised.	-	-
13	Modulation valve reverse drains the pressure to drive clutch reverse at the same rate as the driving clutch forward is pressurised.	Drive reverse: 2200-2600 kPa	-

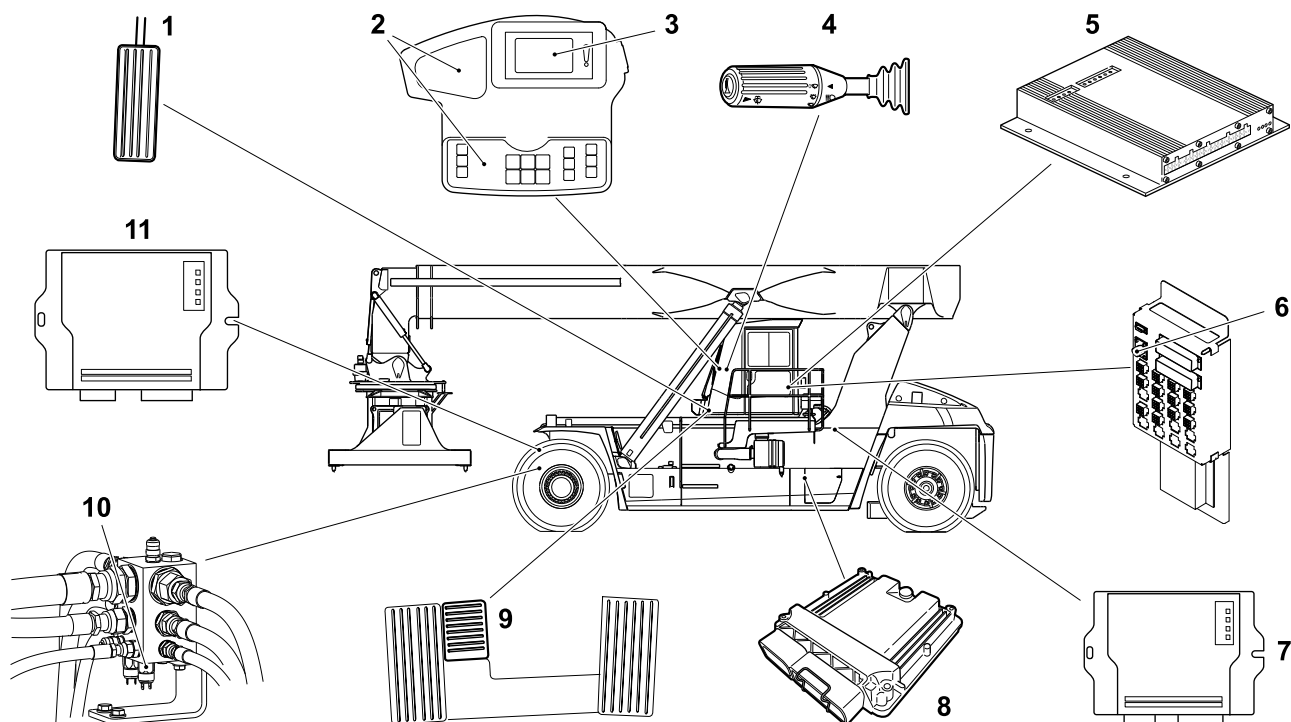
Pos	Explanation	Signal description	Reference
14	Solenoid valve gear selection 1 (Y6067-1) pressurises valve slide gear selection 1.	-	<i>Transmission, component location, page 2:8</i>
15	Valve slide gear selection 1 pressurises drive clutch gear 1 and cuts off the pressure to the gears.	-	-
16	Drive clutch gear 1 locks the transmission in gear position 1 when the clutch is pressurised.	-	-
17	Solenoid valve gear selection 2 (Y6069) pressurises valve slide gear selection 2.	-	<i>Transmission, component location, page 2:8</i>
18	Valve slide gear selection 2 pressurises drive clutch gear 2 and cuts off the pressure to the gears.	-	-
19	Drive clutch gear 2 locks the transmission in gear position 2 when the clutch is pressurised.	-	-
20	Solenoid valve gear selection 3 (Y6067-3) pressurises valve slide gear selection 3.	-	<i>Transmission, component location, page 2:8</i>
21	Valve slide gear selection 3 pressurises drive clutch gear 3 and cuts off the pressure to the gears.	-	-
22	Drive clutch gear 3 locks the transmission in gear position 3 when the clutch is pressurised.	-	-
23	If no solenoid valve for gear selection is activated then drive clutch gear 4 is pressurised.	-	-
24	Sensor, oil pressure transmission (B765) sends a voltage signal proportional to the oil pressure in the transmission to Control unit, transmission (D793).	-	<i>Transmission, component location, page 2:8</i>
25	Sensor, oil temperature (B766) sends a voltage signal proportional to the oil temperature to Control unit, transmission (D793).	-	<i>Transmission, component location, page 2:8</i>
26	The safety valve leads the oil back to the sump if the pressure to the torque converter becomes too high.	Opening pressure: 900 kPa	-
27	The torque converter transmits the engine's power to the transmission.	-	-
28	The transmission oil cooler cools the oil.	-	-
29	The oil is distributed to different lubrication points in the transmission.	-	-

Transmission, component location



1. Oil pump transmission
2. Power take off
3. Sensor, oil pressure transmission (B765)
4. Transmission oil cooler
5. Thermostat
6. Gearbox
7. Solenoid clutch forward (Y630)
8. Solenoid valve clutch gear 3 (Y6067-3)
9. Solenoid valve clutch gear 2 (Y6069)

10. Solenoid valve clutch gear 1 (Y6067-1)
11. Solenoid valve clutch reverse (Y631)
12. Drain plug transmission oil
13. Valve block transmission control
14. Torque converter
15. Oil filter transmission
16. Sensor oil temperature (B766)
17. Sensor turbine speed (B751)
18. Output shaft



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1. Accelerator pedal (B690)
2. Control unit KIT (D790-2)
3. Control unit, KID (D795)
4. Multi-function lever (S162)
5. Control unit, cab (D790-1)
6. Diagnostic socket drive-train

7. Control unit, frame rear (D797-R)
8. Control unit, transmission (D793)
9. Declutch pedal (S220-1)
10. Make-contact (closing switch) declutch (S220-2)
11. Control unit, frame front (D797-F)

Engine and transmission, separation

See Section 1 *Engine*, group 1 *Engine and transmission, separation*.

2.1 Controls and instruments

2.1.1 Gear selector and multi-function lever

Gear selector and multi-function lever, description

Selection of direction travel is made with the gear selector and multi-function lever.

Selecting direction of travel:

- 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 via the diagnostic menu. See section 8 *Control system*, group 8.4.7.2 *TRANSM, menu 2*.

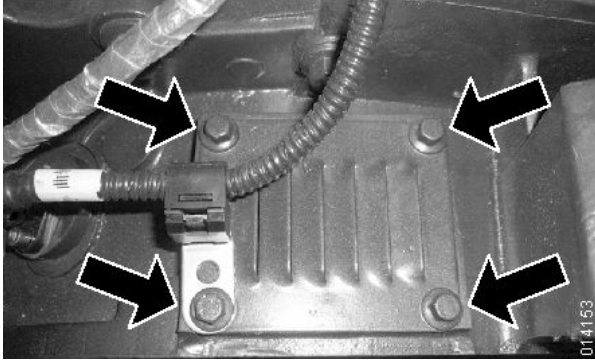
2.2 Torque converter/Clutch system

2.2.1 Flex plates

Flex plates, replacement (engine alternative Yuchai YC6M360-30)

1 Machine in service position, see section *B Safety*.

2 Remove the cover plate.



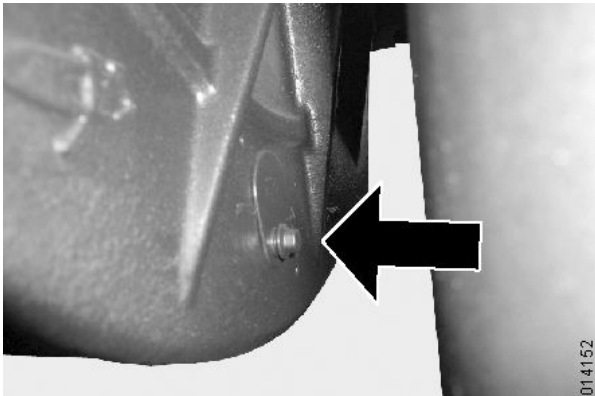
3 Remove the cover plate and rotate the engine so that each bolt to the flex plate can be removed.

4 Remove the screws for the flex plate.

5 Attach the transmission to an overhead crane.

6 Remove the bolts holding together the transmission and engine.

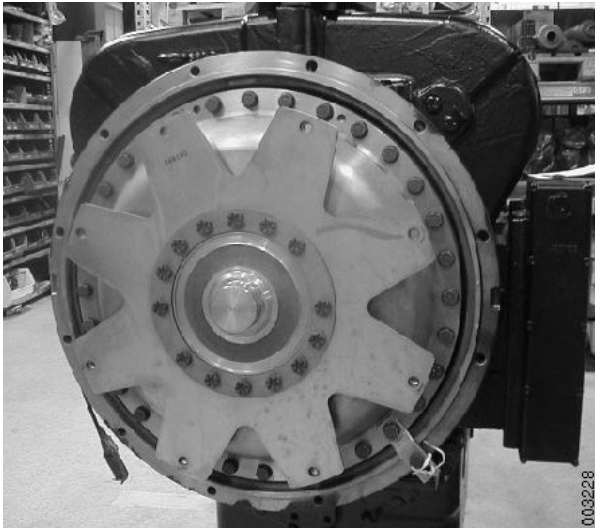
7 Carefully separate the transmission and engine.



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

9 Replace the flex plate.

10 Fit in the reverse order. Fit the attaching bolts with **40 Nm**.

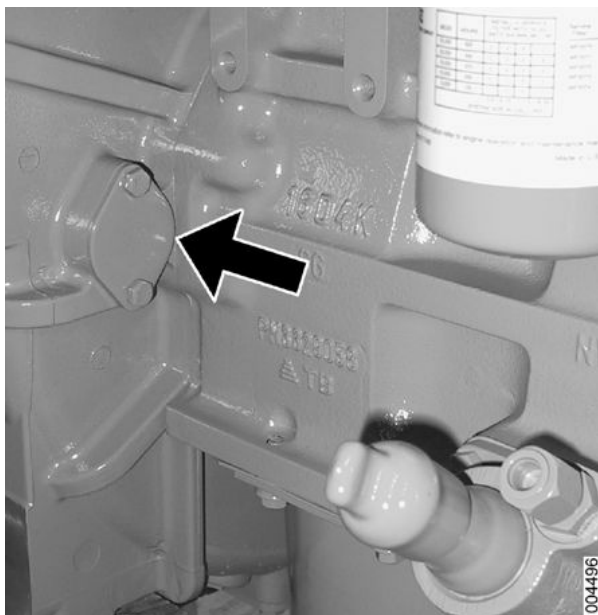


Flex plate attachment.

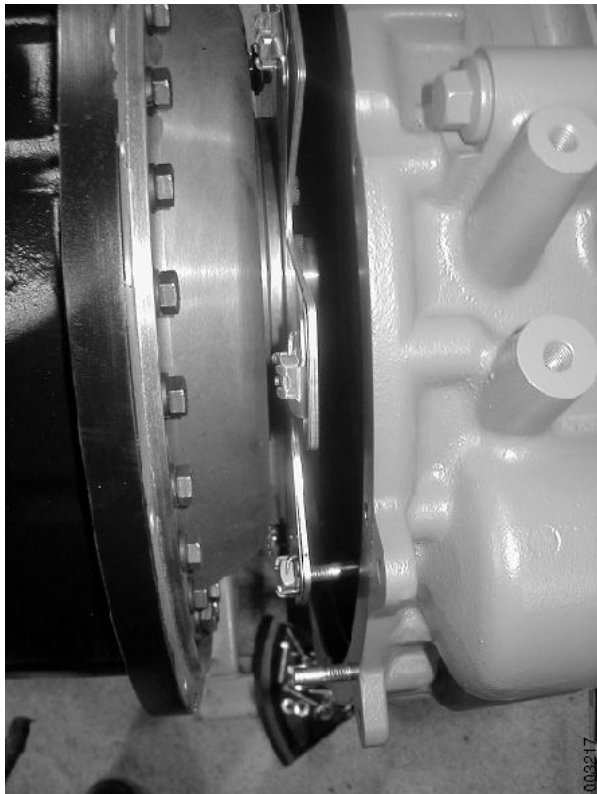
Flex plates, replacement (engine alternative Cummins QSM11)



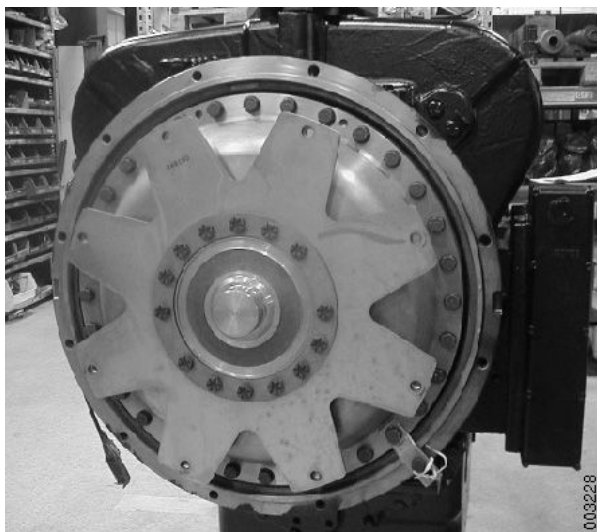
- 1 Machine in service position, see section *B Safety*.
- 2 Remove the cover plate.
- 3 Remove the screws for the flex plate.



- 4 Rotate the engine for each bolt to the flex plate that has 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.



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

9 Replace the flex plate.

10 Fit in the reverse order. Fit the attaching bolts with **40 Nm**.

Flex plate attachment.

2.6 Lubrication system

Lubrication system, description

The transmission lubrication system has the following function:

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

During operation of the engine, the oil pump draws oil from the transmission's oil sump 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's 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

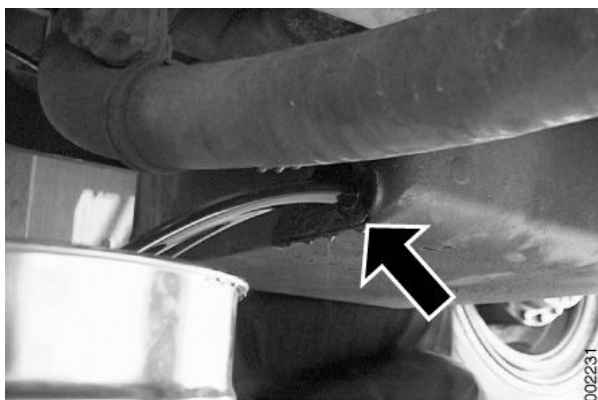
NOTE

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

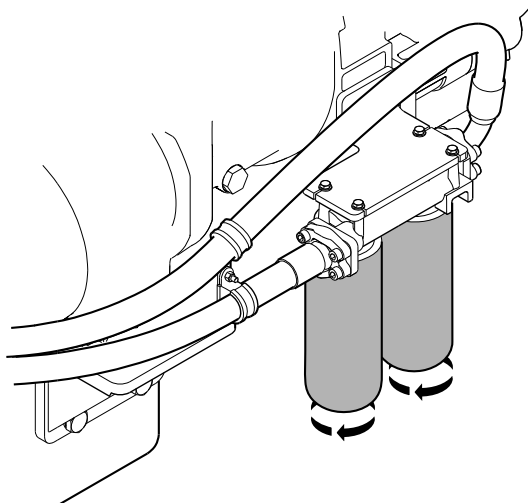
NOTE

The transmission must not be over-filled!

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



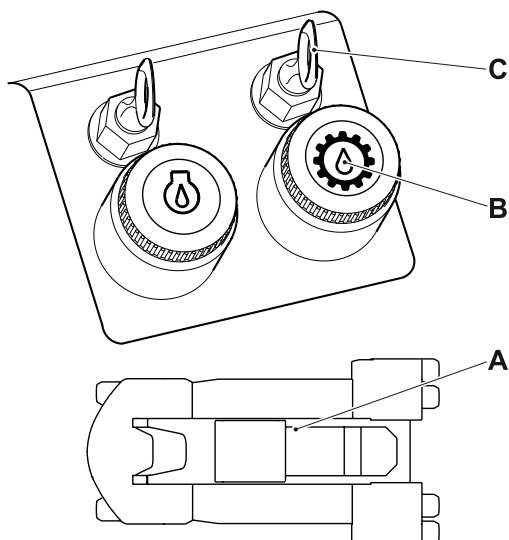
Draining the transmission oil



Oil filter transmission

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- 4 Change oil filter.
Moisten the O-ring of the new oil filters with transmission oil. Tighten until it makes contact and then another two-thirds of a turn.
- 5 When the transmission oil has drained, fit the drain plug. Make sure that the washer for the oil plug is included.



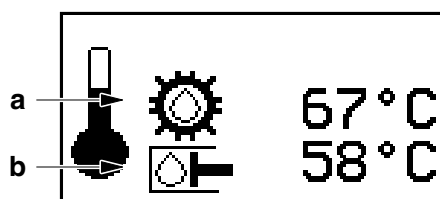
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- 6 Fill with new transmission oil through the oil filling orifice (position B) to the mark for low level on the dipstick.
For volume and quality, see section *F Technical data*.
- 7 Start the engine and allow it to idle for at least two minutes.
- 8 Check that the transmission oil drain plug is sealed.
- 9 Check the transmission oil level with the engine running at idle and top up to the marking for low level.

A. Location of oil filling and dipstick

B. Oil filling transmission oil

C. Dipstick transmission oil



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Operating menu, oil temperature

- a Transmission oil temperature
- b Hydraulic oil temperature

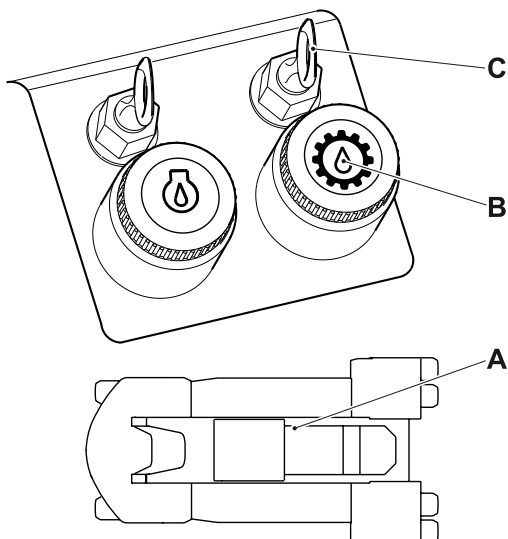
- 10 Operate and warm up the transmission so that the display shows an oil temperature of approx. 85 °C. Use the oil temperature operating menu to check transmission oil temperature.
- 11 Check the oil level. Fill to the MAX mark.

Oil level, checking

NOTE

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

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



- A. Location of oil filling and dipstick
- B. Oil filling transmission oil
- C. Dipstick transmission oil

- 1 Check the oil level with the engine at idle, transmission in neutral position and at operating temperature (approx. 85 °C in the display). The dipstick has two markings, MAX and MIN. The oil level should be at MAX.

Wipe off the oil dipstick before checking.

NOTE

The oil dipstick is long. Wear gloves.

- 2 Fill transmission oil (position B) if required (for volume and grade, see section F Technical data).

Fill - wait a moment - check the oil dipstick.

NOTE

Work carefully when filling transmission oil to prevent other fluids or particles from contaminating the oil. Other fluids or particles in the transmission oil means a risk of transmission damage.

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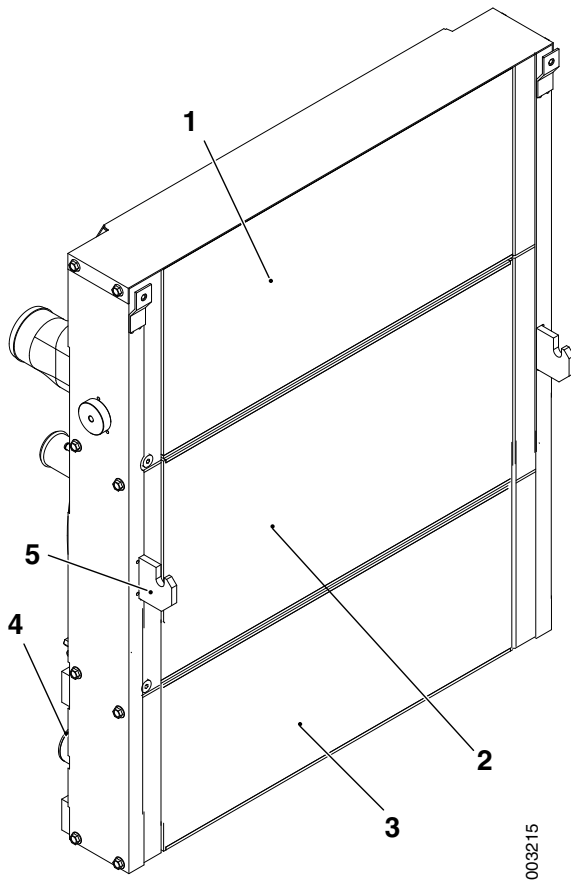
2.6.3 Oil cooler

Oil cooler, description

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

A temperature-controlled bypass valve, which only acts on the transmission oil cooling circuit, is located in a pipe on the underside of the cooler (engine side). The valve closes when the oil starts to reach operating temperature. This means that the oil reaches normal operating temperature more quickly.

For more information, see *supplier documentation, transmission*.



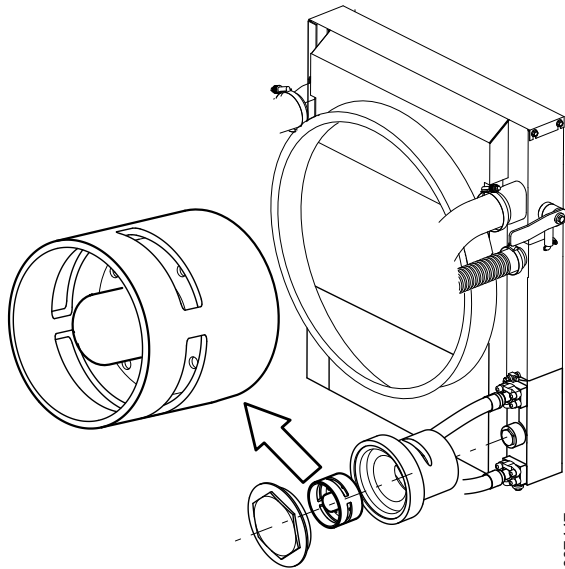
1. Intercooler
2. Radiator, engine
3. Radiator, transmission oil
4. Thermostat transmission oil
5. Mounting condenser (to AC)

Thermostat transmission oil cooler, replacement

NOTE

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

- 1 Machine in service position, see section B Safety.
- 2 Drain the oil from the transmission, see *Oil and oil filter, changing*, page 2:13.
- 3 Loosen the cover plug and remove the thermostat.
- 4 Check the O-ring and the spring in the bottom, replace as necessary.
- 5 Fit the new thermostat, and the cover plug.



IMPORTANT

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

- 6 Fill with transmission oil; see *Oil and oil filter, changing*, page 2:13.
- 7 Start the engine and check for leaks.
- 8 Check the transmission oil level, see *Oil level, checking*, page 2:15.

2.7 Cooling system

2.7.3 Oil cooler

Oil cooler, description

See *Oil cooler, description*, page 2:16.

2.8 Control system, transmission

2.8.1 Transmission control unit

Control unit transmission, general

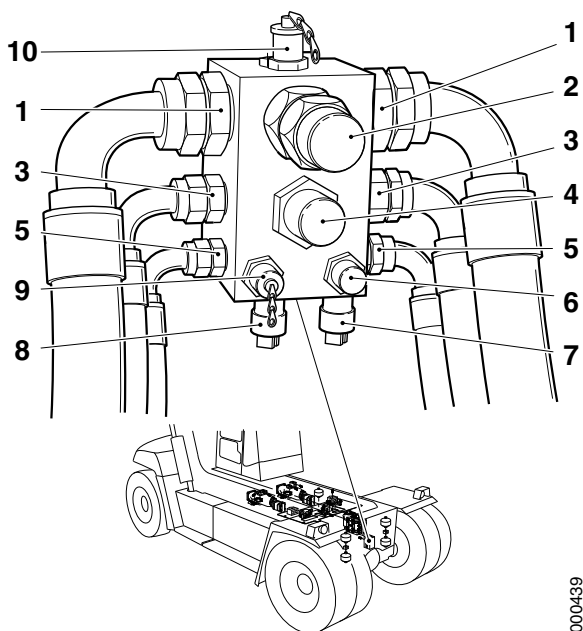
See section 11 *Common electrics*, group 11.5.3.9 *Control unit, transmission* and *supplier documentation, transmission*.

2.8.2 Break contact (opening switch) declutch

Break contact (opening switch) declutch, description

Break contact (opening switch) declutch detects whether the wheel brakes are pressurised. The break contact (opening switch) is located on the distribution block for the brake system above the drive axle's differential.

The sensor can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.7.1 *TRANSM*, menu 1.



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 (closing switch), declutch (S220-2)
8. Make-contact (closing switch), brake light (S216)
9. Measuring outlet, brake pressure
10. Measuring outlet, back pressure brake cooling

2.8.3 Transmission cable harness

Transmission cable harness, description

See section *E Schematics*.

Contents 3 Power transmission

3	Power transmission	3:3
3.2	Propeller shaft.....	3:3
3.3	Drive axle	3:4

3 Power transmission

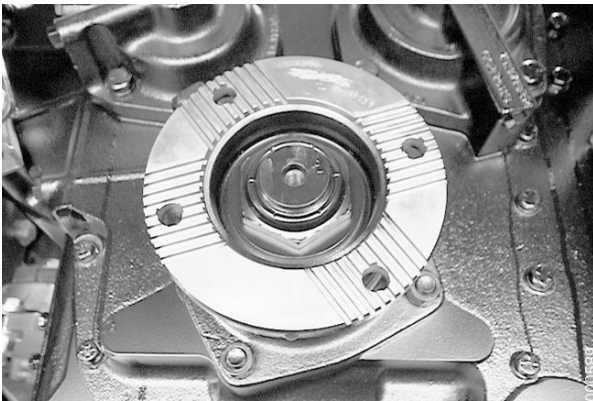
3.2 Propeller shaft

Propeller shaft, description

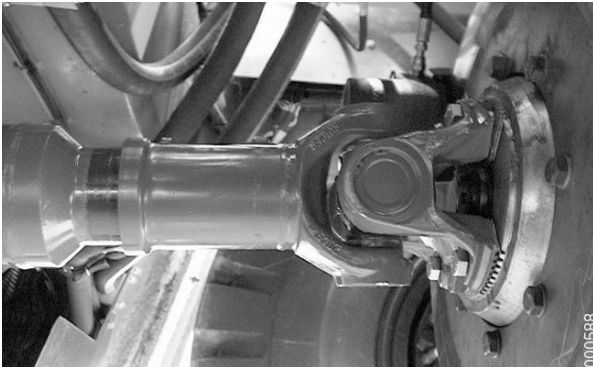
The propeller shaft transfers engine power from the transmission to the drive axle. The propeller shaft has two joints, which means that the engine and drive axle can move in relation to each other.

Propeller shaft, replacement

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



- 3 Fit the propeller shaft in position with the coupling upward.
- 4 Fit the propeller shaft's attaching bolts.
Tightening torque **156 Nm**. Retighten the attaching bolts after 50 hours of operation.



3.3 Drive axle

Drive axle, general

Component 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 the relevant supplier documentation.

References to supplier documentation are only provided in exceptional cases. If information about a component is not found, the component supplier documentation should be used.

Drive axle, replacement



DANGER

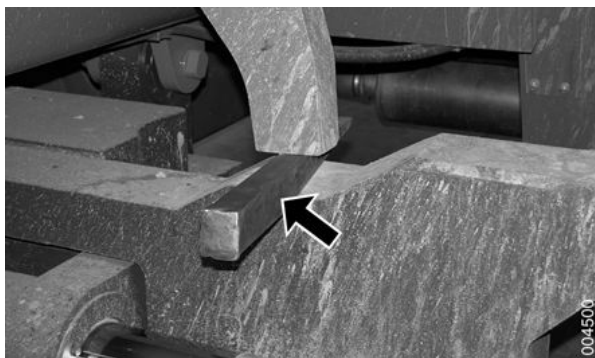
Drive axle and machine are very heavy.

Risk of crushing!

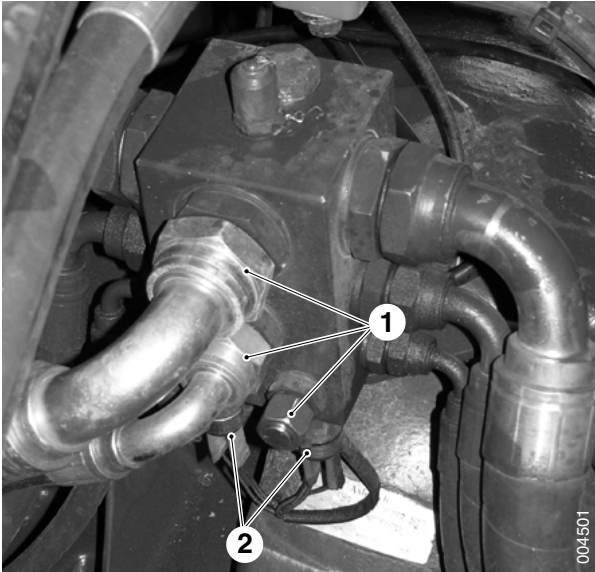
It is forbidden to go under a machine which has been lifted by a jack etc. For machine weight, see section *F Technical data*.



- 1 Park the machine with blocks behind the steering wheels.
- 2 Depressurise the brake and hydraulic systems, see section *B Safety*.
- 3 Turn the start key to position 0 and switch off the system voltage.



- 4 Insert wedges between the steering axle and the frame.



1. Hydraulic hoses
2. Cable harness

- 5 Detach the hydraulic hoses (position 1) and cable harness (position 2) from the distribution block.

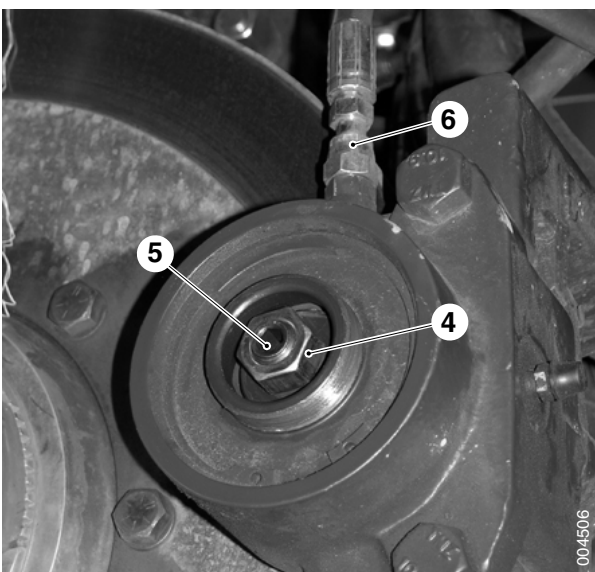
NOTE

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



1. Cover, parking brake

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



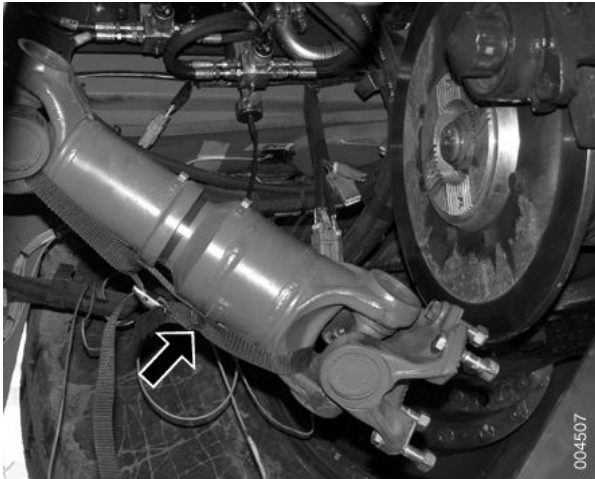
1. Lock nut
2. Release screw
3. Hydraulic hose, parking brake

- 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. Refit the cover on the parking brake (position 3).

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

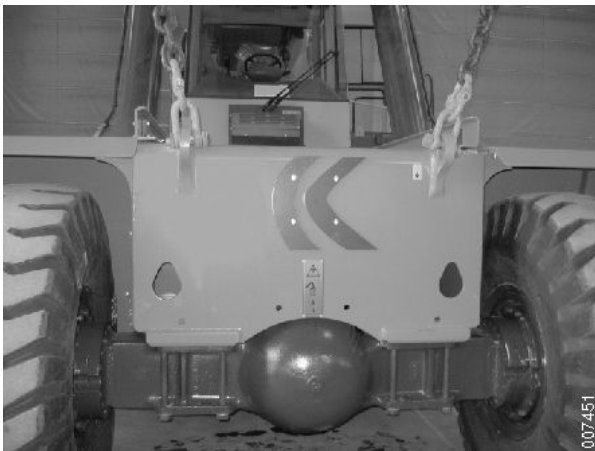
NOTE

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



Securing the propeller shaft.

- 9 Detach 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.

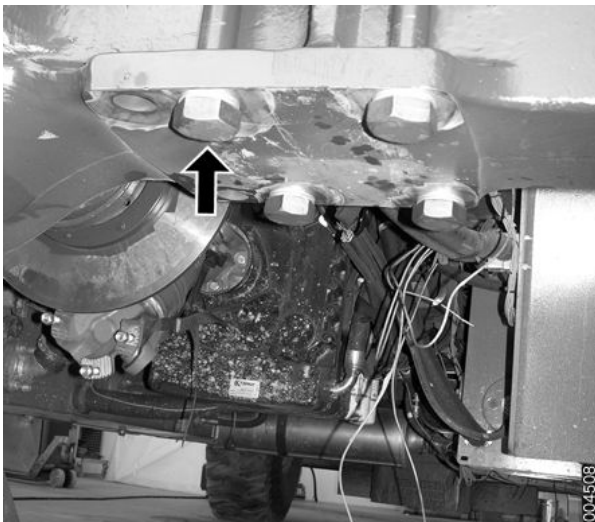


CAUTION

The drive axle may start to roll.

Crushing injury!

Make sure that the drive axle does not roll away uncontrollably.



Attaching bolts drive axle

- 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.

Crushing injury!

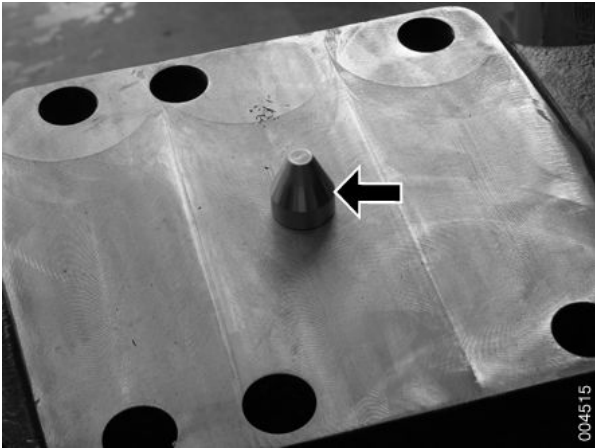
Make sure that the drive axle does not roll away uncontrollably.

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

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 underside of the drive axle.
 17 Remove the nuts for attaching the drive axle, blow clean and refit the nuts.



- 18 Transfer the guide pins from the old axle to the new axle.
- 19 Lift the drive axle into place under the frame.



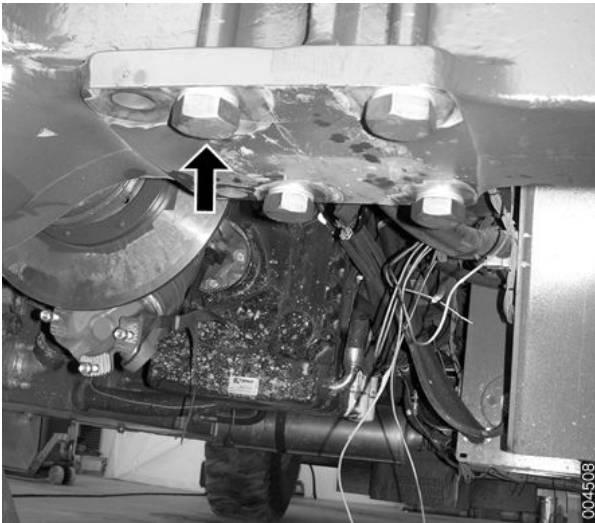
CAUTION

The drive axle may start to roll.

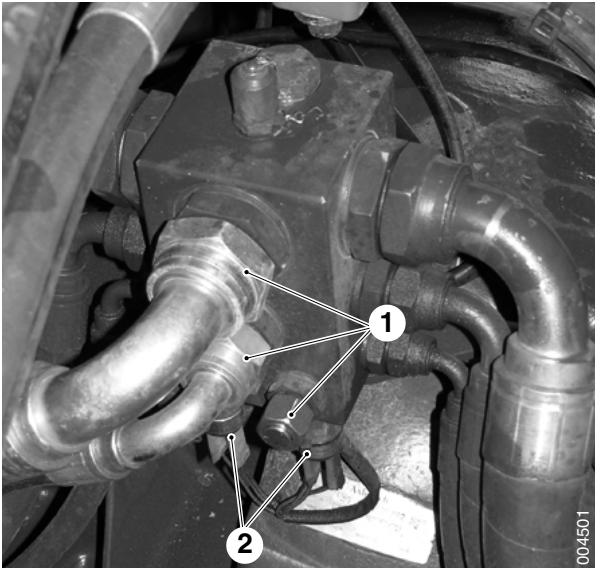
Crushing injury!

Make sure that the drive axle does not roll away uncontrollably.

- 20 Lower the frame toward the drive axle. Check that the guide pins fit in the frame.
- 21 Fit the new bolts that secure the drive axle in the frame. Tighten the bolts to a torque of **2820 Nm**.
- 22 Install the drive wheels on the new axle.
- 23 Rustproof the bolts with suitable paint.



- 24 Connect hydraulic hoses (position 1) and cable harness (position 2) to the distribution block on the drive axle.
- 25 Connect the hydraulic hose to the parking brake, adjust the parking brake.
- 26 Connect the drive shaft to the drive axle, tighten the bolts to a torque of **156 Nm**. (Retighten the attaching bolts after 50 operating hours.)
- 27 Check the oil level in the drive axle.
- 28 Start the machine and bleed the brakes, see section 4 *Brakes*, group 4.3.9 *Wheel brake*.
- 29 Check for leaks.



Contents 4 Brakes

4	Brakes	4:3
4.1	Controls and instruments	4:3
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4.3	Power-assisted brake system	4:5
4.3.1	Brake oil pump	4:6
4.3.2	Brake oil filter	4:10
4.3.3	Accumulator charging valve	4:11
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4.3.5	Brake valve	4:18
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4.8.5	Drive axle block	4:38
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4.8.11	Breather filter	4:42
4.8.12	Brake oil filter	4:43
4.8.13	Pipes and hoses	4:44
4.8.14	Oil, brake system	4:44

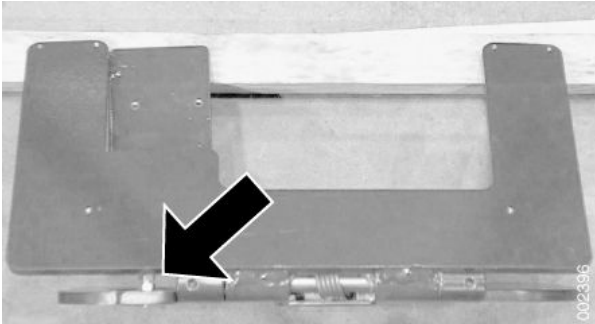
4 Brakes

4.1 Controls and instruments

4.1.1 Brake pedal

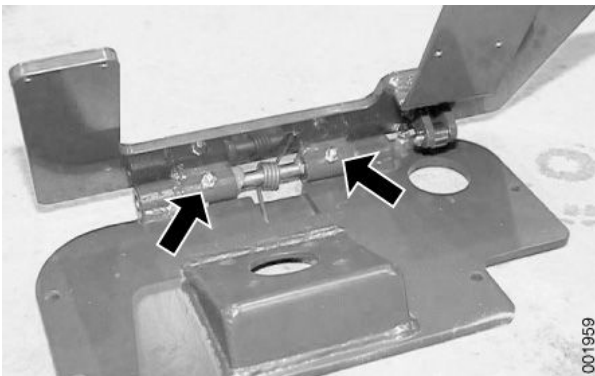
Brake pedal, checking and adjustment

- 1 Clean the floor round the brake pedal and check that nothing is obstructing the movement of the brake pedal.
- 2 Check that the brake pedal springs back adequately and that the clearance between brake pedal and brake valve is 1-1.5 mm. If necessary, adjust the brake pedal's stop screw to the correct clearance.
- 3 Check that the pedal moves smoothly.



Stop screw for adjusting clearance between brake pedal and brake valve. (The illustration shows a loose brake pedal.)

- 4 Lubricate the pedal hinge with "EP2" universal grease.
- 5 Check that the rubber pad on the brake pedal is intact and that the tread pattern is not worn away. Replace if necessary.
- 6 Check the brake valve; see *Brake valve, checking*, page 4:18.



Lubrication points, brake pedal. (The illustration shows a loose brake pedal.)

Brake pedal, replacement

NOTE

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

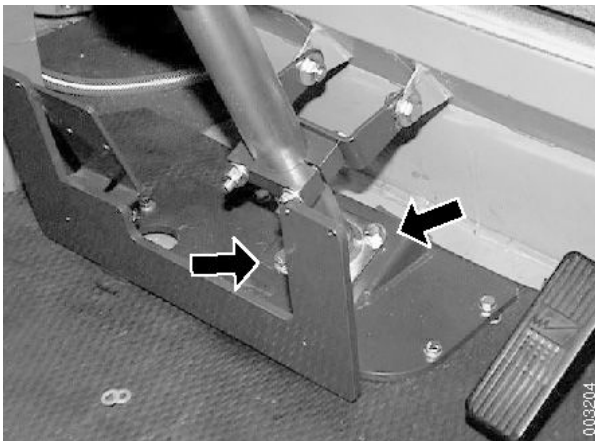
- 1 Switch off the engine and switch off the system voltage.
- 2 Depressurise the brake and hydraulic systems, see section B Safety.
- 3 Detach the brake valve from the brake pedal.
Secure the brake valve on the cab's underside and remove the brake valve attaching bolt.



- 4 Remove the panel around the steering wheel shaft.

NOTE

There is a variant available with adjustable steering wheel shaft.



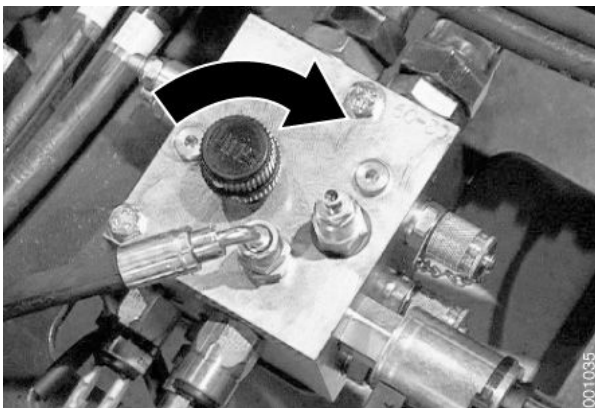
Mounting of steering wheel shaft and steering valve in pedal assembly.

- 5 Detach the steering valve from the pedal assembly.
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 declutch 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.

NOTE

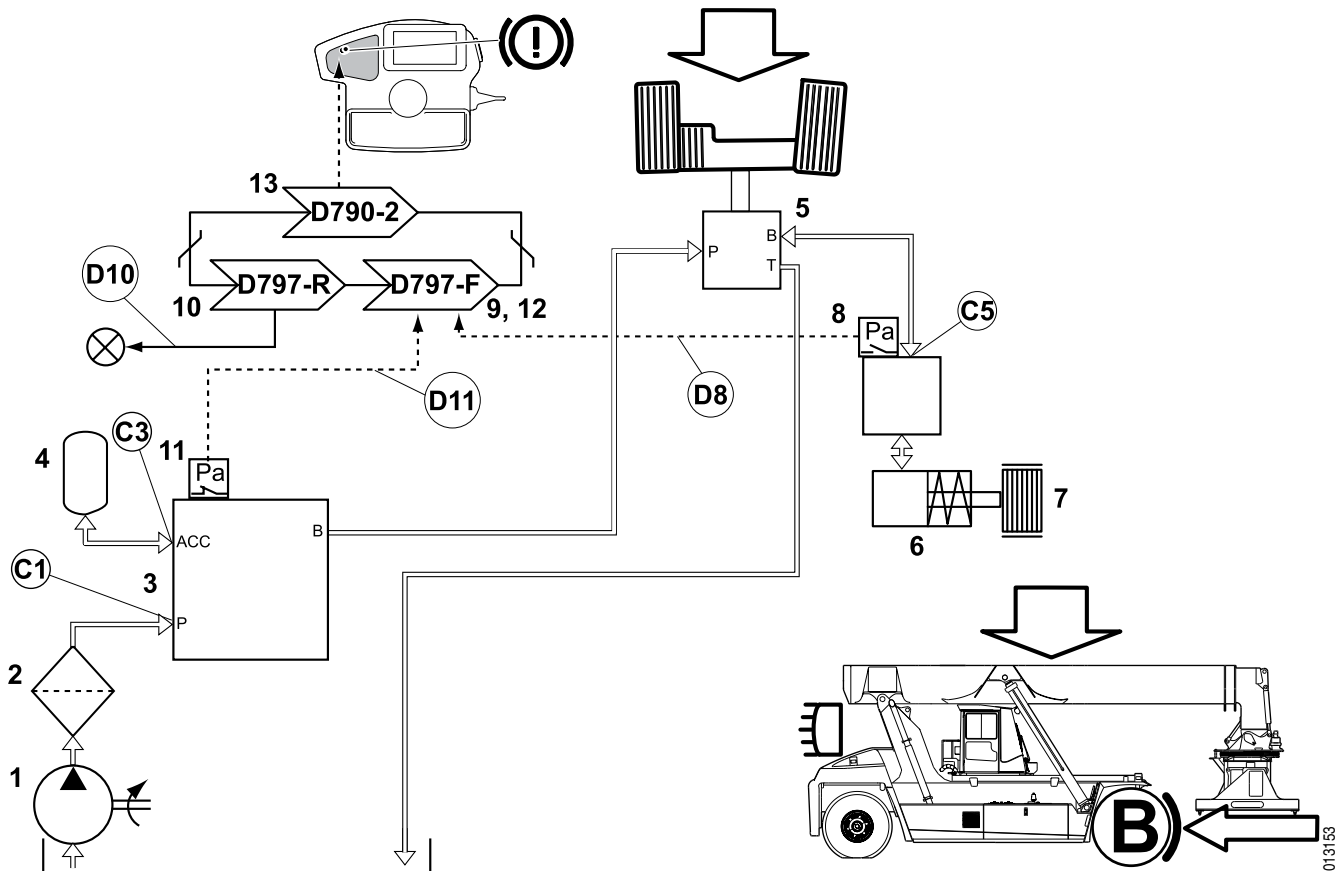
Check that the accumulator drain valve is fully closed and tighten the lock ring.

- 15 Lubricate and adjust the brake pedal, see *Brake pedal, checking and adjustment*, page 4:3.



4.3 Power-assisted brake system

Power-assisted brake system, function description



Pos	Explanation	Signal description	Reference
1	The brake oil pump pumps fluid from the brake oil tank.	$P = 20.5 \pm 1.0 \text{ MPa}$	<i>Brake oil tank, description, page 4:38</i> <i>Brake oil pump, description, page 4:6</i>
2	The brake oil filter cleans the oil.	-	<i>Brake oil filter, description, page 4:43</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 4:11</i>
4	The accumulators store oil pressure.	See the pressure plate, Accumulator pressure brake system, on the left-hand frame member.	<i>Accumulator, description, page 4:14</i>
5	The brake valve directs pressure from the accumulators to the brake cylinders proportional to the pressure on the pedal.	-	<i>Brake valve, description, page 4:18</i>
6	The brake cylinders compress the discs in the brake unit.	See the pressure plate, Brake pressure, on the left-hand frame member.	<i>Wheel brakes, description, page 4:26</i>
7	The wheel brakes brake the machine.	-	<i>Wheel brakes, description, page 4:26</i>

Pos	Explanation	Signal description	Reference
8	Make-contact (closing switch), brake light (S216) closes 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 (closing switch) brake lights, description, page 4:25</i> D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.5.4 <i>HYD</i> , menu 4
9	Control unit, frame front (D797-F) sends brake light request on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame front</i>
10	The brake lights are activated by Control unit, frame rear (D797-R).	U = 24 V	Section 9 <i>Frame, body, cab and accessories</i> , group 9.6.4 <i>Brake lights</i> D10: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.2.11 <i>LIGHTS</i> , menu 11
11	Break contact (opening switch), 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 oil pressure, description, page 4:23</i> D11: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.5.4 <i>HYD</i> , menu 4
12	Control unit, frame front (D797-F) transmits a warning about low brake pressure on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame front</i>
13	Control unit KIT (D790-2) activates Warning lamp brake pressure.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.11 <i>Control unit, KIT</i>

Hydraulic diagram, see section *E Schematics*, group 10 *Common hydraulics*, *Hydraulic diagram, basic machine*.

4.3.1 Brake oil pump

Brake oil pump, description

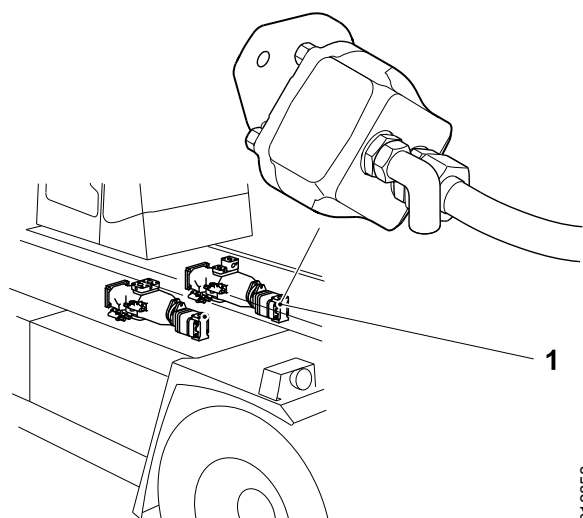
The brake system has a gear pump with fixed displacement. The pump is fitted at the front of the left-hand main pump. The pump generates hydraulic power, which is stored in the accumulators for brake force to the power-assisted brake and parking brake. It also generates the oil flow used for cleaning and cooling. The switchover between power generation and flow is regulated by the accumulator charging valve, see *Accumulator charging valve, description*, page 4:11.

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

For a description of how a gear pump works, see section 10 *Common hydraulics*, group 10.4.1 *Gear pump with fixed displacement*.

NOTE

It is very important that the clearance between the gears and between the gear and the housing is correct. Clearance that is too small creates wear damage. Clearance that is too large reduces the pump's power output.



1. Brake oil pump

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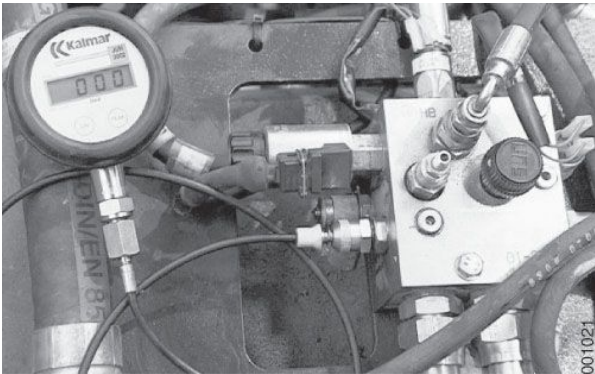
Brake oil pump, checking

NOTE

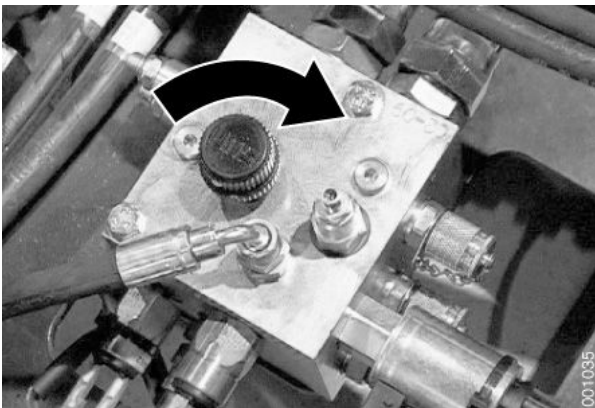
Read the safety instructions for oil before working, see section B Safety.

Checking the 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 section B Safety.
- 3 Depressurise the brake and hydraulic systems, see section B Safety.
- 4 Connect a pressure gauge (0-25 MPa) to the pump pressure measuring outlet on the accumulator charging valve.
- 5 Start the engine and run it at idle.



Measuring outlet, pump pressure

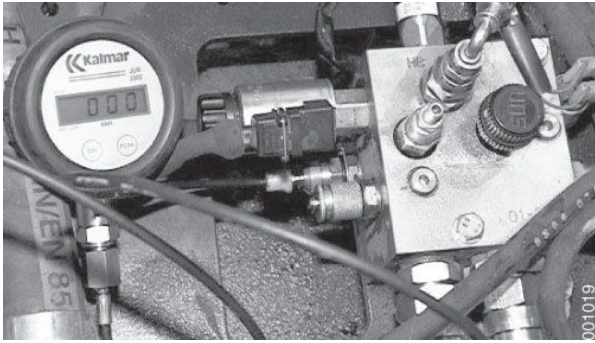


Close the accumulator charging valve

- 6 Close the drain valve on the accumulator charging valve and check the pump pressure during charging.
During charging the pressure should increase to **22 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 speed.
- 8 Turn off engine.
- 9 Depressurise the brake and hydraulic systems, see section B Safety.
- 10 Remove the pressure gauge and fit the protective cap on the measuring outlet.
- 11 Close the drain valve on the accumulator charging valve.

Checking the accumulator charging

- 12 Depressurise the brake and hydraulic systems, see section B Safety.

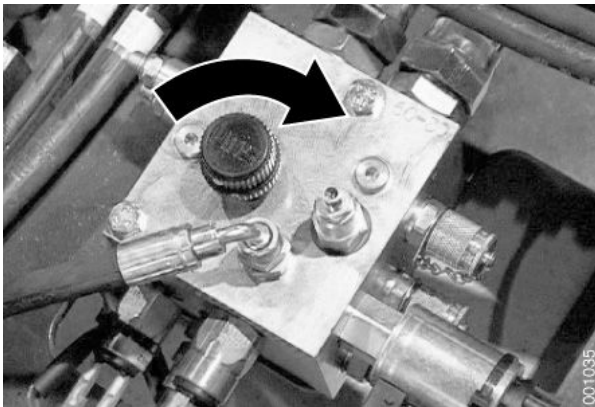


Measuring outlet, accumulator pressure

- 13 Connect a pressure gauge (0-25 MPa) to the accumulator pressure measuring outlet on the accumulator charging valve.
- 14 Start the engine and run it at idle.
- 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 must switch to charging at **15.5±0.5 MPa**.
- 18 Depressurise the brake and hydraulic systems, see section *B Safety*.
- 19 Remove the pressure gauge and fit the protective cap on the measuring outlet.
- 20 Close the drain valve on the accumulator charging valve.

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



Brake oil pump, replacement

NOTE

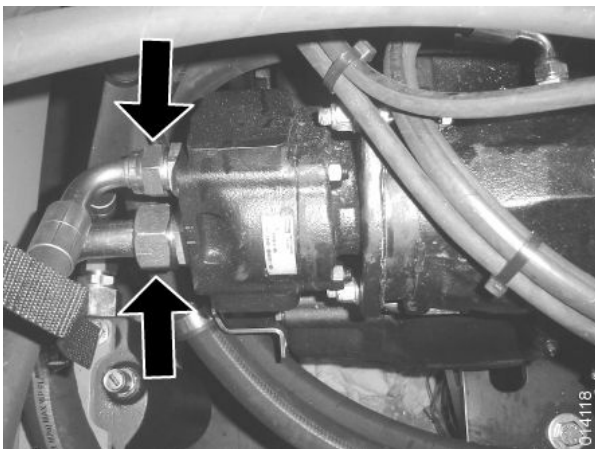
*Read the safety instructions for oil before working, see section *B Safety*.*

- 1 Machine in service position, see section *B Safety*.
- 2 Depressurise the brake and hydraulic systems, see section *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.





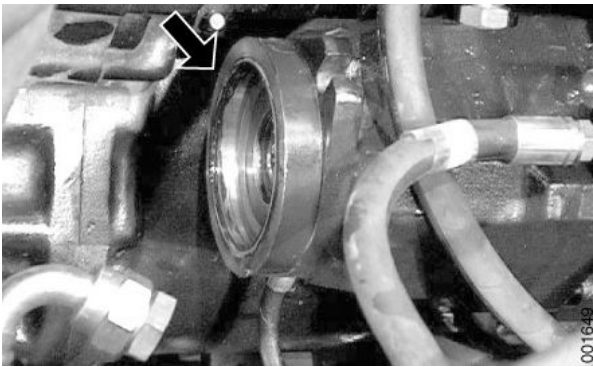
- 6 Remove the spacer ring from the brake oil pump or hydraulic oil pump.

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

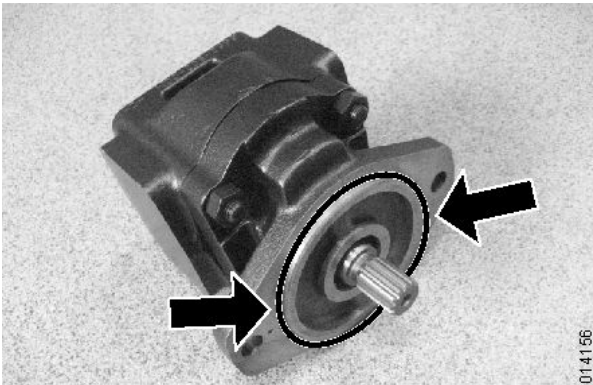
- 7 Check the O-rings and replace if necessary. Fit the O-rings on the spacer ring. Brush sealing silicone onto the sealing face against the brake oil pump, see section *F Technical data*.

NOTE

Only use silicone on the side facing the oil pump, brake system.



- 8 Fit the spacer ring on the main pump.

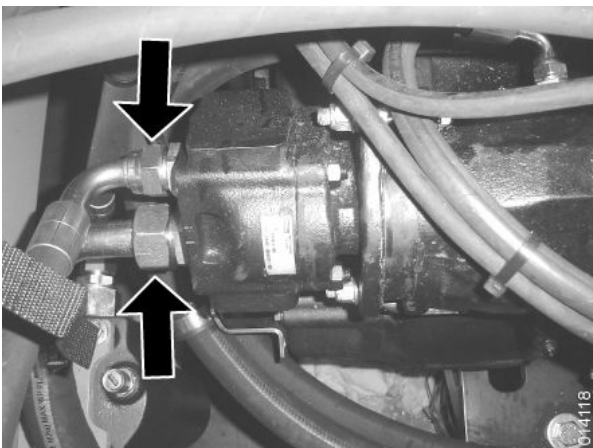


- 9 Brush sealing silicone onto the sealing face of the brake oil pump against the spacer ring, see section *F Technical data*.

- 10 Fit the brake oil pump on the main pump.

Fit the pump and check that the gear engages in the shaft and that the spacer ring is fitted directly against the pump.

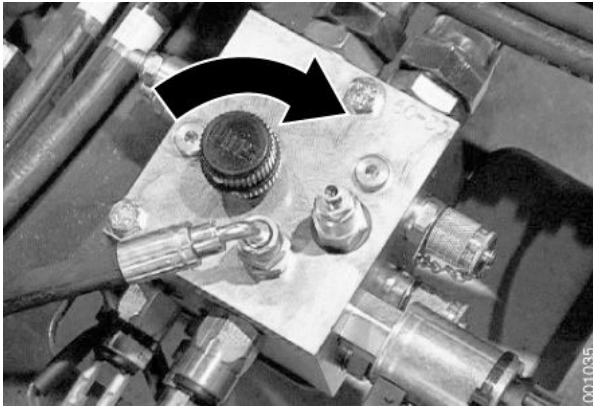
Fit the pump's attaching bolts.



- 11 Connect the hydraulic hoses to the brake oil pump.

NOTE

Check that the O-rings are intact, clean and in the correct position.



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

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.

- 13 Switch on the system voltage and start the engine.
- 14 Check that the hose connections and seal between the hydraulic oil pump and brake oil pump are sealed tightly.
Check the feed pressure from the brake oil pump, see *Brake oil pump, checking*, page 4:7.
- 15 Check the oil level in the brake system, fill if necessary.

NOTE

If the pump is replaced due to malfunction, change the oil and filter in the brake system as well.

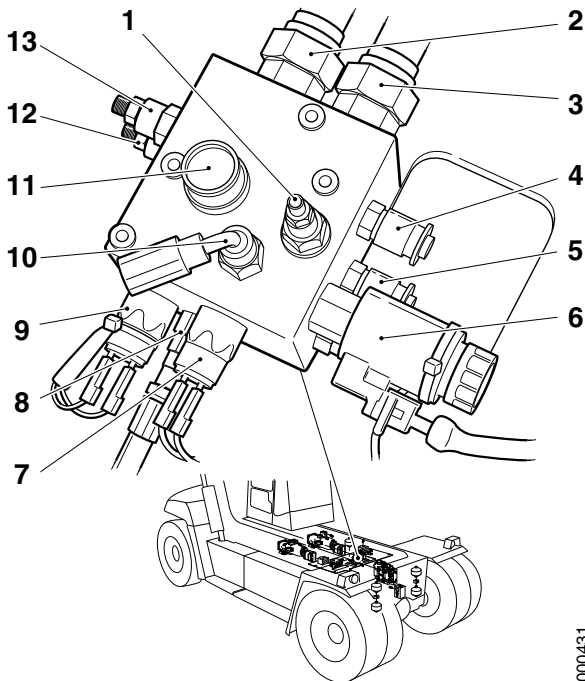
4.3.2 Brake oil filter

Brake oil filter, general

See *Brake oil filter, description*, page 4:43.

4.3.3 Accumulator charging valve

Accumulator charging valve, description



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. Break contact (opening switch), parking brake (GHB) (S200)
8. Connection, accumulators (ACC)
9. Break contact (opening switch), brake oil pressure (LB) (S204)
10. Connection, parking brake caliper (HB)
11. Drain valve
12. Main valve, charging
13. Pressure limiting valve

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

The accumulator charging valve stores pressure by directing the oil to the accumulators. The wheel brakes are cooled by oil being 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 idle the flow from the pump is so small that all oil flows to pressure storage.

The drain valve (position 11) is used to relieve 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 the accumulator pressure (position 5) and pump pressure (position 4) on the accumulator charging valve. The pressures are individual to each machine and the values are specified on the pressure plate on the left-hand frame member, see section 10 *Common hydraulics*. Also fitted on the accumulator charging valve are: Solenoid valve parking brake (position 6), Break contact (opening switch) brake oil pressure (position 9) and Break contact (opening switch) parking brake (position 7).

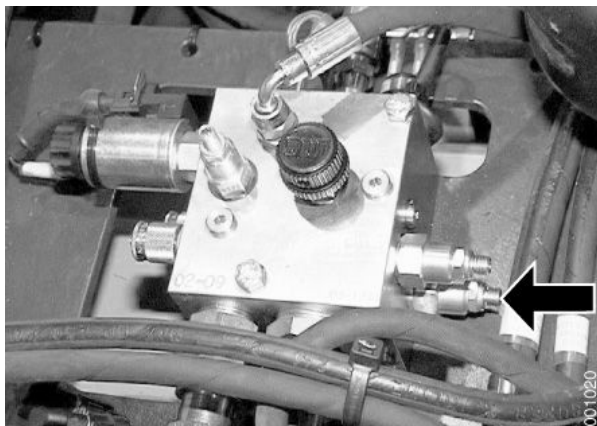
- *Solenoid valve parking brake, description, page 4:31*
- *Break contact (opening switch) brake oil pressure, description, page 4:23*
- *Break contact (opening switch) parking brake, description, page 4:36*

Accumulator charging, checking and adjustment

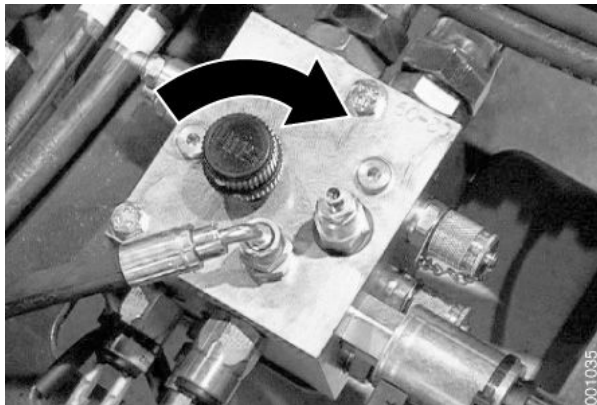
NOTE

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

- 1 Machine in service position, see section B Safety.
- 2 Check accumulator charging, see *Brake oil pump, checking*, page 4:7.
- 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.
Anticlockwise: 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



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

NOTE

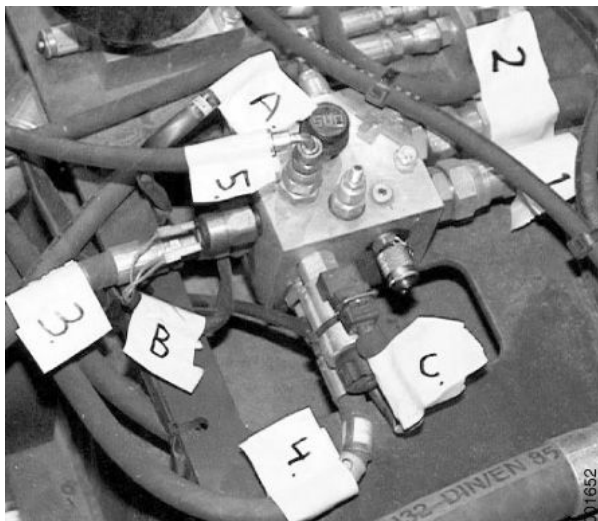
Check that the accumulator drain valve is fully closed and tighten the lock ring.

Accumulator charging valve, replacement

NOTE

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

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

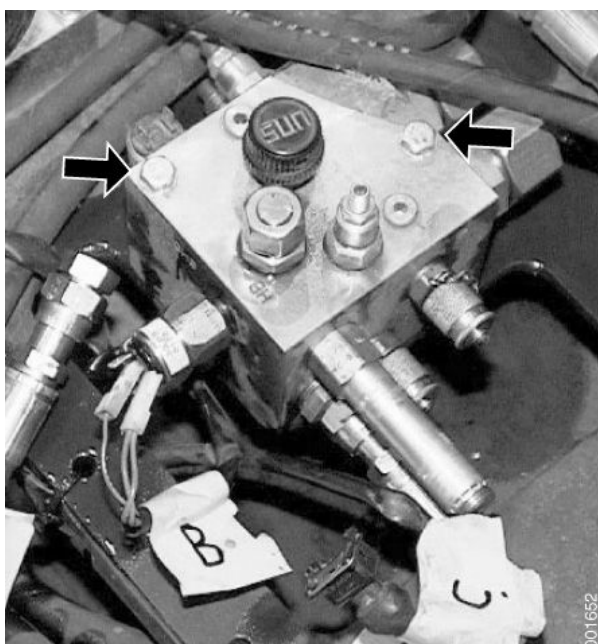


- 3 Mark up hydraulic hoses and electric cables.
- 4 Disconnect the cable harness from the accumulator charging valve.
- 5 Detach and plug all hydraulic hoses from the accumulator charging valve.

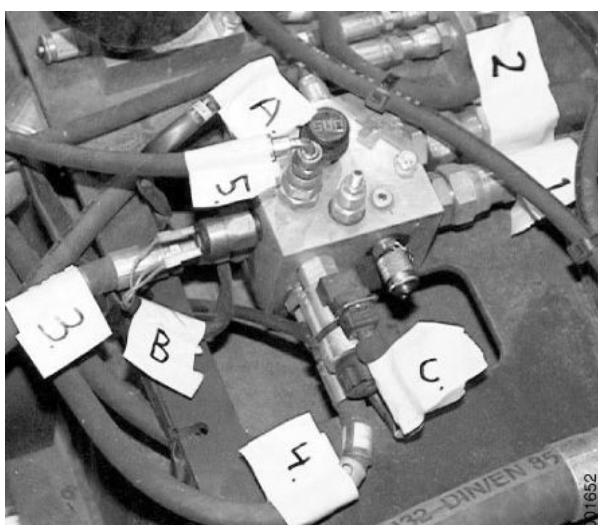
Remove the parking brake valve (C) for easier access.

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.

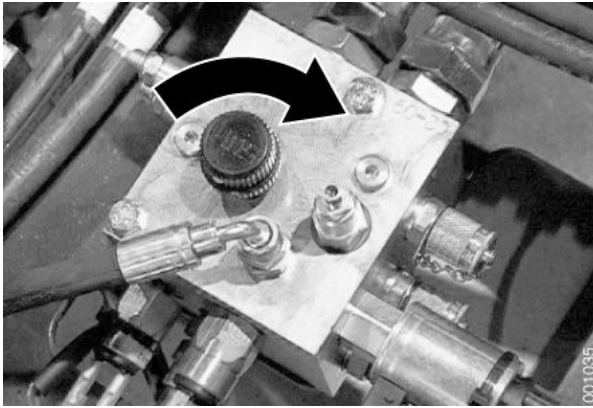


- 9 Connect the hoses to the accumulator charging valve in accordance with the marking.

NOTE

Check that the O-rings are intact, clean and in the correct position.

- 10 Fit the parking brake valve and break contact (opening switch) parking brake.
- 11 Connect the cable harness to the accumulator charging valve.



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

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.

- 13 Switch on the system voltage and start the engine.
Check that the hydraulic connections are sealed tightly.
- 14 Check the charging and switching function, see *Accumulator charging, checking and adjustment*, page 4:12.

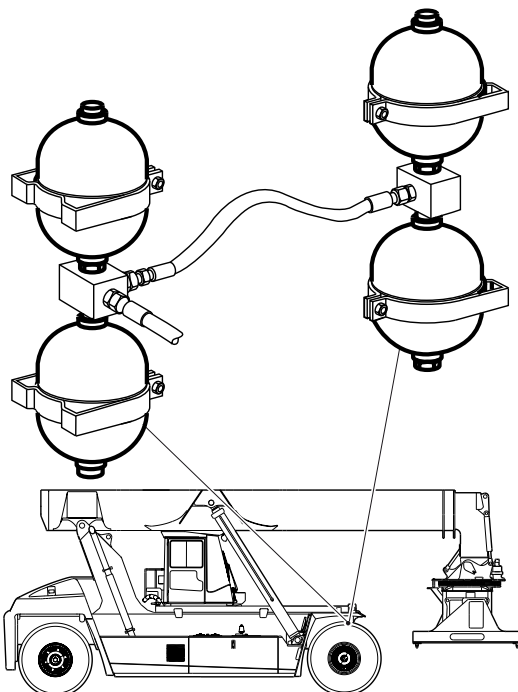
4.3.4 Accumulator

Accumulator, description

The accumulators store pressure so that there is a pressure reserve in the event of engine or brake system malfunction. The brake system has four accumulators connected in parallel. These are fitted at the front in the engine compartment, above the drive axle.

The accumulators are of the diaphragm type. Each accumulator is divided into two compartments by a diaphragm. One side of the diaphragm is pressurised by nitrogen gas. The other side is pressurised by the hydraulic oil, which compresses the nitrogen gas.

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



Accumulator, checking

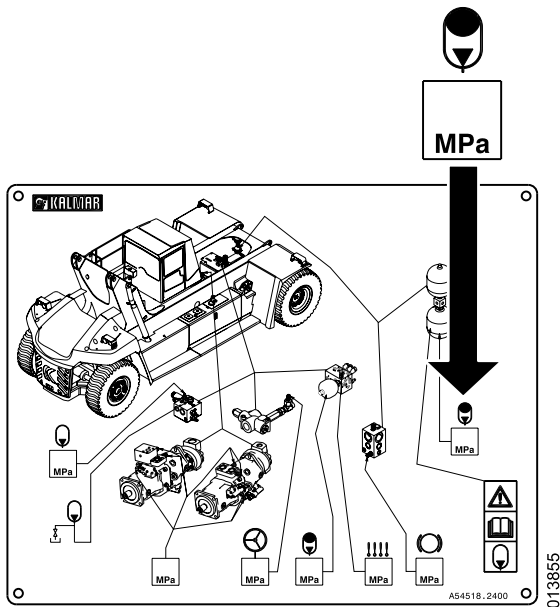
NOTE

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

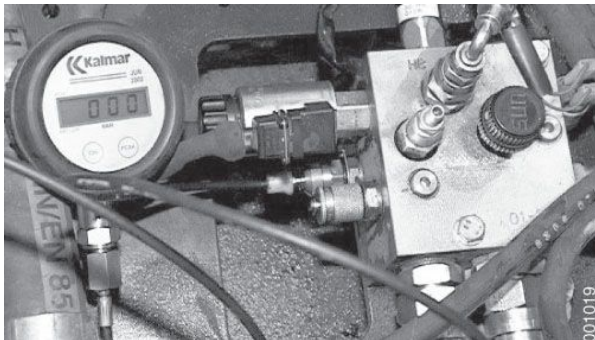
- 1 Machine in service position, see section *B Safety*.
- 2 Depressurise the brake and hydraulic systems, see section *B Safety*.
- 3 The accumulators can be tested with separate test equipment or in the machine. Primarily, separate test equipment should be used since it is faster and more accurate.

Test equipment can be ordered from Cargotec.

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



Pressure plate, gas pressure brake accumulators

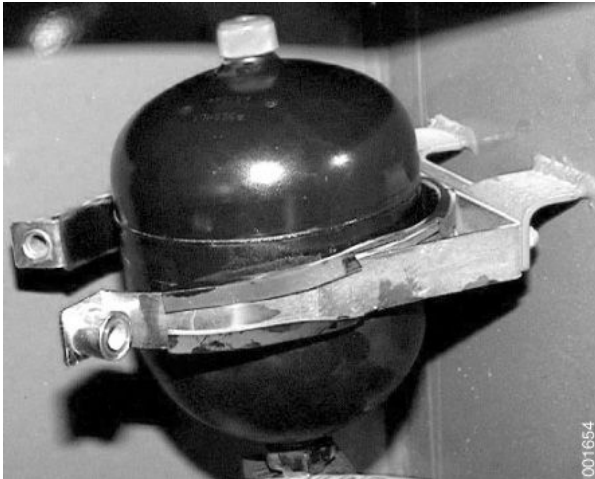


Checking with test equipment

- 4 Remove the accumulators and test them with the test equipment designed for the purpose.
The accumulators' gas pressure must match with the pressure plate.
- 5 Continue with step 17.

Checking in the machine

- 6 Detach three of the accumulators from the distribution blocks. Plug the distribution block connections with plugs that can withstand high pressure. Plug the connections on the accumulators to protect against impurities.
- 7 Connect a pressure gauge (0-25 MPa) to the accumulator pressure measuring outlet on the accumulator charging valve.
- 8 Switch on the system voltage 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 seal properly.
- 11 Turn off 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 switched off then the accumulator does not have any precharge pressure. This indicates internal leakage and the accumulator must be replaced.
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 handed over to authorised personnel for maintenance.
- 13 Depressurise the brake and hydraulic systems, see section *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 Depressurise the brake and hydraulic systems, see section *B Safety*.

Installation and final checking

- 17 Connect all accumulators to the distribution blocks. If necessary, replace or fill deficient accumulators.

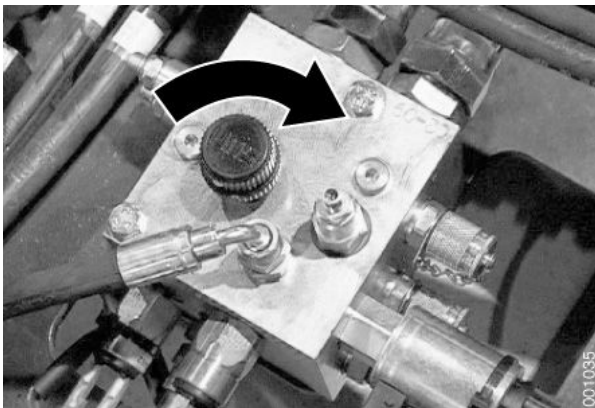
NOTE

Check that the seals are intact, clean and in the correct position.

- 18 Switch on the system voltage and start the engine.
- 19 Close the drain valve on the accumulator charging valve so that the accumulators are charged.

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



- 20 Check that the accumulators' connections are sealed tightly.
- 21 When the accumulators are fully charged, switch 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 be switched on.

Accumulator, replacement

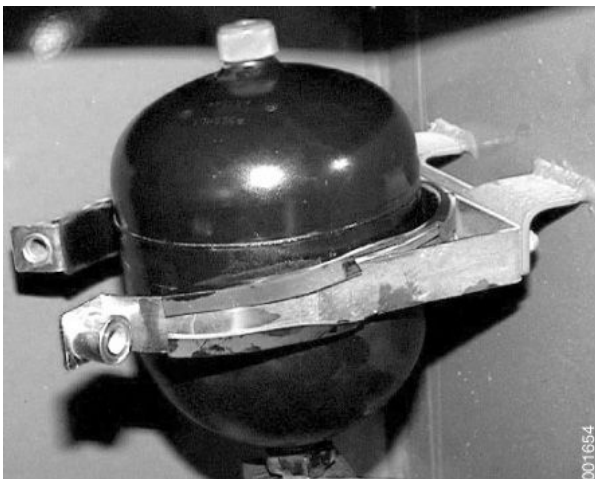
NOTE

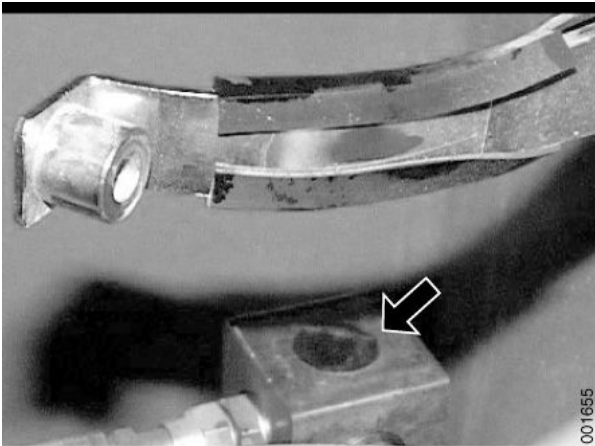
*Read the safety instructions for oil before working, see section *B Safety*.*

- 1 Machine in service position, see section *B Safety*.
- 2 Switch off the engine and switch off the system voltage.
- 3 Depressurise the brake and hydraulic systems, see section *B Safety*.
- 4 Detach the accumulator's clamp and remove the bolt.
- 5 Detach the accumulator from the distribution block.

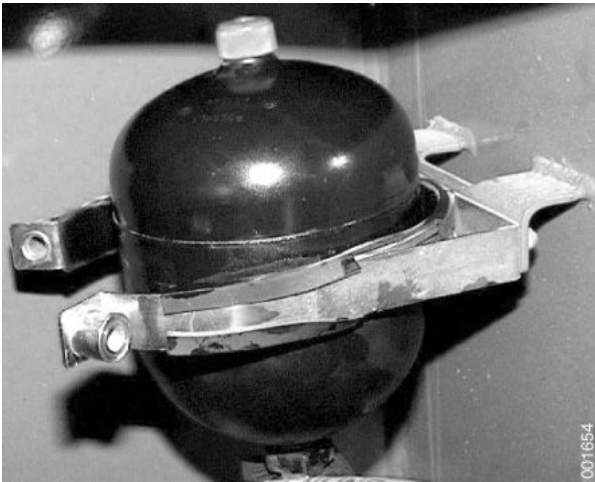
NOTE

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





- 6 Bend the clamp away and remove the accumulator.

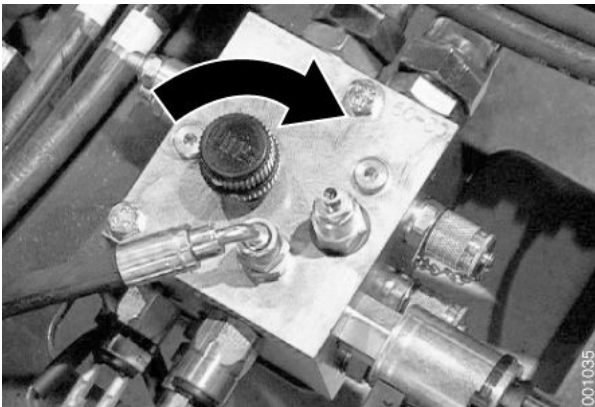


- 7 Fit the new accumulator.

NOTE

Check that the seal is intact, clean and fitted in the correct position.

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



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

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.

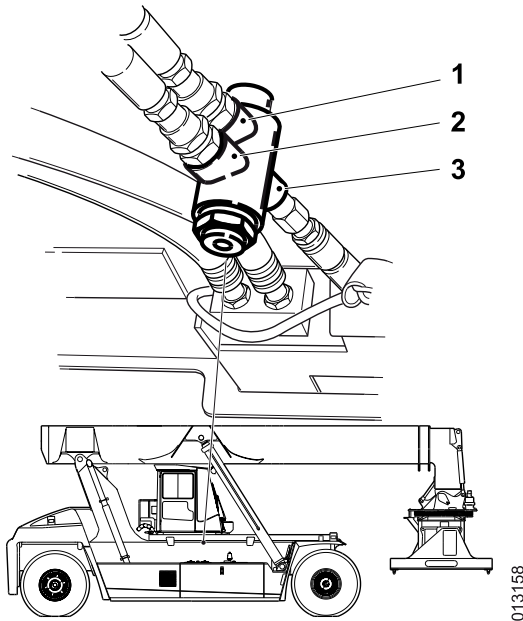
- 10 Switch on the system voltage and start the engine.
11 Check that the accumulator's connection is sealed tightly.
12 Check precharging and function, see *Accumulator, checking*, page 4:14 steps 18-19.

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 pedal force to the valve.

The brake valve is a mechanically activated proportional valve. This means that the resistance in the brake valve increases in proportion to 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).



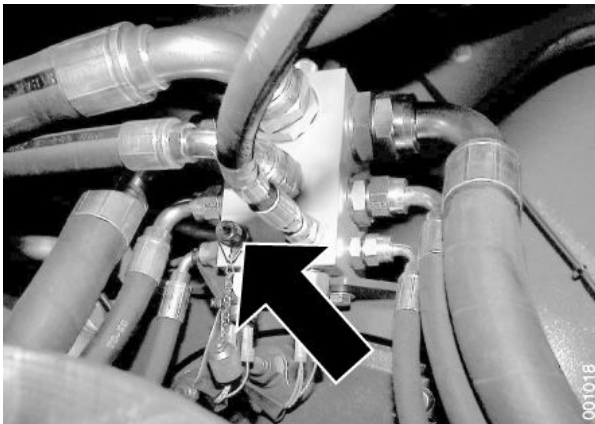
1. Inlet from accumulator [P]
2. Return connection [T]
3. Outlet to brake cylinders [B]

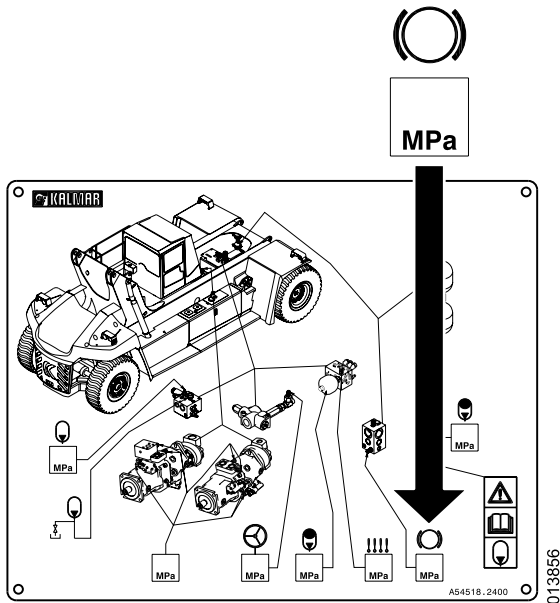
Brake valve, checking

NOTE

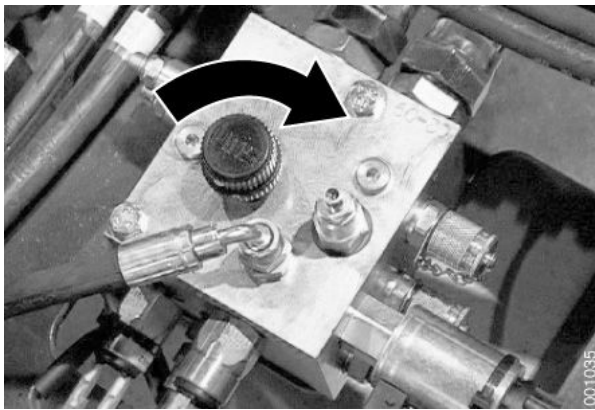
Read the safety instructions for oil before working, see section B Safety.

- 1 Operate and warm up the machine so that the brake system's oil reaches operating temperature, at least 50 °C.
- 2 Machine in service position, see section B Safety.
- 3 Depressurise the brake and hydraulic systems, see section 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 idle 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 with the pressure plate on the left-hand frame member.
- 8 Turn off 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 must decrease to 0 MPa immediately. Otherwise the brake valve is not sealed and could cause the brakes to remain applied and then overheat during operation.
Replace the brake valve if it is not sealed.
- 11 Depressurise the brake and hydraulic systems, see section *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.

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.

Brake valve, replacement

NOTE

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

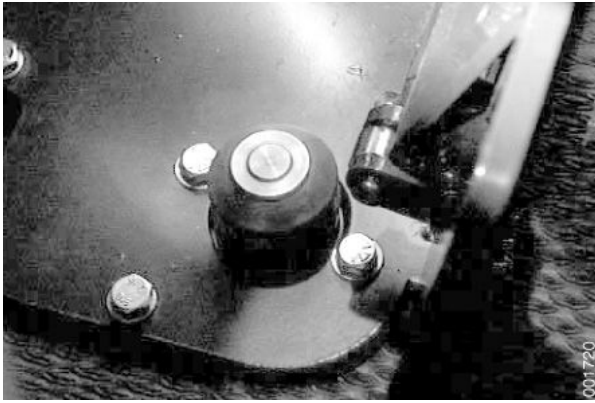
- 1 Slide the cab forward slightly so that the brake valve is accessible under the cab.
- 2 Machine in service position, see section *B Safety*.
- 3 Depressurise the brake and hydraulic systems, see section *B Safety*.
- 4 Mark up and detach the hydraulic hoses from the brake valve.

NOTE

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

- 5 Secure the brake valve under the cab.

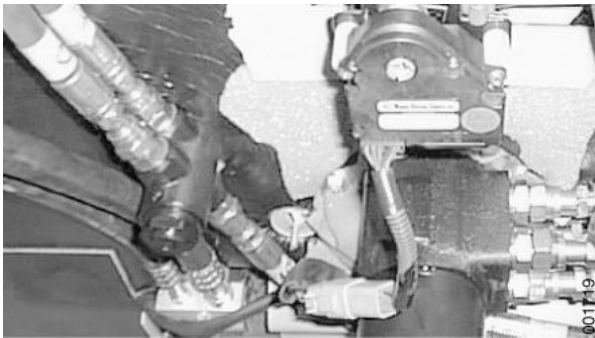




- 6 Remove the brake valve's attaching bolt.
- 7 Remove the brake valve.
- 8 Transfer the connection adapters to the new brake valve.
- 9 Install the new brake valve.

NOTE

Remember the spacer ring.

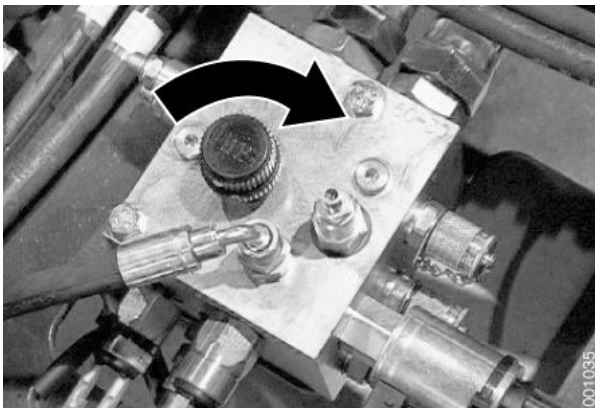


- 10 Connect the hydraulic hoses to the brake valve in accordance with the marking.

NOTE

Check that the O-rings are intact, clean and in the correct position.

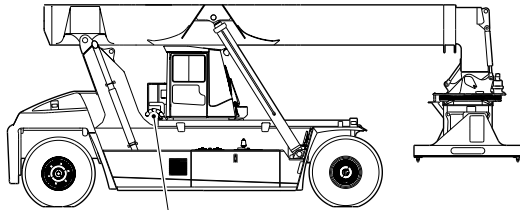
- 11 Lubricate and adjust the brake pedal, see *Brake pedal, checking and adjustment*, page 4:3.



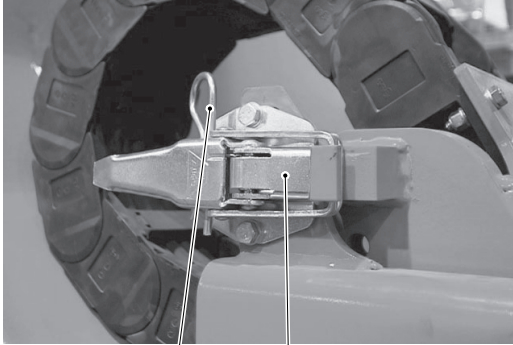
- 12 Close the drain valve on the accumulator charging valve.

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



A



B

C

- A Location, locking catch
- B Lock pin
- C locking catch for securing the cab

- 13 Secure the cab in the rearmost position with the cab locks.



WARNING

The cab has the manual sliding cab function. The cab must ALWAYS be in the rear position while operating the machine.

Warning - risk of crushing!

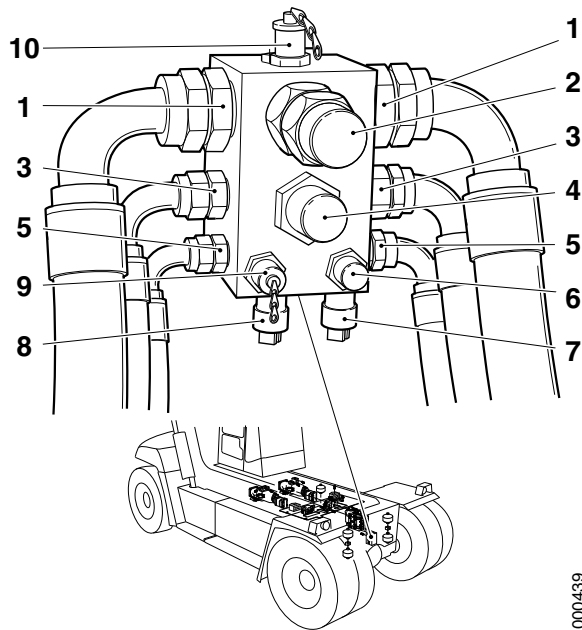
Always make sure that the cab locks on both sides are locked in their rear position before operating, and that the locks are secured with the lock pins.

- 14 Switch on the system voltage and start the engine. Let the engine run at idle speed.
- 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 4:28.

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4.3.6 Drive axle block

Drive axle block, description



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

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

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

4 There are two switches fitted on the drive axle block: Make-contact (closing switch) brake light (S216), see *Make-contact (closing switch) brake lights, description*, page 4:25 and Make-contact (closing switch) declutch (S220-2), see section 2 *Transmission*, group 2.8.2 *Make-contact (closing switch) declutch*.

1. Connection brake cooling, return from wheel brake
2. Connection brake cooling, return to radiator
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 (closing switch), declutch (S220-2)
8. Make-contact (closing switch), brake light (S216)
9. Measuring outlet, brake pressure
10. Measuring outlet, back pressure brake cooling

000439

4.3.7 Break contact (opening switch) brake oil pressure

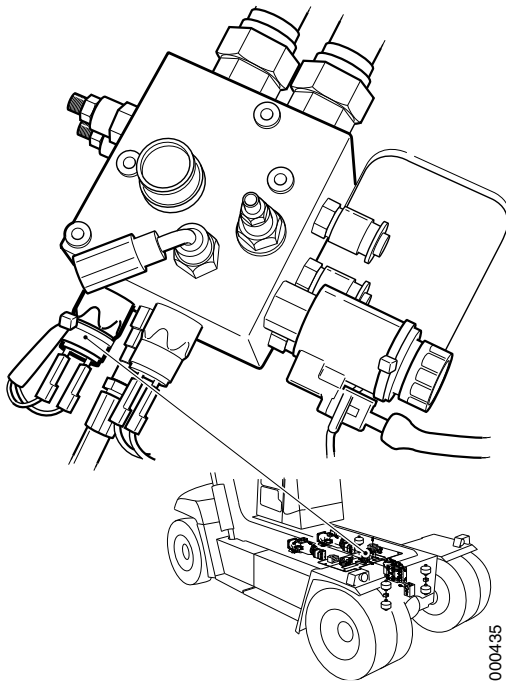
Break contact (opening switch) brake oil pressure, description

Break contact (opening switch) brake oil pressure (S204) detects the pressure in the accumulators. The break contact (opening switch) is fitted on the accumulator charging valve on the lifting 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 another eight brake applications without additional feed from the pump after the lamp has illuminated.

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

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.5.4 *HYD*, menu 4.

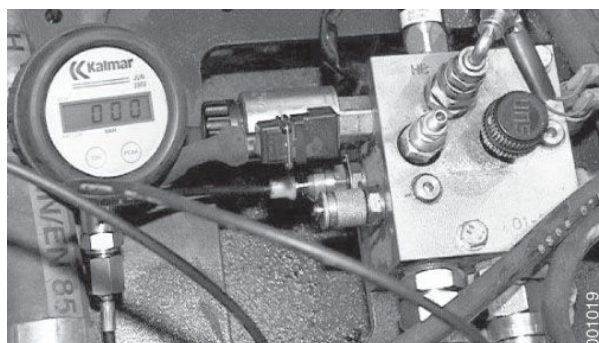


Break contact (opening switch) brake oil, adjustment

NOTE

Read the safety instructions for oil before working, see section 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 section *B Safety*.
- 3 Depressurise the brake and hydraulic systems, see section *B Safety*.



- 4 Connect a pressure gauge (0-25 MPa) to the accumulator pressure measuring outlet 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 Stop the engine and turn the start key to position I.
- 8 Brake several times, stop when the warning lamp for low brake pressure illuminates.
- 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.

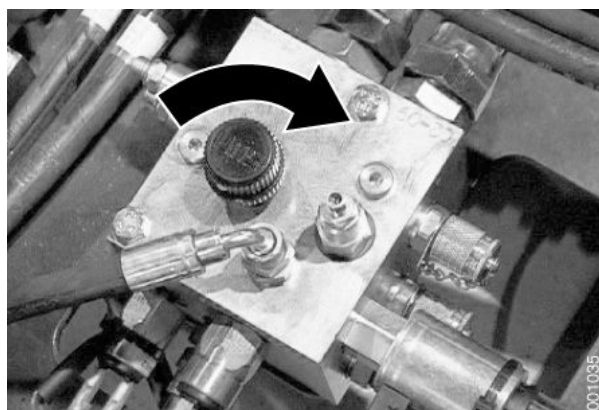
NOTE

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

- 11 Repeat steps 6-10 until the warning lamp illuminates at 11.5 MPa.
- 12 Seal the adjusting screw with locking fluid.
- 13 Depressurise the brake and hydraulic systems, see section *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.

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



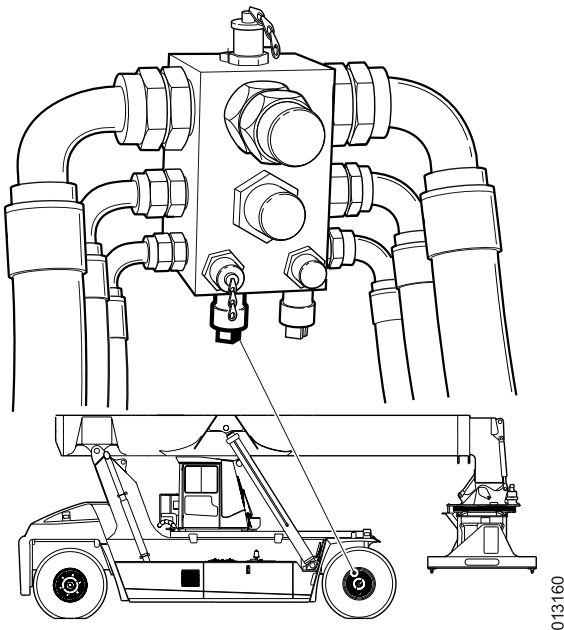
4.3.8 Make-contact (closing switch) brake lights

Make-contact (closing switch) brake lights, description

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

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

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.5.4 *HYD*, menu 4.

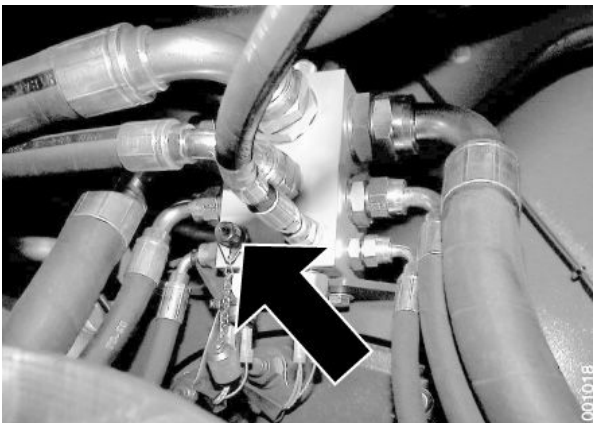


Make-contact (closing switch) brake light, checking

NOTE

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

- 1 Operate and warm up the machine until the brake system's oil reaches operating temperature, at least 50 °C.
- 2 Stop the engine and turn the start key to position I.
- 3 Brake and check that the brake light is switched on.
- 4 Depressurise the brake and hydraulic systems, see section 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.



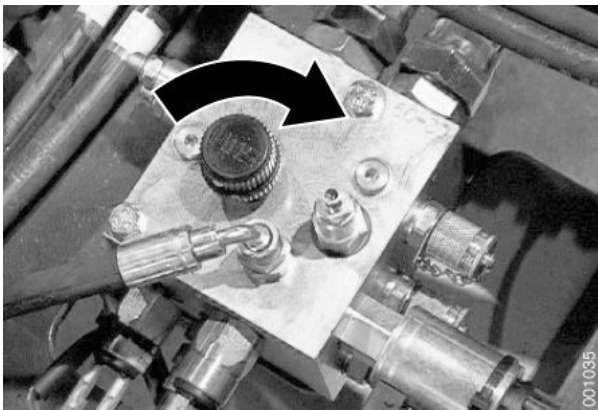
DIAG HYD	4 (6)
PRESSURE SWITCHES	
BRAKE PRESSURE	X
BRAKE LIGHT PRESS.	X
DECLUTCH PRESSURE	X

000144

- 8 Use the display, go to the diagnostic menu, see section *8 Control system*, group *8.4.5.4 HYD*, menu *4*.
BRAKE LIGHT PRESS. indicates status for the brake light switch.
1 = Activated switch (brakes applied).
- 9 Depress the brake pedal slowly until the brake light is switched on or the status of the input signal changes. Keep the pedal in this position and check the pressure on the pressure gauge.
The status should change and the brake light should be switched on when the pressure is **approx. 0.2 MPa**.
- 10 Turn off engine.
- 11 Depressurise the brake and hydraulic systems, see section *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.

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.

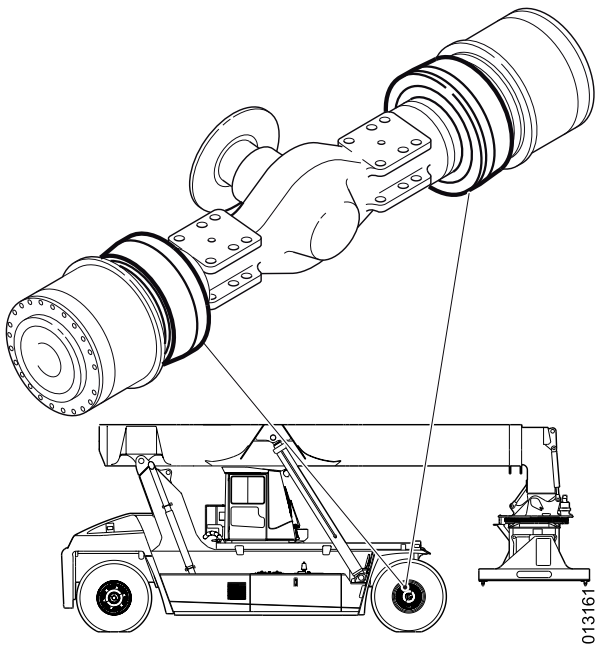


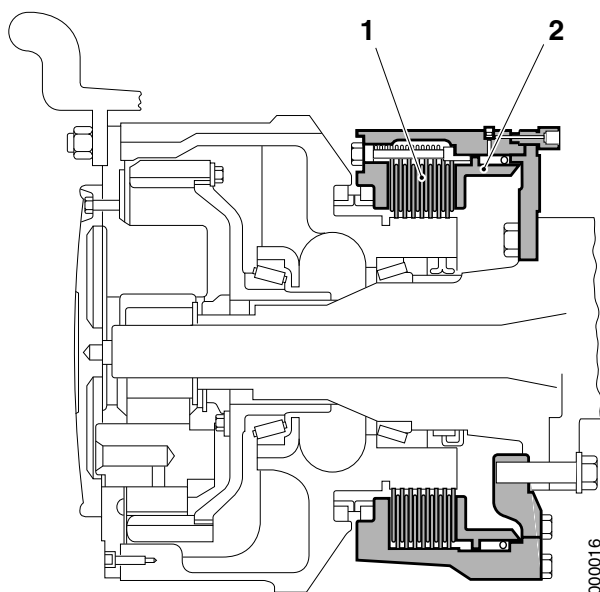
4.3.9 Wheel brakes

Wheel brakes, description

The wheel brakes brake the machine during operation and are fitted 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 require minimal maintenance and have a long service life due to efficient cooling. Maintenance requirements are minimised since oil circulates in the brake system and prevents corrosion.





The wheel brakes have two main sections - disc pack and brake cylinder. The disc pack performs the braking. The brake cylinder presses the discs in the disc pack together during braking.

Wheel hub and brake, cross-section

1. Disc pack
2. Brake cylinder

Wheel brakes, bleeding

NOTE

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

IMPORTANT

Both the brake cylinder and disc brake must be bled after work which involves the brake system being opened or after work on the wheel brake.

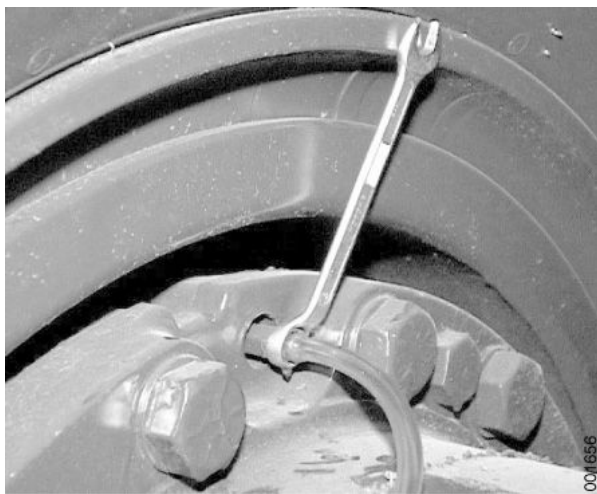
Brake cylinder

- 1 Machine in service position, see section B Safety.
- 2 Position a ring spanner on the bleed nipple and connect a transparent hose to the bleed nipple.
Route the other end of the hose down into a receptacle.
- 3 Start the machine and depress the brake pedal, keep the pedal depressed.
- 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 long. So allow at least two litres of oil to pass through the bleed 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.



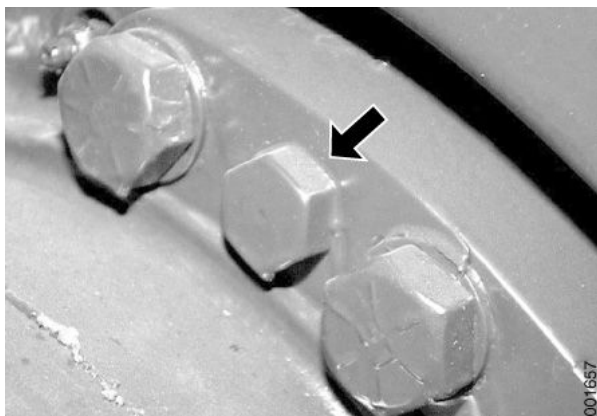
Bleed nipple, brake cylinder, on top of the drive axle at the wheel hub's inner short side (left-hand side).

Disc brake

NOTE

Disc brake ventilation is vital for the correct cooling of the discs.

- 1 Start the engine and run the engine at idle. Wait until the brake accumulators are fully charged and the accumulating charging valve has switched to brake cooling.
- 2 Remove the bleed screw for the disc brake and allow oil to flow out of the hole until it is free of air bubbles. Refit the bleed screw.
- 3 Repeat steps 1-3 on the other wheel.
- 4 Check the oil level in the brake system, fill if necessary.



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*.

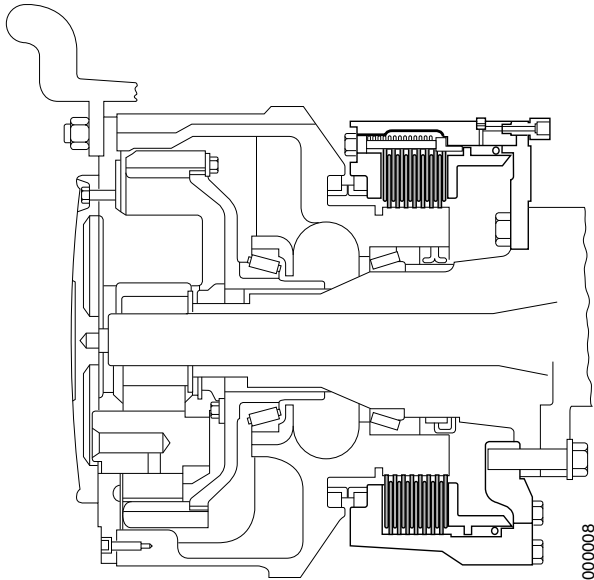
4.3.9.1 Disc pack

Disc pack, description

The disc pack consists of several thin coated metal discs fixed alternately to the wheel brake housing and to the hub reduction housing. The discs are mounted on splines, which allows them to 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 takes place by means of 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.



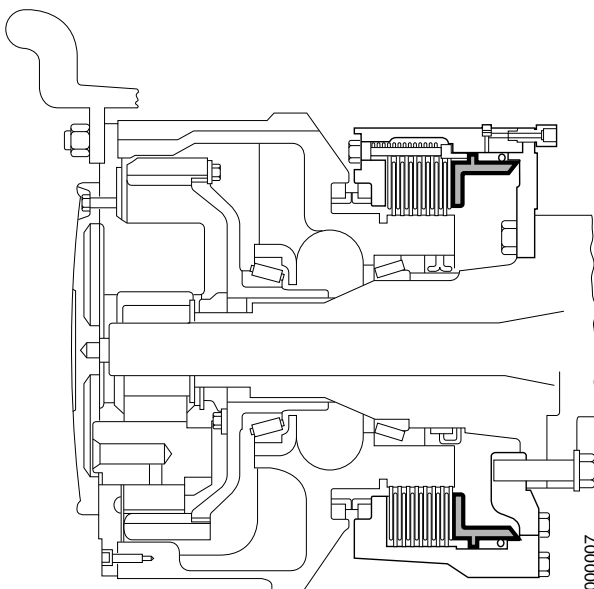
Disc pack

4.3.9.2 Brake cylinder

Brake cylinder, description

The brake cylinder is integrated in the wheel brake and consists of a metal ring (cylinder) with two seal rings. The seals have lateral support from a bevel on the cylinder and a bevel on the wheel brake housing.

The space between the seal rings is pressurised through a channel in the wheel brake housing. The pressure moves the metal ring sideways and compresses the disc pack.



Brake cylinder

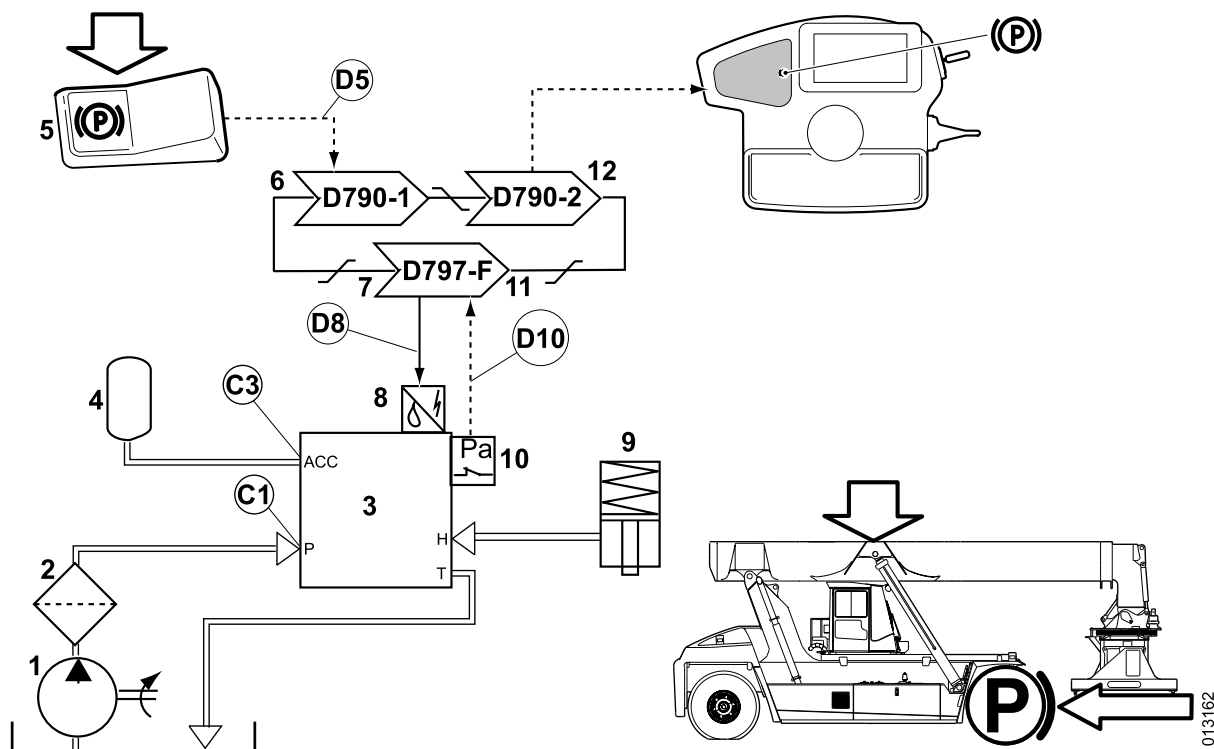
4.3.10 Pipes and hoses

Piped 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 fluid from the brake oil tank.	$P = 20.5 \pm 1.0 \text{ MPa}$	<i>Brake oil tank, description, page 4:38</i> <i>Brake oil pump, description, page 4:6</i>
2	The brake oil filter cleans dirt from the oil.	-	<i>Brake oil filter, description, page 4:43</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 4:11</i>
4	The accumulators store oil pressure.	See the pressure plate on the left-hand frame beam.	<i>Accumulator, description, page 4:14</i>
5	Switch parking brake (S107) activates the parking brake. The switch uses two released, 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, $U = 22-28 \text{ V}$ Conn 7, $U = 0 \text{ V}$ Switch in home position: Conn 1, $U = 0 \text{ V}$ Conn 7, $U = 22-28 \text{ V}$	Section 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instruments</i> D5: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.5.5 <i>HYD, menu 5</i>
6	Control unit, cab (D790-1) transmits release or apply parking brake on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
7	Control unit, frame front (D797-F) activates Solenoid valve parking brake (Y642).	$U = 24 \text{ V}$	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame front</i> D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.5.5 <i>HYD, menu 5</i>
8	Solenoid valve parking brake (Y642) acts on the valve slide which drains pressure in the parking brake's brake caliper to tank.	Pump pressure.	<i>Solenoid valve parking brake, description, page 4:31</i> D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.5.5 <i>HYD, menu 5</i>

Pos	Explanation	Signal description	Reference
9	The brake caliper is drained of pressure and the spring applies the parking brake.	0 MPa	<i>Parking brake unit, description, page 4:32</i>
10	Break contact (opening switch) parking brake (S200) closes the circuit when the pressure decreases.	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 (opening switch) parking brake, description, page 4:36</i> D10: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.5.5 <i>HYD</i> , menu 5
11	Control unit, frame front (D797-F) transmits Parking brake applied on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame front</i>
12	Control unit KIT (D790-2) activates indicator light, parking brake (508).	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.11 <i>Control unit, KIT</i>

Hydraulic diagram, see section *E Schematics*, group 10 *Common hydraulics*, *Hydraulic diagram, basic machine*.

4.5.1 Brake oil pump

Brake oil pump, general

See *Brake oil pump, description*, page 4:6.

4.5.2 Brake oil filter

Brake oil filter, general

See *Brake oil filter, description*, page 4:43.

4.5.3 Solenoid valve parking brake

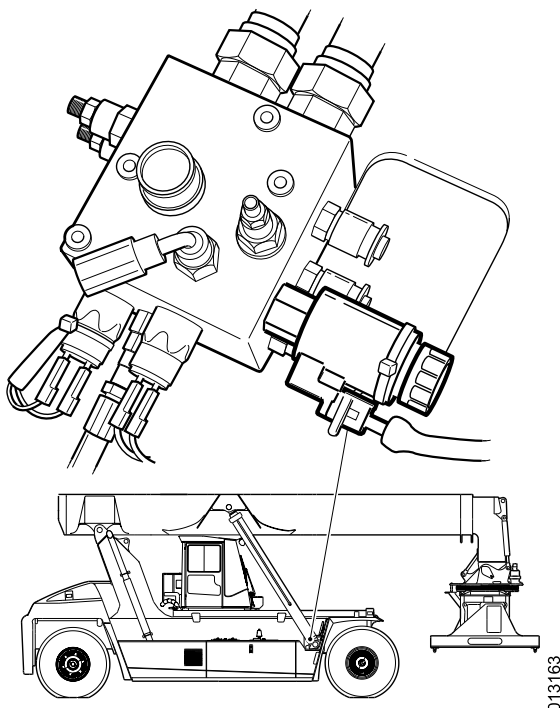
Solenoid valve parking brake, description

Solenoid valve parking brake (Y642) activates the parking brake. The solenoid valve is fitted on the accumulator charging valve, which is fitted on the lifting beam in front of the transmission in the engine compartment, see *Accumulator charging valve, description*, page 4:11.

The solenoid valve opens a connection between the accumulators and the parking brake caliper on activation. This means that the parking brake caliper is pressurised and the parking brake is released. When the voltage feed to the solenoid valve is cut off, the connection between the accumulators and parking brake caliper is closed. Instead, a connection between the parking brake caliper and tank is opened and the parking brake is applied. This means that the parking brake is applied if the machine becomes de-energised or if the brake system becomes depressurised.

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

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.5.5 *HYD*, menu 5.



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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 idle until the warning lamp for brake pressure goes out and the accumulator charging valve changes to cooling.
- 2 Switch off the engine and turn the start key to position I.
- 3 Release the parking brake with the switch for the 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 switch for the parking brake and check that the parking brake's brake caliper is applied.

4.5.4 Parking brake unit

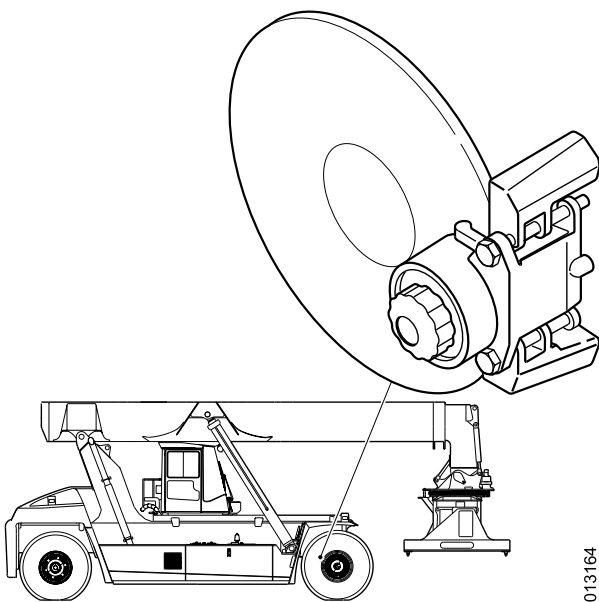
Parking brake unit, description

The parking brake unit keeps the machine stationary when parked. The parking brake unit is fitted on the drive axle input shaft between the propeller shaft and drive axle.

The parking brake acts on the propeller 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 feed 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 in motion, the brake disc and brake pads must be replaced.



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Parking brake unit, checking and adjustment



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 Switch 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 Loosen the lock nut.
- 8 Adjust the adjusting screw so that the brakes are applied.
- 9 Turn back the adjusting screw so that the clearance between pad and disc is 0.5 ± 0.1 mm.
- 10 Tighten the lock nut.

NOTE

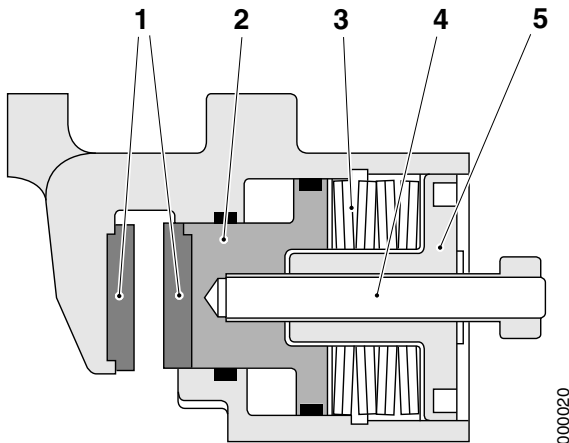
To avoid turning the adjusting screw as well it must be held still when tightening the lock nut.

- 11 Refit the cover to the caliper.
- 12 Test the function of the parking brake.

4.5.4.1 Parking brake caliper

Brake caliper, description

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



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

4.5.4.2 Parking brake pads

Brake pads, description

The brake pads consist of a metal plate with friction material (lining).

Brake pads, replacement



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 blocked, see section *B Safety*.
- 2 Remove the cover from the brake caliper.





- 3 Loosen the lock nut.
- 4 Slacken the adjusting screw to release the brake pads.
- 5 Remove the split pin and undo the nut on one of the attaching bolts holding the parking brake caliper in place.



- 6 Pull the attaching bolt out so that the brake pads can be angled out and removed.

NOTE

The bolt does not need to be removed.

- 7 Remove the parking brake pads.
- 8 Clean the brake disc with methylated spirit.
- 9 Fit new parking brake pads.
- 10 Press back the attaching bolt.
- 11 Fit the nut and a new split pin.
- 12 Adjust the parking brake, see *Parking brake unit, checking and adjustment*, page 4:33.

4.5.4.3 Parking brake disc

Brake disc, description

The brake disc is fitted on the drive axle input shaft. The drive axle's gear ratio amplifies the braking force.

4.5.5 Break contact (opening switch) parking brake

Break contact (opening switch) parking brake, description

Break contact (opening switch) parking brake (S200) detects whether the parking brake is applied or released. The break contact (opening switch) is fitted on the accumulator charging valve, which is fitted on the lifting beam in front of the transmission in the engine compartment, see *Accumulator charging valve, description*, page 4:11.

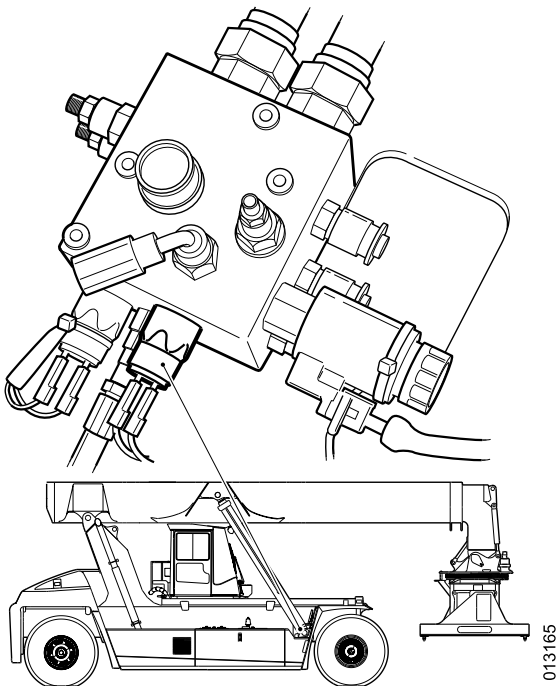
Break contact (opening switch) parking brake (S200) senses the pressure in the parking brake circuit. When the pressure is so high that the parking brake is released, the sensor opens an electric circuit. This is used to indicate that the parking brake is released.

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

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.5.5 *HYD*, menu 5.

NOTE

Gears cannot be engaged when the parking brake is applied.



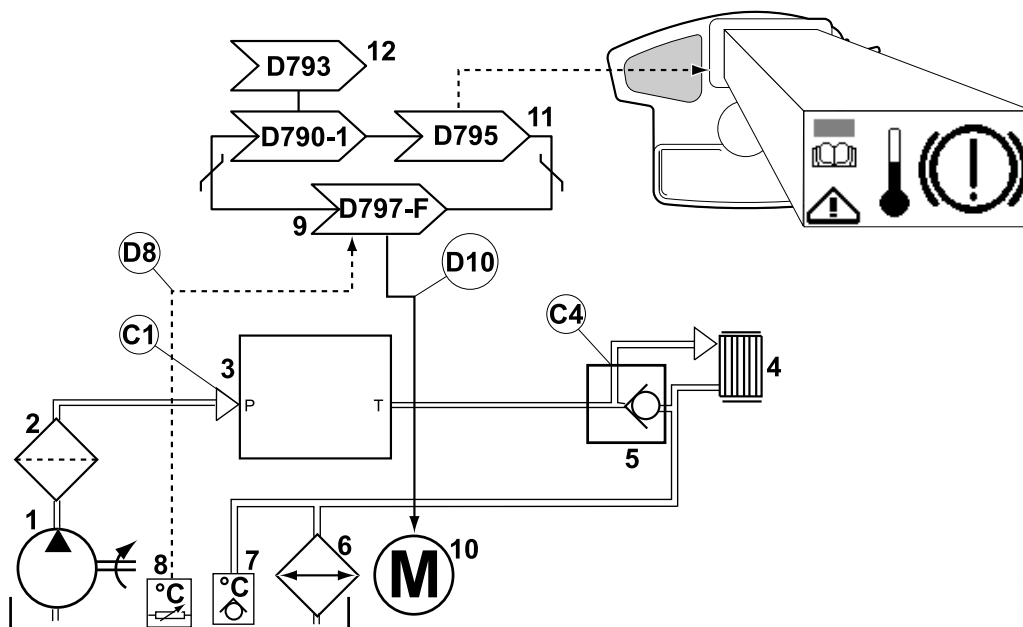
4.5.6 Pipes and hoses

Piped and hoses, description

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

4.8 Temperature control, cleaning and oil brake system

Temperature control, cleaning and oil brake system, function description



Pos	Explanation	Signal description	Reference
1	The brake oil pump pumps fluid from the brake oil tank.	P = 20.5±1.0 MPa	<i>Brake oil pump, description, page 4:6</i> <i>Brake oil tank, description, page 4:38</i>
2	The brake oil filter cleans the oil.	-	<i>Brake oil filter, description, page 4:43</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 4:11</i>
4	The oil cools the wheel brake.	-	<i>Wheel brakes, description, page 4:26</i>
5	The bypass valve in the distribution block leads oil past the drive axle if the back pressure through the wheel brake is too great.	-	<i>Drive axle block, description, page 4:22</i>
6	The cooler cools the oil.	-	<i>Oil cooler, description, page 4:39</i>
7	The thermo-bypass valve leads oil past the cooler if the temperature is low.	approx. 50 °C	<i>Thermal bypass valve, description, page 4:40</i>
8	The temperature sensor (B762) detects the oil temperature and sends a voltage signal proportional to the oil temperature to Control unit, frame front (D797-F).	R = 25 kΩ at 20 °C	<i>Sensor, oil temperature brake system, description, page 4:41</i> D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.5.2 <i>HYD, menu 2</i>
9	Control unit, frame front (D797-F) sends oil temperature information on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame front</i>
10	When the oil is hot, Control unit, frame front (D797-F) activates the cooling fan (M674) and increases the airflow through the cooler.	U = 24 V with activated fan Activates at 65 °C Deactivates at 55 °C	<i>Cooling fan, description, page 4:40</i> D10: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.5.2 <i>HYD, menu 2</i>

Pos	Explanation	Signal description	Reference
11	If the temperature is high Control unit KID (D795) activates a warning for high brake system oil temperature in the display.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.12 <i>Control unit, KID</i>
12	If the temperature is high then the Control unit, transmission (D793) limits the machine's speed in order to protect the brakes.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.9 <i>Control unit, transmission</i>

Hydraulic diagram, see section *E Schematics*, group 10 *Common hydraulics*, *Hydraulic diagram, basic machine*.

4.8.1 Brake oil tank

Brake oil tank, description

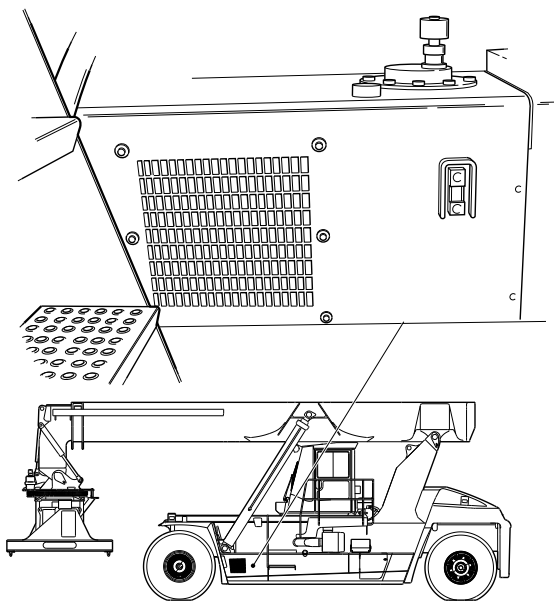
The brake oil tank stores oil in the brake system and is fitted on the left-hand side of the machine in front of the fuel tank.

The brake system is separate from other hydraulics and has its own tank and oil filter. This makes it possible to specify the oil in the brake system so that additives can be avoided.

Filling oil in the brake system takes place directly to the tank. There is a drain plug located at the bottom of the tank. Hatches on top of the tank facilitate internal cleaning.

The tank is equipped with a filtered breather that allows volume changes in the tank, due to temperature variations and use. See *Breather filter, description*, page 4:42.

The tank has a sight glass for checking oil level.



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4.8.3 Brake oil pump

Brake oil pump, general

See *Brake oil pump, description*, page 4:6.

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 4:22.

4.8.6 Wheel brakes

Wheel brake, general

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

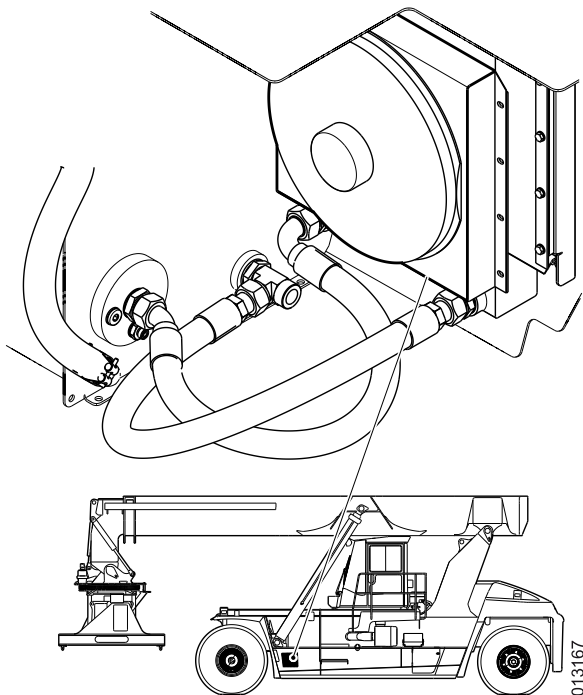
4.8.7 Oil cooler

Oil cooler, description

The oil cooler cools the oil in the brake system in order to maintain brake performance. The oil cooler is fitted inside the side panel on the left-hand side behind the front wing.

The brake system uses a flow-through cooler with electric cooling fan. The brake system's oil is cooled when it passes through the cooler. Openings in the frame panel allow air to pass through the cooler.

The cooling fan is screwed onto the cooler. See *Cooling fan, description*, page 4:40.



Oil cooler brake system, replacement

NOTE

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

- 1 Machine in service position, see section B Safety.
- 2 Drain the oil from the brake oil tank, see *Oil, brake system, changing*, page 4:45.
- 3 Mark up and detach the hydraulic hoses from the cooler. Let the oil in the cooler drain into the receptacle.

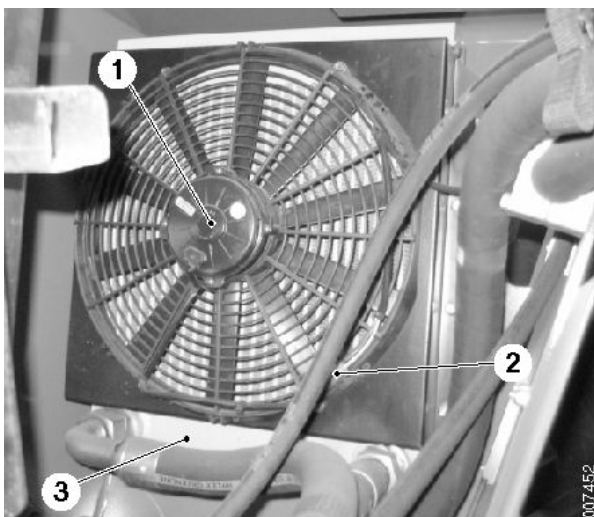
NOTE

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

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

NOTE

Check that the O-rings are intact, clean and in the correct position.



1. Cooling fan
2. Connector
3. Cooler



- 10 Fill oil in the brake oil tank, see *Oil, brake system, changing*, page 4:45. The oil level should be visible in the sight glass.

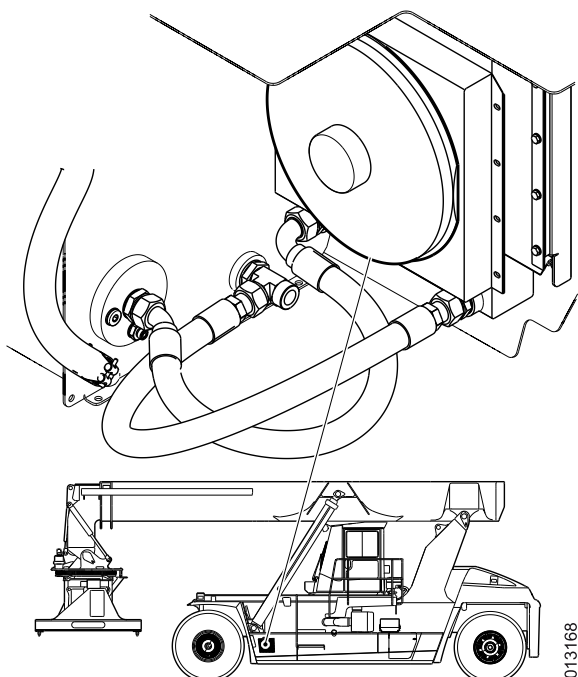
4.8.8 Cooling fan

Cooling fan, description

The cooling fan (M674) is a suctioning electric fan. The fan draws air from the outside of the machine through the cooler and increases the airflow through the oil cooler as required. The cooling fan is mounted on the inside of the cooler inside the side panel behind the left-hand drive wheel.

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

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.5.2 *HYD*, menu 2.

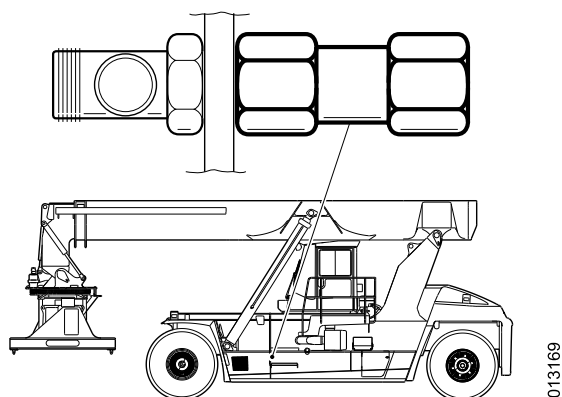


4.8.9 Thermal bypass valve

Thermal bypass valve, description

When the oil is cold, the thermo-bypass valve directs the oil past the cooler directly to the tank. The thermo-bypass valve is fitted inside the brake oil tank at the hose connections to and from the cooler.

The thermo-bypass valve is a temperature-regulated bimetal valve. The valve is open at low temperatures and completely closed at 50 °C.



Thermo-bypass valve, replacement

NOTE

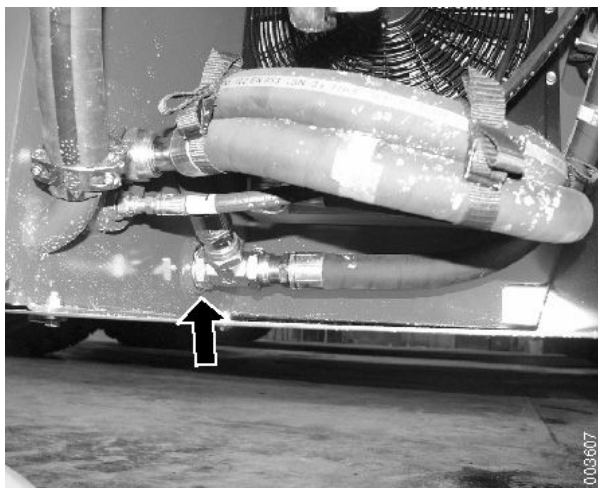
Read the safety instructions for oil before working, see section B Safety.

- 1 Machine in service position, see section B Safety.
- 2 Depressurise the brake and hydraulic systems, see section B Safety.
- 3 Drain the oil from the brake oil tank, see *Oil, brake system, changing*, page 4:45.
- 4 Remove the thermo-bypass valve that is fitted inside the hydraulic oil tank.

NOTE

Note how the valve is fitted.

- 5 Fit in reverse order.



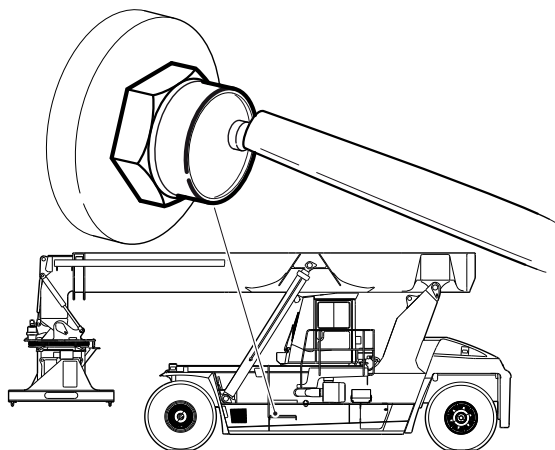
4.8.10 Sensor, oil temperature brake system

Sensor, oil temperature brake system, description

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

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

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.5.2 HYD, menu 2.



Sensor, oil temperature brake system, replacement

NOTE

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

- 1 Machine in service position, see section B Safety.
- 2 Drain the oil from the brake oil tank, see *Oil, brake system, changing*, page 4:45.
- 3 Disconnect the cable harness from the sensor for the brake system's oil temperature.

- 4 Replace the sensor for the brake system's oil temperature.

NOTE

Check that the O-rings are intact, clean and in the correct position.

- 5 Connect the cable harness to the sensor.
- 6 Fill oil in the brake oil tank, see *Oil, brake system, changing*, page 4:45. The oil level should be visible in the sight glass.

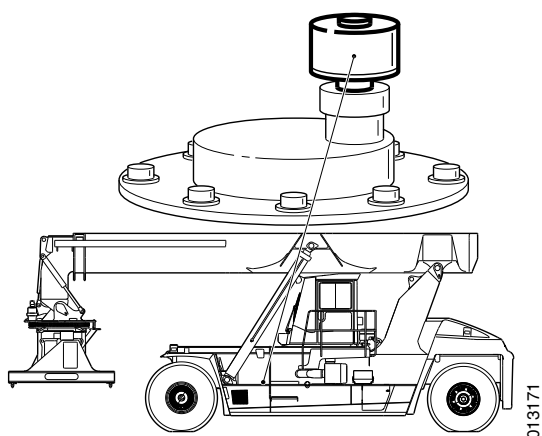


4.8.11 Breather filter

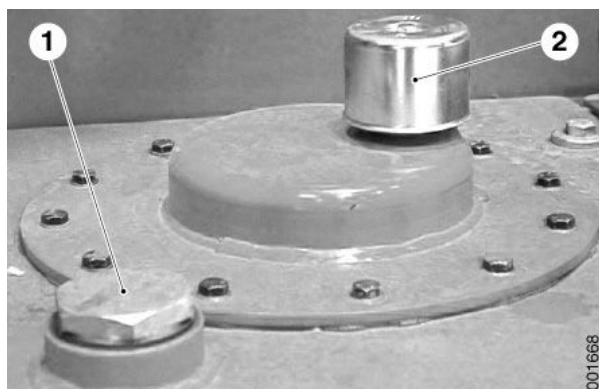
Breather filter, description

The breather filter cleans the air that passes through the tank's breather in the event of volume changes arising due to temperature variations and use. The breather filter is fitted in a holder on the top of the brake oil tank.

The breather filter is a paper insert filter. The filter cleans moisture and dust from the air passing through the tank's breather.



Breather filter, replacement



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

NOTE

Take care that impurities do not enter the tank.

- 5 Fit a new filter insert.
- 6 Refit the cover on the filter holder.

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

4.8.12 Brake oil filter

Brake oil filter, description

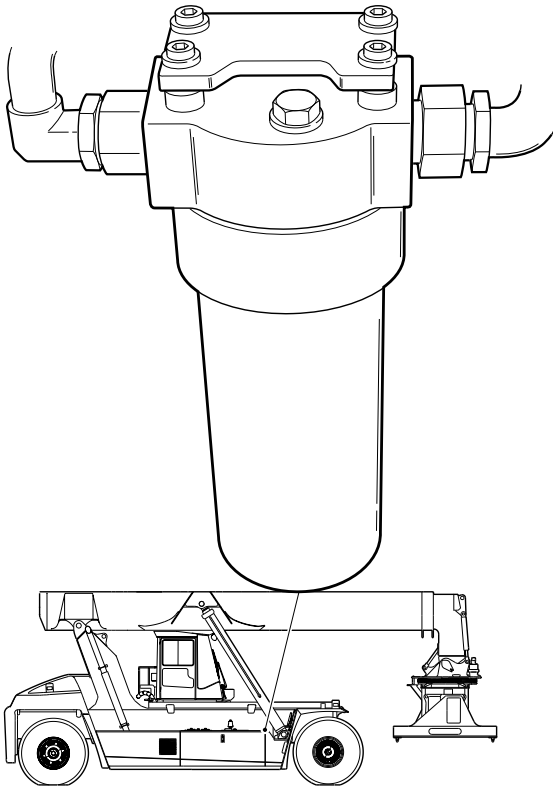
The brake system's oil filter cleans impurities from the oil in the brake system. The filter is fitted on a bracket in front of the transmission under the lifting beam.

The brake system's oil filter is a high-pressure filter with removable filter insert. It is fitted between the pump and accumulator charging valve. The oil is cleaned when it is forced through the (glass fibre) material of the filter insert before reaching the accumulator charging valve.

A bypass valve located between the intake and outlet protects the insert. If resistance through the filter surface becomes too great, the bypass valve opens a passage past the insert. The bypass function opens if the oil is viscous (cold or too low/high viscosity) or if the filter insert is clogged with dirt.

NOTE

When the filter is clogged, the oil is directed past the filter without cleaning. It is therefore very important to replace the filter at the prescribed interval.



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Brake oil filter, replacement

NOTE

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

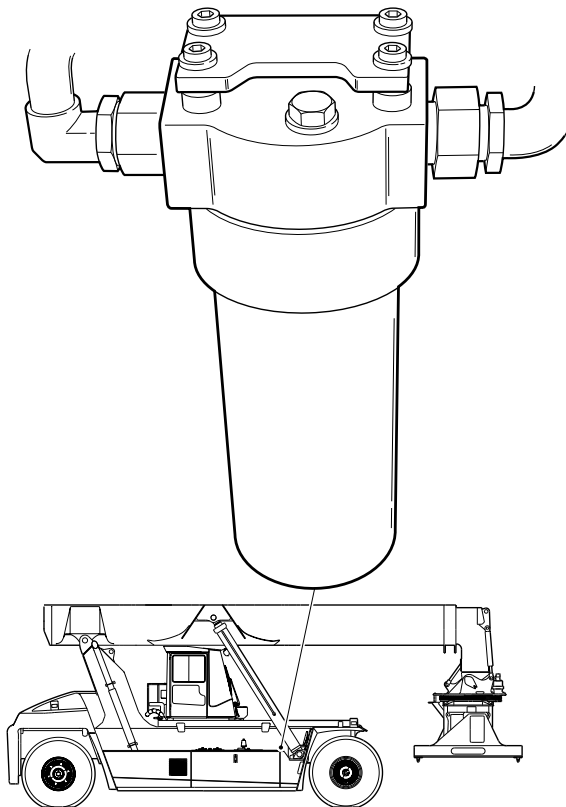
IMPORTANT

The filter protects the brake system against impurities. It is very important that new impurities do not enter the brake system during filter replacement.

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

NOTE

Leave the valves open during replacement.



- 3 Remove the drain plug on the underside of the filter.
Let the oil run out. Wait a moment since it runs out slowly.
- 4 Remove the filter holder.

NOTE

The filter holder is heavy. Detach it carefully.

- 5 Remove the filter insert.

NOTE

Note the location of the O-rings.

- 6 Clean the filter holder.
- 7 Fit the O-rings on the filter insert and the filter holder. Lubricate the O-rings with oil for the brake system.
- 8 Fit the new filter insert on the filter bracket.
- 9 Fit the filter holder and drain plug.
- 10 Close the valves opened for draining the pressure in the hydraulic system.
- 11 Start the engine and check the filter holder for leaks.

4.8.13 Pipes and hoses

Piped 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

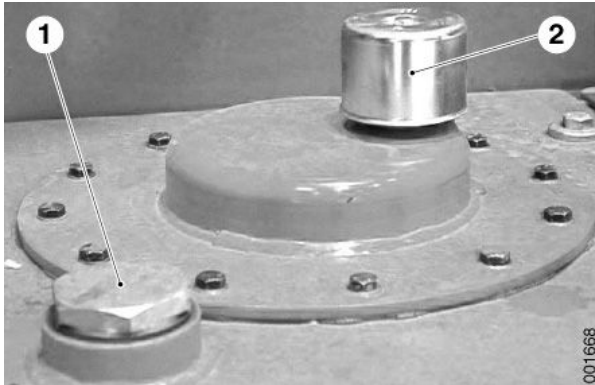
See section F *Technical data*.

Oil, brake system, changing

NOTE

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

- 1 Machine in service position, see section B Safety.
- 2 Depressurise the hydraulic and brake systems, see section B Safety.
- 3 Remove the filler cap and drain the brake oil tank.
- 4 Remove the drain plug and allow the last of the fluid drain into a receptacle.
- 5 Fit the drain plug, using a new gland washer.
- 6 Fill oil for the brake system until the oil level is in the middle of the sight glass. For volume and grade, see section F Technical data.
- 7 Fit the filler cap.



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

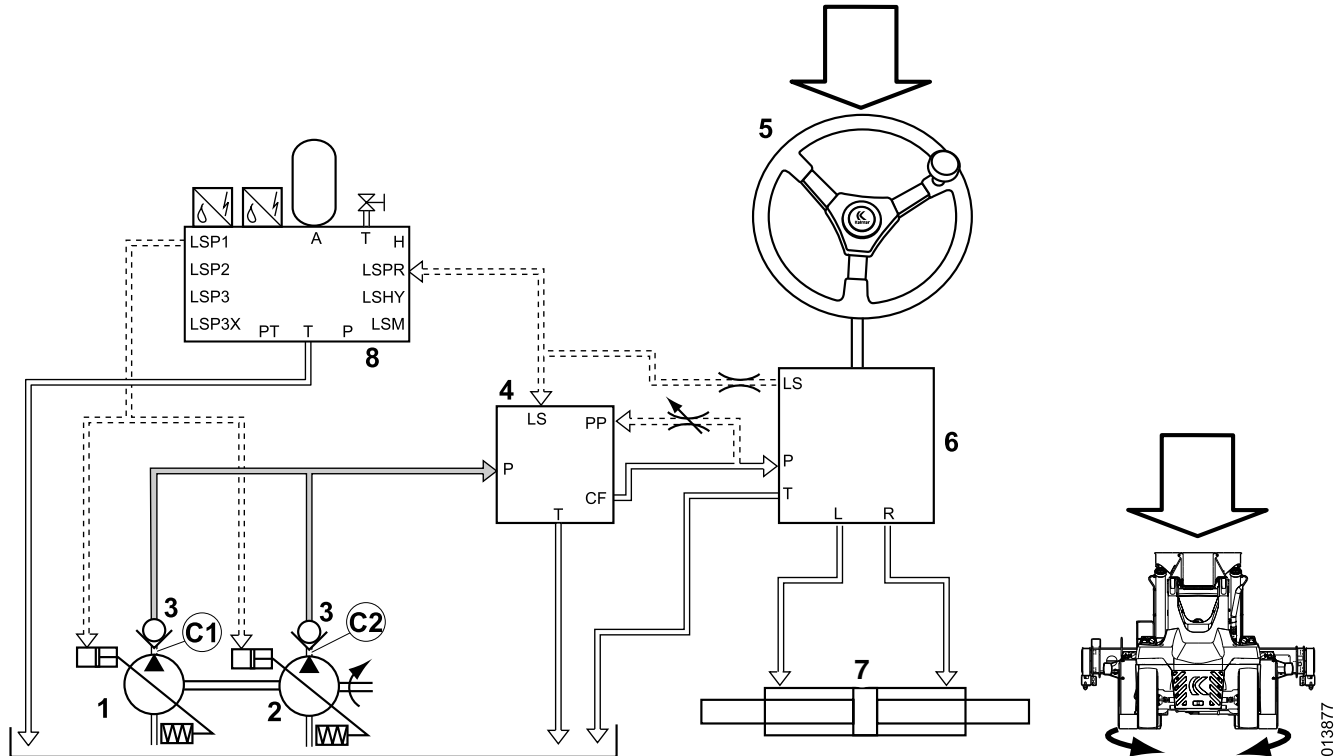
Contents 5 Steering

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5.2.2	Priority valve	5:4
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5.2.6	Link arm	5:14
5.2.7	Wheel spindle	5:14
5.2.8	Wheel hub	5:14
5.2.13	Pipes and hoses	5:14
5.2.21	Valve block servo pressure	5:14

5 Steering

5.2 Power assisted system

Power assisted system, function description



Pos	Explanation	Signal description	Reference
1	Hydraulic oil pump 3 pumps oil to the priority valve.	See the pressure plate on the left-hand frame beam.	Section 10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement
2	Hydraulic oil pump 4 pumps oil to the priority valve.	See the pressure plate on the left-hand frame beam.	Section 10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement
3	The non-return valves prevent oil from being pumped between the pumps.	-	Section 10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement
4	The priority valve prioritises pressure supply to the steering valve over the working hydraulics. The priority valve also transmits a control signal to valve block servo pressure.	Checked by control system, error shown with error code.	Priority valve, description, page 5:4
5	The steering wheel is turned and acts on the steering valve's input shaft.	-	Section 9 Frame, body, cab and accessories, group 9.1 Controls and instruments
6	The steering valve pumps pressurised oil to the steering cylinder and transmits a load signal to the priority valve and valve block servo pressure.	-	Steering valve, description, page 5:8
7	The steering cylinder turns the wheels.	-	Steering cylinder, description, page 5:11
8	Valve block servo pressure sends a load signal to hydraulic oil pump 3 and 4.	-	Section 10 Common hydraulics, group 10.5.7 Valve block servo pressure

Hydraulic diagram, see section E Schematics, group 10 Common hydraulics, Hydraulic diagram, basic machine.

5.2.1 Hydraulic oil pump

Hydraulic oil pump, general

Steering is supplied oil by the hydraulic oil pumps 3 and 4, see section *10 Common hydraulics*, group *10.4 Pumps*.

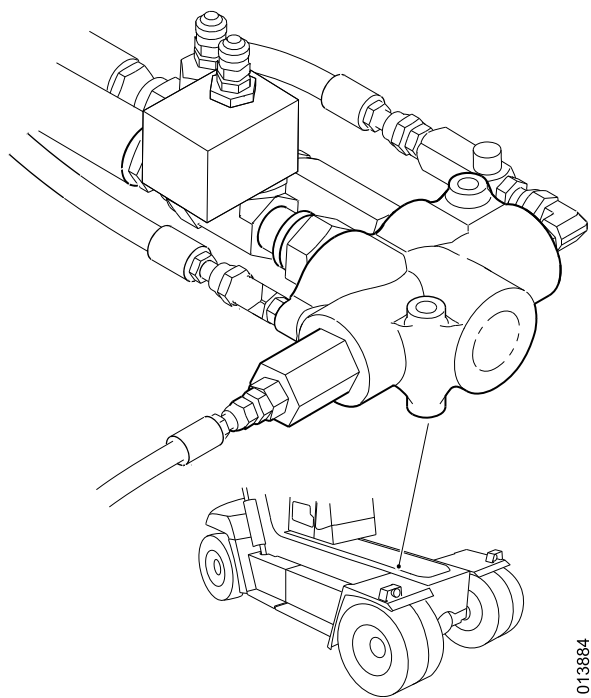
5.2.2 Priority valve

Priority valve, description

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

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

The priority valve has a built-in pressure limiter on the load signal. The pressure limiter maximises the load signal's pressure.

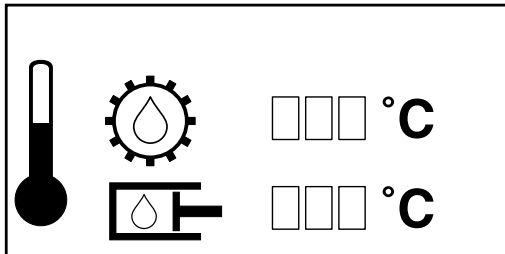


013884

Control pressure, checking

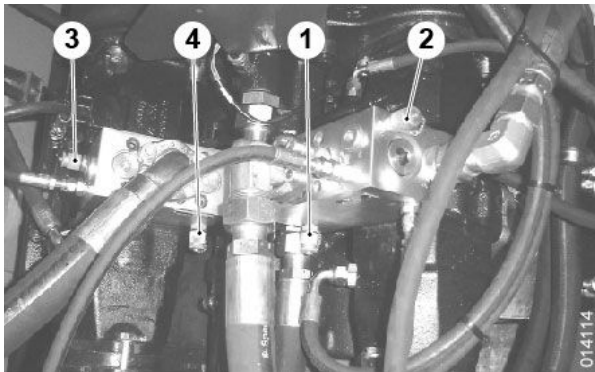
NOTE

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



000475

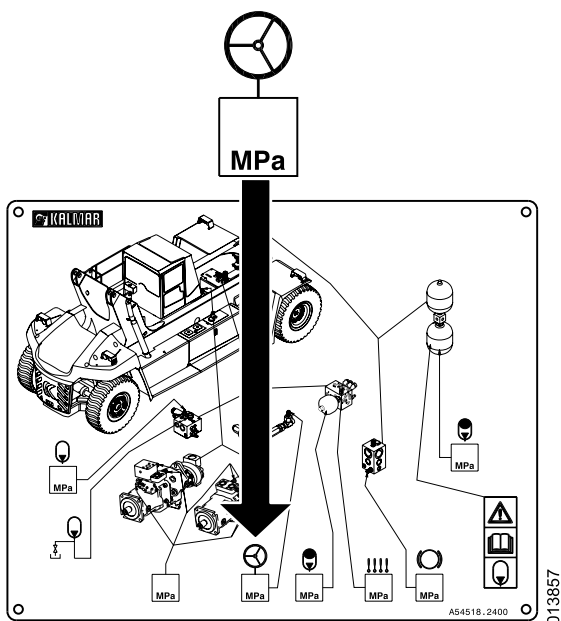
Operating menu, hydraulic oil temperature



014114

Measuring outlet, hydraulic oil pumps

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



013857

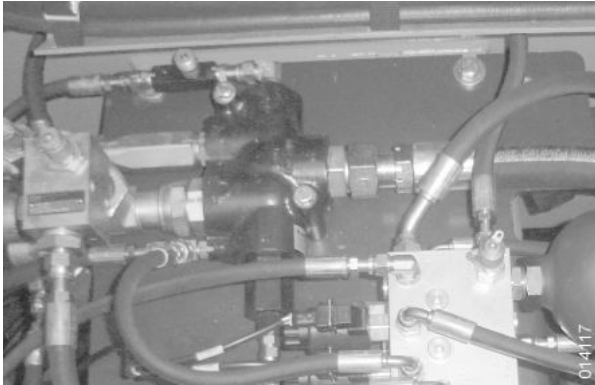
- 1 Operate and warm up the machine so that the hydraulic oil reaches operating temperature, 50 °C.
- 2 Machine in service position, see section *B Safety*.
- 3 Connect the pressure gauge to the measuring outlet for hydraulic oil pump 3 or 4.
- 4 Start the engine and increase engine speed to approx. 1200 rpm.
- 5 Turn the steering wheel fully and read pump pressure during steering wheel movement. Compare this to the control pressure on the hydraulics plate. The max. pressure measured on the pump should be **1.5 MPa** more than the control pressure on the hydraulics plate.
- 6 Stop the engine and turn the start key to position I.
- 7 Turn the start key to position 0 and switch off the system voltage.
- 8 Remove the pressure gauge and fit the protective cap on the measuring outlet.

Priority valve, replacement

NOTE

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

- 1 Machine in service position, see section B Safety.
- 2 Depressurise the brake and hydraulic systems, see section B Safety.
- 3 Turn the start key to position 0 and switch off the system voltage.
- 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's attaching bolts.
- 6 Release 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.

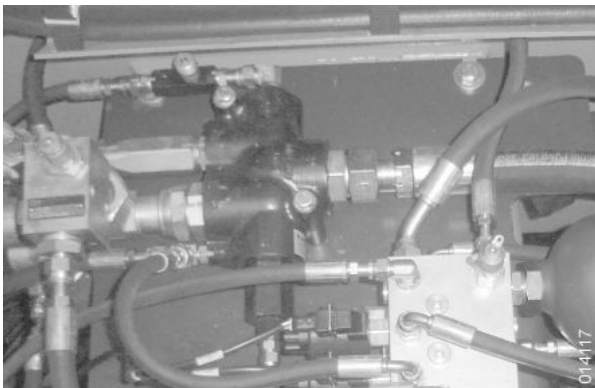


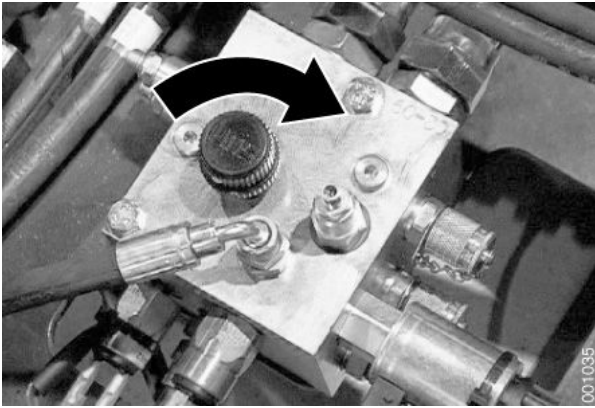
CAUTION

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's 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.

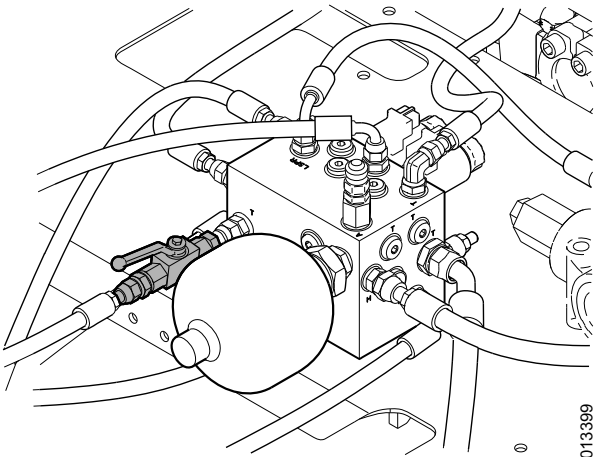




- 14 Close the drain valve on the accumulator charging valve.

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



Relief valve for top lift, the figure shows an open valve.

- 15 Close the relief valve for top lift.



CAUTION

Hydraulic oil may be directed the wrong way.

Risk of damage to the fine filter for hydraulic oil.

Check that the relief valve for top lift is closed before starting the engine.

- 16 Start the engine and check that the hydraulic connections at the priority valve are sealed tightly.



- 17 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 centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

Do not overfill!

Leakage and environmental damage!

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

- 18 Check the control pressure, see *Control pressure, checking*, page 5:5.

5.2.3 Steering valve

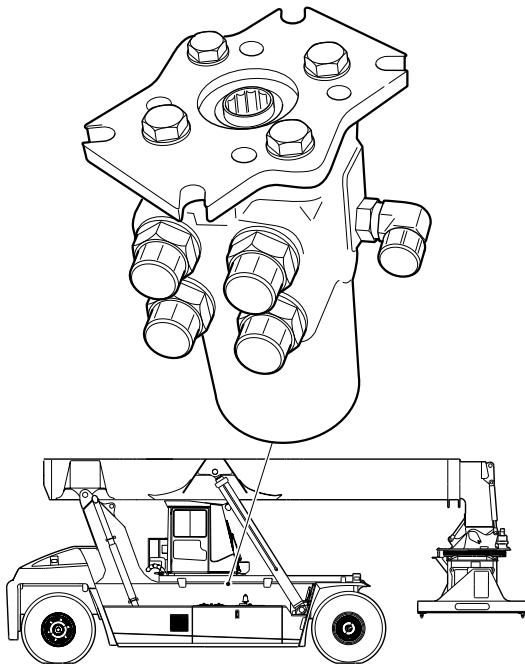
Steering valve, description

The steering valve is a "progressive, closed centre, non-reaction valve" with load signal connection to the priority valve.

The load signal provides load dependent regulation of the oil flow from the priority valve to the control valve. "Closed center" means that the control valve is closed in the neutral position. This is necessary so 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 directs the oil to the steering cylinder. The gear pump ensures that the oil flow fed to the cylinder is proportional to the steering wheel's turning angle.

The steering valve contains double shock and anti-cavitation valves. 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.



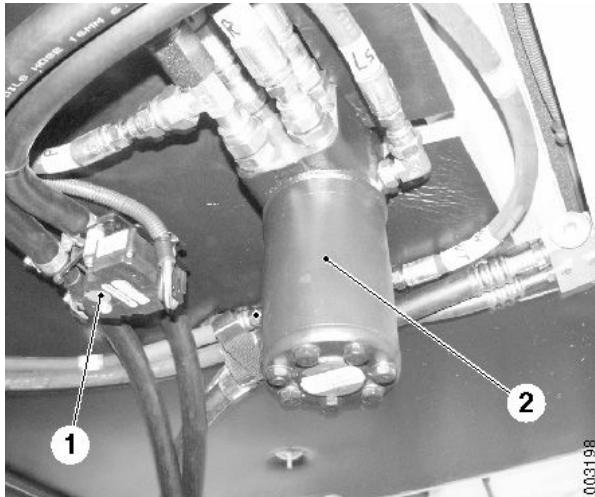
013177

Steering valve, replacement

NOTE

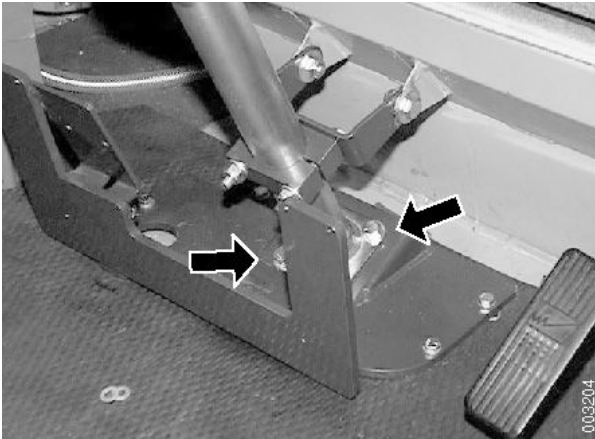
Read the safety instructions for oil before working, see section B Safety.

- 1 Remove the cover plates over the engine compartment.
- 2 Slide the cab forward so that the steering valve is accessible from below.
- 3 Stop the engine and turn the start key to position I.
- 4 Depressurise the brake and hydraulic systems, see section B Safety.
- 5 Turn the start key to position 0 and switch off the system voltage.



003198

1. Water valve
2. Steering valve



- 6 Detach the steering valve from the brake pedal.
Remove the steering valve's attaching bolts and lower the control 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

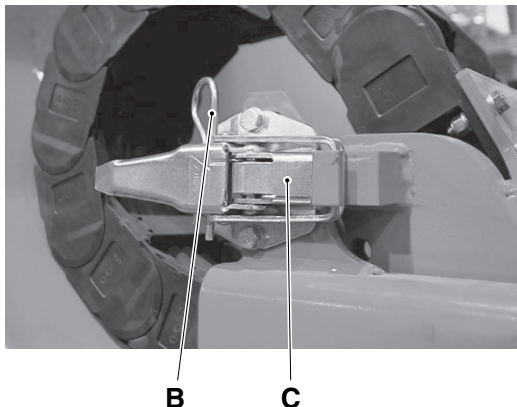
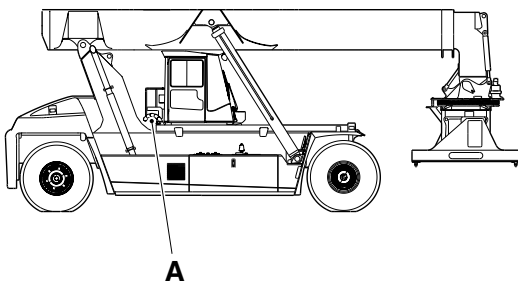
Transfer one connection at a time so that the marking is not mixed up.

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

NOTE

Check that the O-rings are intact, clean and in the correct position.

- 11 Connect the new steering valve to the brake pedal.
Position the steering valve and check that the steering wheel shaft's splines enter straight in the steering valve's slot. Fit the attaching bolts.
- 12 Lock the cab in its rearmost position with both locking catches.



- A Location, locking catch
B Lock pin
C locking catch for securing the cab



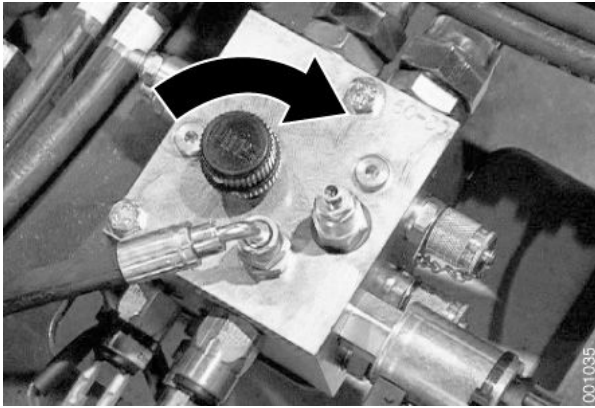
WARNING

The cab has the manual sliding cab function. The cab must ALWAYS be in the rear position while operating the machine.

Warning - risk of crushing!

Always make sure that the cab locks on both sides are locked in their rear position before operating, and that the locks are secured with the lock pins.

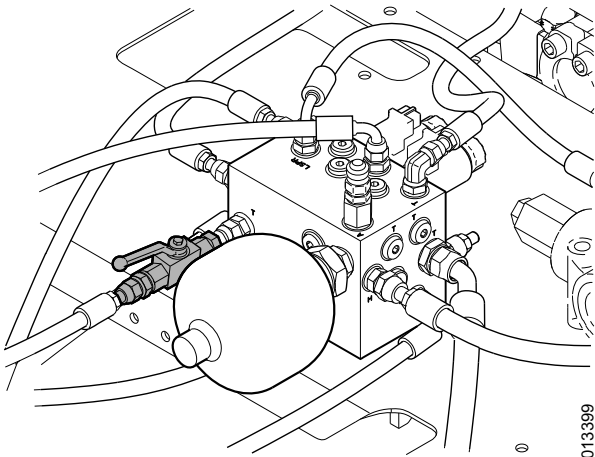
012760



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

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



Relief valve for top lift, the figure shows an open valve.

- 14 Close the relief valve for top lift.



CAUTION

Hydraulic oil may be directed the wrong way.

Risk of damage to the fine filter for hydraulic oil.

Check that the relief valve for top lift is closed before starting the engine.

- 15 Switch on the system voltage and start the engine.
- 16 Check that the connections on the steering valve are sealed tightly.
- 17 Steer very carefully a few times right - left, to bleed the steering valve and steering cylinder.
- 18 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 centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

Do not overfill!

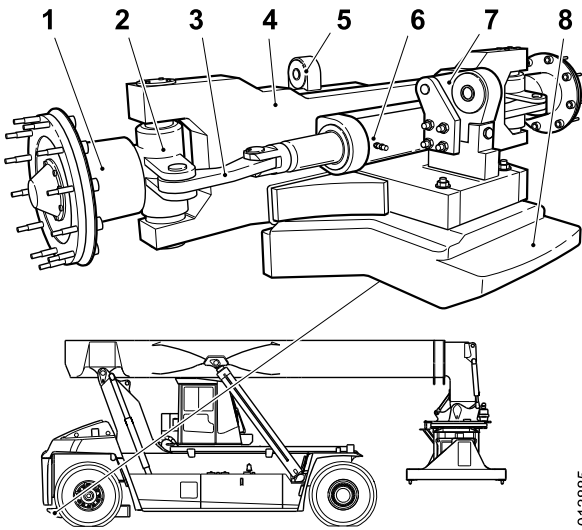
Leakage and environmental damage!

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

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.



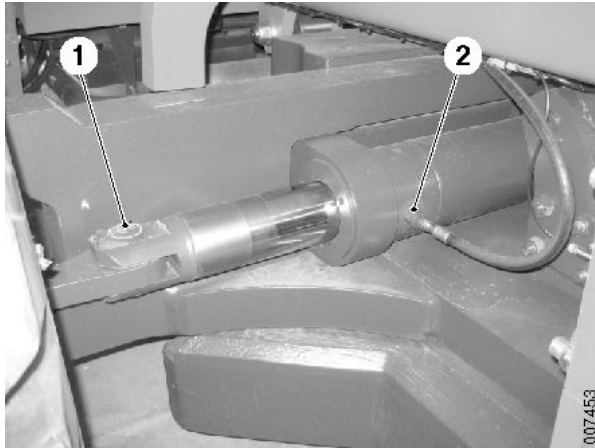
1. Wheel hub
2. Wheel spindle
3. Link arm
4. Steering axle
5. Front suspension
6. Steering cylinder
7. Rear suspension
8. Counterweight

Steering cylinder, replacement

NOTE

Read the safety instructions for oil before working, see section 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 section B Safety.
- 3 Depressurise the brake and hydraulic systems, see section B Safety.

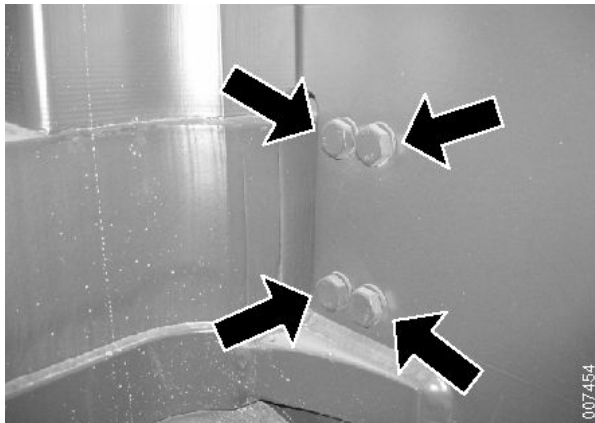


1. Link arm mounting
2. Hydraulic connection

- 4 Detach the link arms from the steering cylinder.
- 5 Mark up and detach the hydraulic hoses from the steering cylinder.

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 Replace the steering cylinder. Lift the steering cylinder aside.

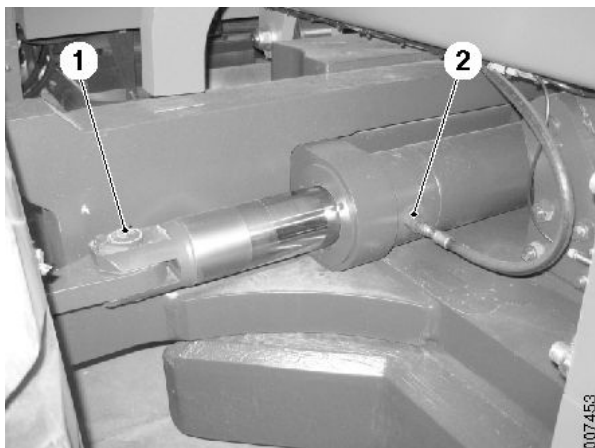
NOTE

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 Fit and lubricate the steering cylinder attaching bolts. Tighten the bolts crosswise in steps until 680 Nm is achieved.
- 10 Transfer parts to the new steering cylinder.

NOTE

Check that the O-rings are intact, clean and in the correct position.

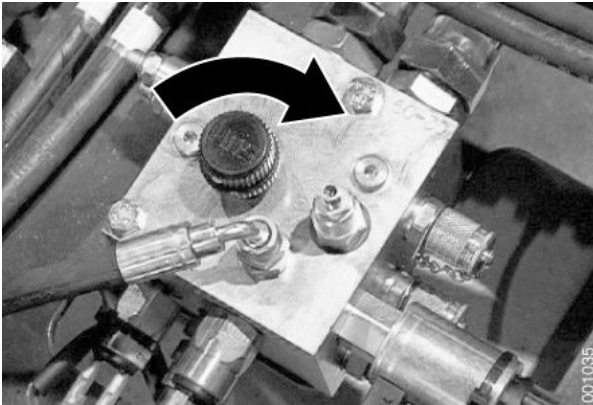


1. Link arm mounting
2. Hydraulic connection

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

NOTE

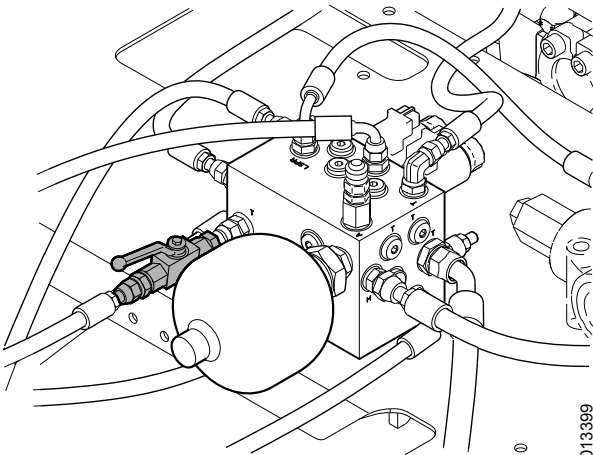
Check that the O-rings are intact, clean and in the correct position.



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

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



Relief valve for top lift, the figure shows an open valve.

- 14 Close the relief valve for top lift.



CAUTION

Hydraulic oil may be directed the wrong way.

Risk of damage to the fine filter for hydraulic oil.

Check that the relief valve for top lift is closed before starting the engine.

- 15 Start the engine and 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 in the centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

Do not overfill!

Leakage and environmental damage!

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

Hydraulic cylinders, repairs

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

5.2.5 Steering axle cradle

Steering axle cradle, general

See section *6 Suspension*, group *6.2.1 Steering axle cradle*.

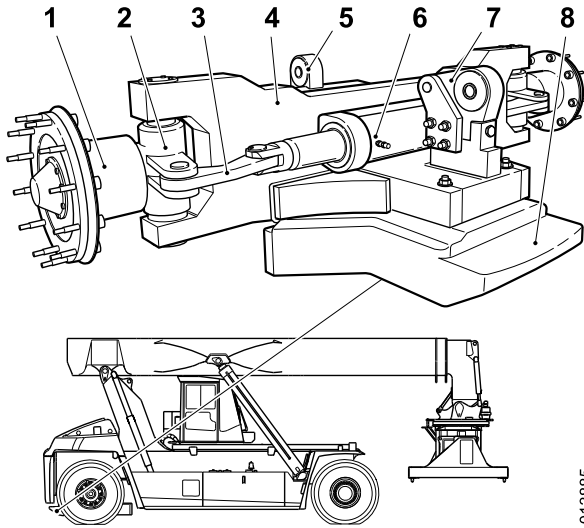
5.2.6 Link arm

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 in a way that changes the setting of the steering wheels 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. Front suspension
6. Steering cylinder
7. Rear suspension
8. Counterweight

5.2.7 Wheel spindle

Wheel spindle, general

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

5.2.8 Wheel hub

Wheel hub, general

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

5.2.13 Pipes and hoses

Piped and hoses, description

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

5.2.21 Valve block servo pressure

Valve block servo pressure, general

See section 10 *Common hydraulics*, group 10.5.7 *Valve block servo pressure*.

Contents 6 Suspension

6	Suspension	6:3
6.2	Suspension	6:3
6.2.1	Steering axle cradle	6:5
6.2.2	Wheel spindle.....	6:7
6.2.3	Wheel hub	6:11
6.3	Tyres and rims	6:16
6.3.1	Tyres	6:18
6.3.2	Rim	6:19
6.3.3	Nut, washer and clamp	6:20

6 Suspension

6.2 Suspension

Bushing steering axle mounting, changing



DANGER

Steering axle and machine are very heavy.

Risk of crushing!

It is forbidden to go under a machine which has been lifted by a jack etc. For machine weight, see section *F Technical data*.

- 1 Machine in service position, see section *B Safety*.
- 2 Turn the start key to position 0 and switch off the system voltage.
- 3 Remove the counterweights on the rear of the machine.

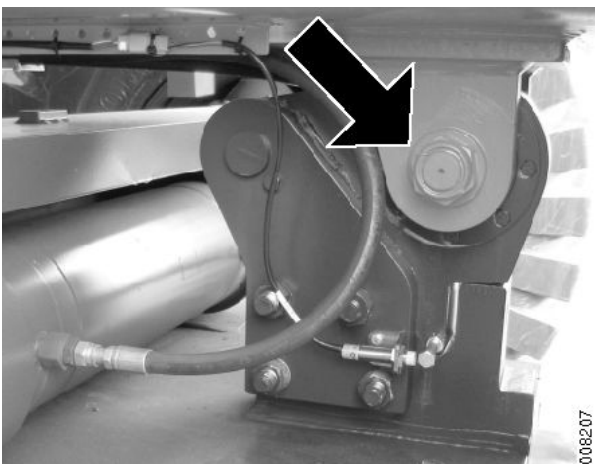
NOTE

Mark the locations of the counterweights so that they can be refitted at the same spot. This is important for the machine's stability.

- 4 Support under the steering axle so that it cannot fall over.
- 5 Attach hoisting 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.

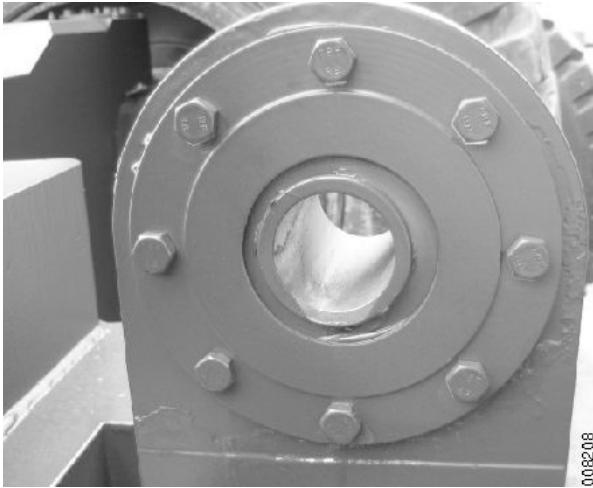


The illustration shows rear attachment.

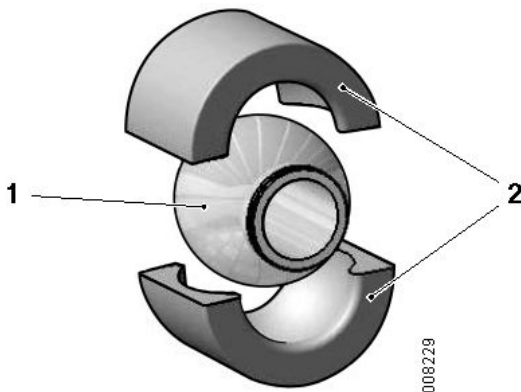
- 6 Remove the pins holding the steering axle.
- 7 Lift the machine up so that the frame is lifted away from the axle.
- 8 Support the machine under the frame.
- 9 Move the steering axle so that the mountings can be accessed.

NOTE

If necessary, disconnect the cable harness for the sensors on the steering axle.



The illustration shows front attachment.



Bushing steering axle parts

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 parts of the bushing and press in the new bushing. Lubricate the bushing with grease in order to simplify installation.



CAUTION

The bearing halves must be mounted horizontally.

- 14 Fit the washers that hold the bushing in place. Use locking fluid and tighten the bolts to a torque of **45 Nm**.
- 15 Move the steering axle into place under the frame.
- 16 Lubricate and fit the pins at the steering axle's mounts.
- 17 Remove the lifting equipment from the machine.
- 18 Fit the counterweights.

NOTE

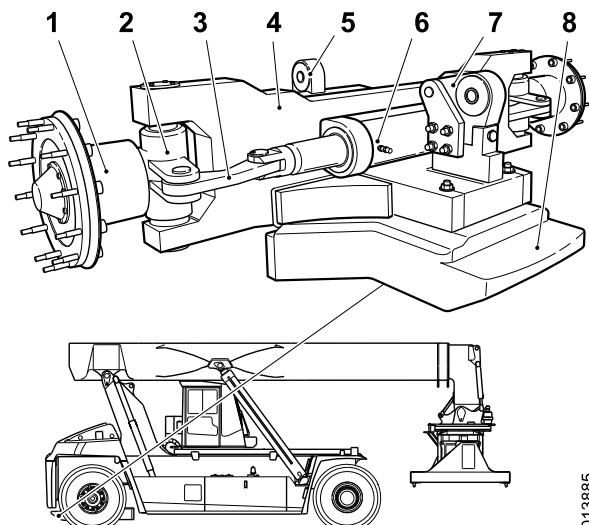
Make sure that all counterweights are refitted and that they are fitted in the exact same location as before. The stability of the machine is affected if the counterweights are changed.

6.2.1 Steering axle cradle

Steering axle cradle, description

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

The frame suspension comprises maintenance-free parts. The rear suspension is designed with a leading knee which absorbs small movements during operation.



013885

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

Steering axle cradle, replacement



DANGER

Steering axle and machine are very heavy.

Risk of crushing!

It is forbidden to go under a machine which has been lifted by a jack etc. For machine weight, see section *F Technical data*.

- 1 Stop the engine and turn the start key to position I.
- 2 Clean the steering axle and its surrounding area.
- 3 Depressurise the brake and hydraulic systems, see section *B Safety*.
- 4 Turn the start key to position 0 and switch off the system voltage.
- 5 Remove the counterweights on the rear of the machine.

NOTE

Mark the locations of the counterweights so that they can be refitted at the same spot. This is important for the machine's stability.

- 6 Attach hoisting equipment to the boom mounting's rear lifting points.

- 7 Tension the lifting equipment, do not lift so much that the wheels are off the ground.
- 8 Support the machine's rear section.
- 9 Detach the hydraulic hoses from the steering cylinder.

NOTE

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

- 10 Remove the pins holding the steering axle.
- 11 Lift the machine up so that the frame is lifted away from the axle.
- 12 Lift out the steering axle.



CAUTION

The steering axle may start to roll.

Crushing injury!

Make sure that the steering axle does not roll away uncontrollably.

- 13 Adjust the support so that the machine is secured in the new position.
- 14 Lift the steering axle into place under the frame.
- 15 Remove the support under the frame.
- 16 Lower the rear section of the machine.
- 17 Fit the pins at the steering axle mountings.
- 18 Connect the hydraulic hoses to the steering cylinder.

NOTE

Check that the O-rings are intact, clean and in the correct position.

- 19 Remove the lifting equipment from the machine.
- 20 Fit the counterweights.

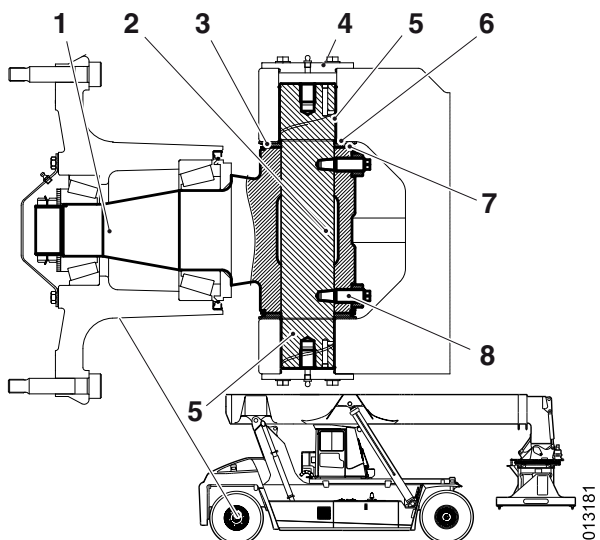
NOTE

Make sure that all counterweights are refitted and that they are fitted in the exact same location as before. The stability of the machine is 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.

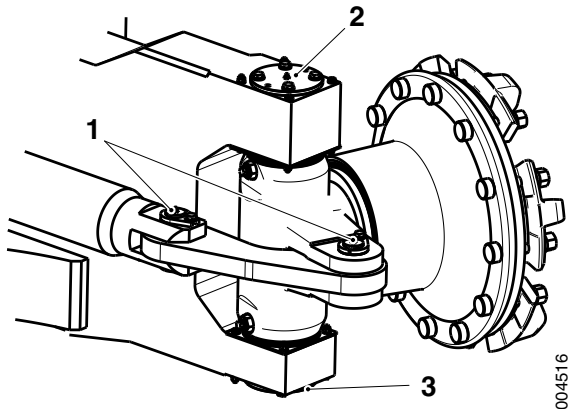


1. Wheel spindle
2. Spindle bolt
3. Seal
4. Cover
5. Spindle bolt bearing
6. Thrust washer
7. Thrust bearing
8. Lock screw

Spindle bolt bearing, replacement

- 1 Clean the wheel spindle and its surrounding area.
- 2 Raise the machine under the steering axle at the wheel in question. Support the steering axle in a safe way.
- 3 Remove the steering wheel in question.





1. Shaft, link arm
2. Cover (upper)
3. Cover (lower)

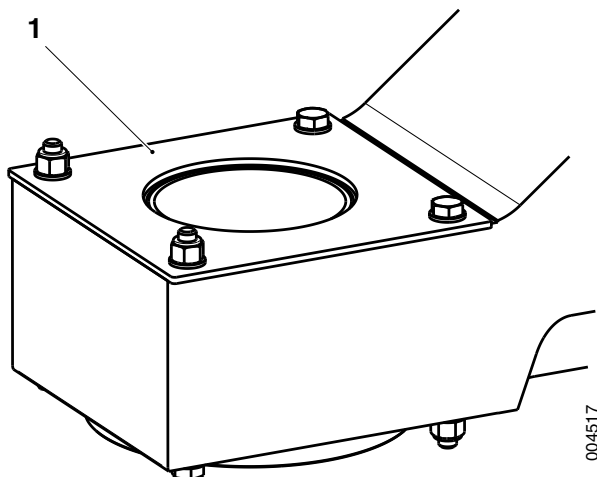
- 4 Detach the link arm from the wheel spindle.
Remove the lock screw and then remove the axle. Move the link arm aside.
- 5 Position a lifting strap inside the hub to secure the spindle.
- 6 Remove the covers at the spindle bolt's upper and lower bearing.
- 7 Remove the grease between the cover and spindle bolt.



- 8 Remove the spindle bolt's upper and lower lock screw.
Remove the nut and the lock screw.
- 9 Adjust the lifting equipment to relieve the load on the wheel spindle.



- 10 Remove the spindle bolt.
Pull the spindle bolt up, using a sliding hammer or similar connected to the threaded hole in the centre of the spindle bolt.
- 11 Remove the wheel spindle.
Place the wheel spindle on a soft surface.

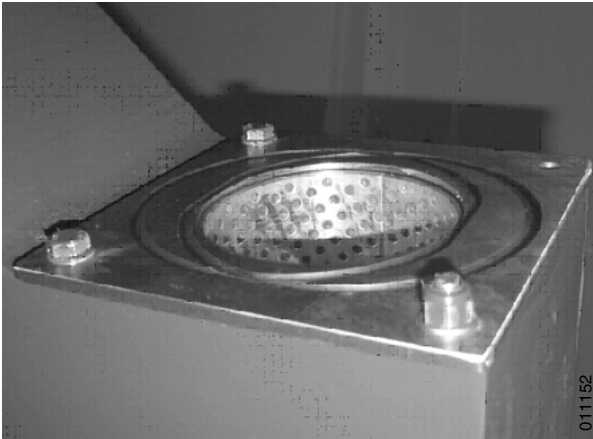


1. Wear washer, thrust bearing

- 12 Remove the thrust bearings from the steering axle.
- 13 Press out the old bearing bushings. Note how the old bearing bushings are fitted so that the new ones can be positioned the same way with the space between in the same place.
- 14 Clean the surfaces inside the steering axle.
- 15 Press in the new bearing bushings. Make sure that the space between is at the same location as before.

NOTE

The upper bearing bushing must protrude (4.5-4.8 mm) so that it is level with the thrust bearing's slotted washer.



- 16 Fit new thrust washers on the steering axle. Only fit three bolts in the manner illustrated. The fourth bolt cannot be fitted until the wheel spindle is in place. Only tighten the bolts slightly (**5-10 Nm**) so that the thrust bearings are secured in position.

Thoroughly coat the bearing bushings with lubricating grease. For grade, see section *F Technical data*.

NOTE

Make sure the nuts are positioned as illustrated.

- 17 Fit new O-rings on the wheel spindle.
Pull the O-ring toward the hub.
- 18 Lift the wheel spindle into place on the steering axle.



- 19 Apply lubricating grease onto the wear surface of the lower wear washer, and align the bearing between the wheel spindle and the lower thrust washer. Use a rubber mallet to get the bearing into the right position. Check that the bearing is centred in the wheel spindle by looking in the spindle from below.
- 20 Apply lubricating grease onto the wear surface of the upper wear washer, and align the bearing between the wheel spindle and the upper thrust washer. Use a rubber mallet to get the bearing into the right position. Check that the bearing is centred in the wheel spindle by looking in the spindle from above.

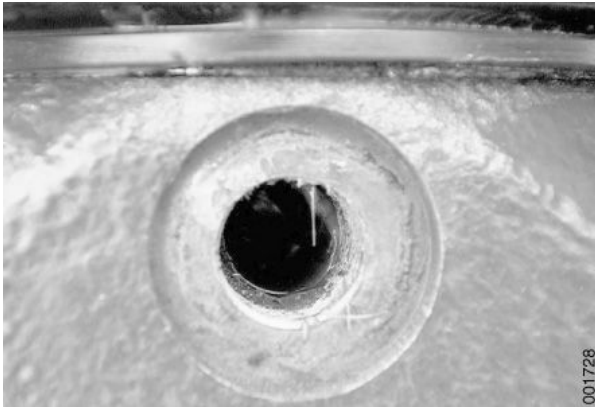


- 21 Fit the spindle bolt.

Apply lubricating grease onto the spindle bolt and press it into place.

NOTE

Check that the spindle bolt is turned so that the holes for the guide screws align with the holes in the wheel spindle. It is important that the spindle bolt is perfectly seated before the lock screws are fitted. It is not possible to "tighten" the spindle bolt into place.

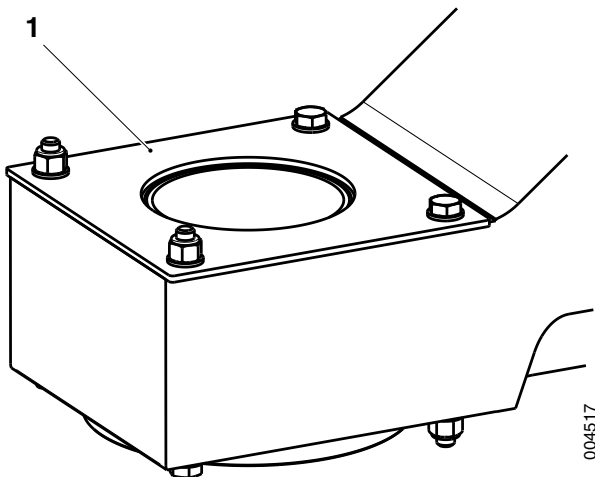


22 Fit the lock screws and tighten the lock nut. Tighten to a torque of **250 Nm (oiled screw)**.

23 Apply lubricating grease onto the space between the wheel spindle and steering axle.

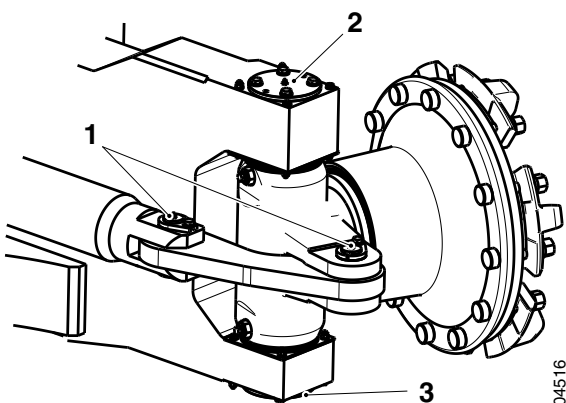


24 Position the O-rings.



25 Fit the remaining bolts to the thrust bearings' wear washers. Fit the bolts in the manner illustrated. Tighten to a torque of **25 Nm (oiled screw)**.

1. Wear washer, thrust bearing



1. Shaft, link arm

2. Cover (upper)

3. Cover (lower)

26 Fit the upper cover and the lower cover.

27 Lubricate the upper and lower bearings of the spindle bolt with lubricating grease.

28 Turn the wheel spindle back and forth a few times to even out the grease. Check that resistance is uniform.

29 Connect the link arm to the wheel spindle.
Lubricate the link arm bearings with lubricating grease.

30 Fit the wheel.

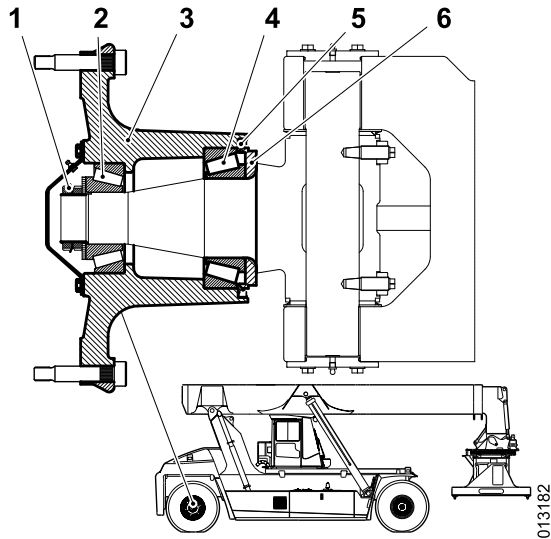
31 Remove the support and lower the steering wheel.

32 Test-operate 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 allows the wheel to rotate.

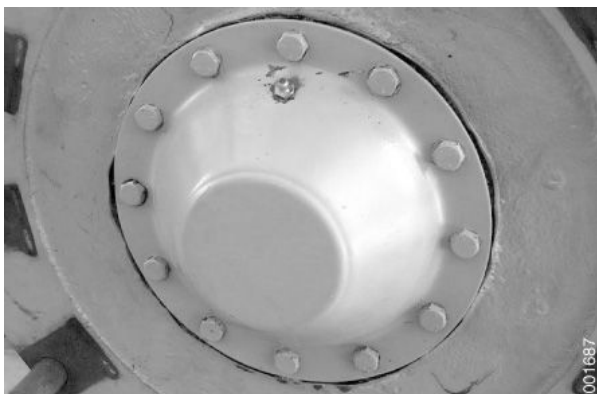


1. Hub nut with locking washer
2. Outer wheel bearing
3. Hub
4. Inner wheel bearing
5. Seal
6. Support ring

Wheel bearing, replacement



- 1 Raise the machine under the steering axle at the wheel in question. Support under the steering axle in a safe way.
- 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 nut. Handle it as environmentally hazardous waste.



- 6 Secure the hub with a lifting strap.

Route the lifting strap over the hub and around a wheel bolt. Fit a clamp and nut to secure the lifting strap. Use manual forklift, pallet forks or similar to lift the hub.



- 7 Bend up the locking washer's tabs, remove the lock nut and locking washer.

- 8 Tension the lifting equipment so that the hub is unloaded.

- 9 Remove the hub nut.



- 10 Lift the hub out from the spindle.

Remove the outer bearing's 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 line the inside with universal grease "EP2".
- 15 Fit new outer races in the hub.
Use a drift and press in the bearing races. Never tap directly on the bearings.

NOTE

Fit the outer races 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 Fit 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 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.



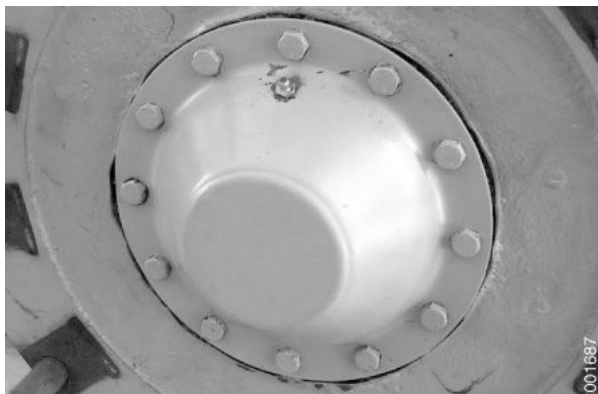
22 Tighten the bearing nut in the following stages.

- A. Lubricate the thread and the side of the nut facing the bearing with oil (SAE 80W/140).
- B. Tighten the nut to a torque of **250 Nm (oiled screw)**.
- C. Rotate the hub 10 revolutions.
- D. Angle tighten the nut 45°.
- E. Rotate the hub 10 revolutions.
- F. Angle tighten the nut 45°.



23 Apply grease onto the locking washer and fit it.

24 Fit the lock nut and tighten to at least **250 Nm (oiled screw)** or then more to engage the locking washer in the closest groove.
Lock the bearing nut and lock nut with the locking washer.



- 25 Fit the bearing casing and fill it with grease.
- 26 Grease the wheel bearing with grease through the lubricant nipple.
Lift the seal ring's lip with a small screwdriver to facilitate the escape of air. Lubricate until grease comes out at the seal.
- 27 Fit the wheel.
- 28 Remove the support and lower the steering wheel.

6.3 Tyres and rims

Tyres and rims, safety



DANGER

Always block the wheels on the side of the axle that is not going to be worked on before positioning the jack. Always secure the jack to prevent it from sliding out of position.

Fully deflate the tyre before removal. Otherwise the conical ring and locking clips can loosen and shoot out when the pressure is changed. With double wheel fitting both tyres must be fully deflated!

The air must always be released via the valve. If this is not possible - drill holes in the tread to release the air. Damaged tyres may explode.

Never stand directly in front of the wheel when deflating or inflating. The conical ring and locking clips can loosen and shoot out when the pressure is changed.

Never fit damaged tyres or rims.

It is prohibited to repair rims with welding.

It is prohibited to operate the machine if one of the tyres is flat.

Wheels, tyres and rims are dimensioned and selected for each machine type so that maximum wheel loads and travel speeds are not exceeded. For this reason it is not permitted to change tyre dimension, tyre make, tyre type, rim type, or rim make without approval from Cargotec.



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 secured in position when the spacer rings are removed. If the wheels move they may displace the spacer rings, with crushing injuries as a result.

When fitting 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 fit or remove rim components. Instead, use a lead, brass or plastic mallet.

Keep the tyre pressures at the prescribed level. Insufficient tyre pressure impairs stability and reduces the machine's capacity.

Remove stuck 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.

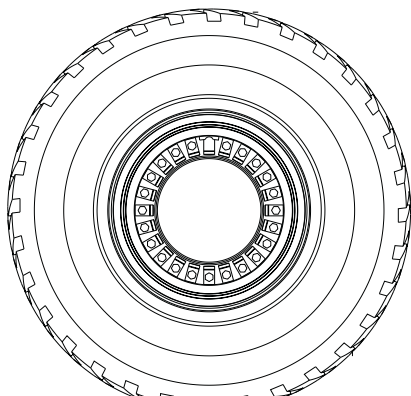
6.3.1 Tyres

Tyres, description

The tyres are the point of contact between the machine and the ground, and they absorb unevenness and provide suspension.

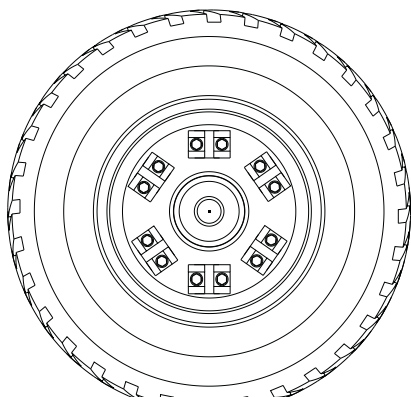
The drive axle is subject to major forces during operation. If each tyre's rolling circumference differs, the stresses on the drive axle increase. For this reason it is important that the tyres on the drive axle have equal wear and correct air pressure.

Spare and replacement tyres must be from a manufacturer approved by Cargotec.



002027

Front wheels



002026

Rear wheels

Tyres, changing

**DANGER**

**Changing tyres is complicated and dangerous work.
EXTREME DANGER!**

Leave tyre work to authorised personnel/tyre company.

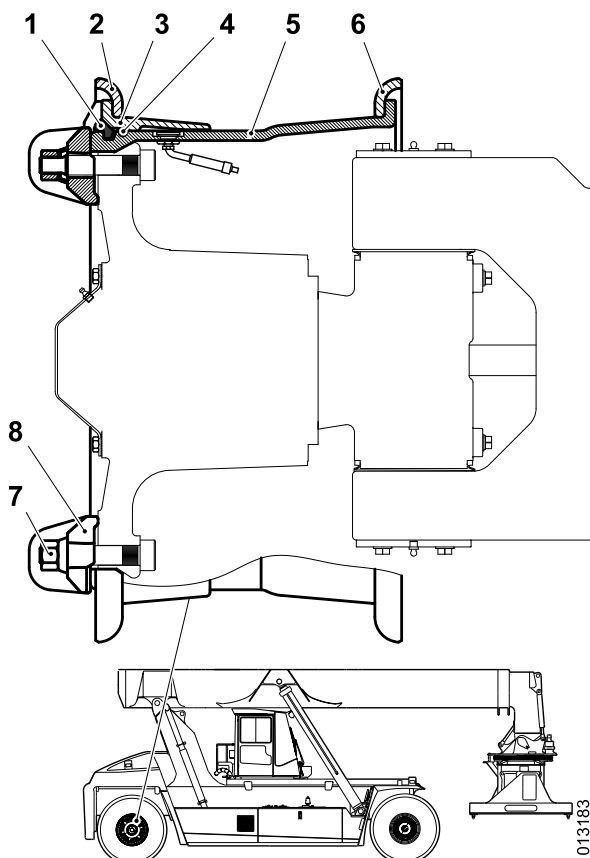
The wheel rims must be checked when tyres are changed. See *Maintenance manual DRT 450* section 6 *Suspension*.

6.3.2 Rim

Rim, description

The rim is split to make it possible to fit a tyre. The rim consists of the following parts.

- Rim
- Rim bead seat
- Rim edge
- Lock ring
- Lock lugs
- Hub plate



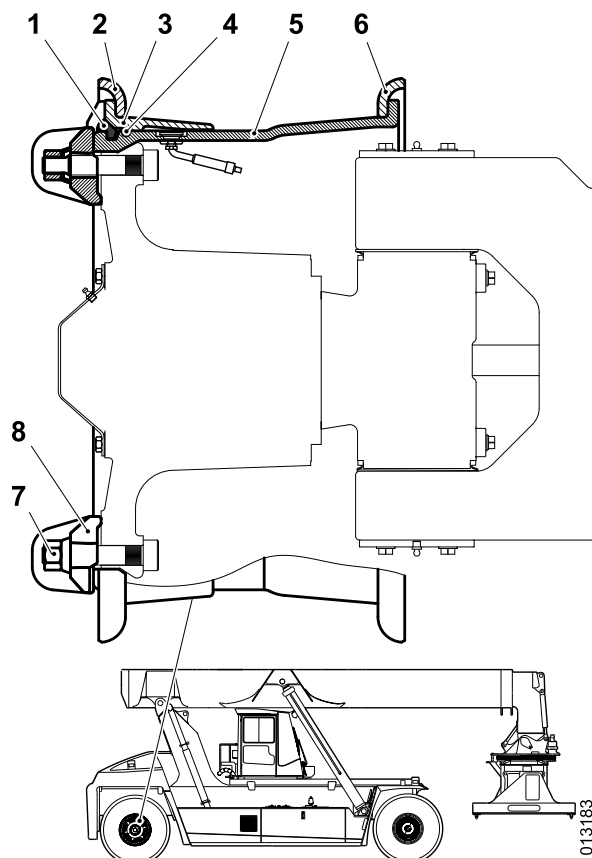
1. Lock ring
2. Rim edge
3. Tapered rim
4. O-ring
5. Rim
6. Rim edge
7. Wheel nut
8. Wheel clamp

6.3.3 Nut, washer and clamp

Nut, washer and clamp, description

The rim is attached to the wheel hub with nuts and clamps.

The number of nuts and clamps varies depending on the type of drive axle and steering axle used.



1. Lock ring
2. Rim edge
3. Tapered rim
4. O-ring
5. Rim
6. Rim edge
7. Wheel nut
8. Wheel clamp

Wheel bolt, replacement

- 1 Machine in service position, see section *B Safety*.
- 2 Raise the machine with a jack positioned under the steering axle.
- 3 Remove the steering wheel, see *Maintenance Manual DRT 450* section 6 *Suspension*.





- 4 Knock out the bolt with a sledge hammer.
- 5 Replace the bolt.

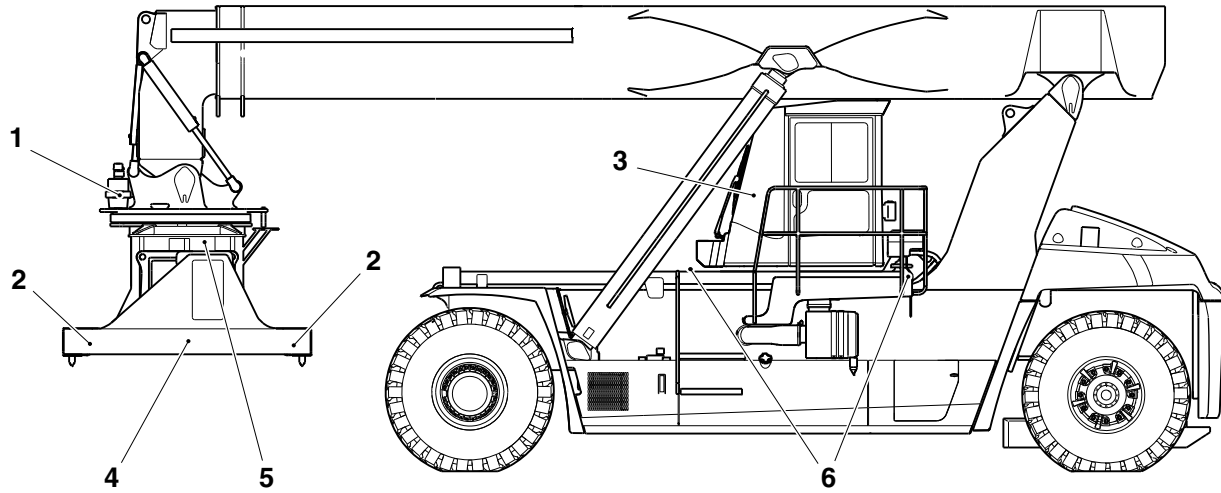
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7 Load handling

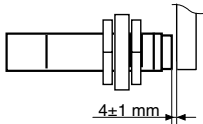
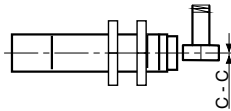
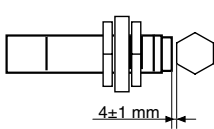
Position sensor, checking and adjustment



013889

1. Sensor rotation stop
2. Sensor, alignment
3. Sensor steering wheel movement

4. Sensor twistlocks
5. Sensor spreading
6. Sensor end position damping



- 1 Machine in service position, see section *B Safety*.
- 2 Check that the sensor in question is free of damage and dirt.
- 3 Check that the distance between the position sensor and indicator is 4 ± 1 mm. Adjust if necessary.

012352

Adjusting position sensor - indicator

7.1 Controls and instruments

7.1.1 Control lever

Control lever, description

The 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.

Lift and lower

Lifting/lowering is controlled by moving the control lever forward (lower boom) or rearward (lift boom). See *Lifting/lowering, function description*, page 7:6.

The signal can be checked via the diagnostic menu. See section 8 *Control 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 7:26.

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.8.1 *BOOM*, menu 1.

Side shift or spreading

When switch (position 4) is pressed down side shift right is activated, and when switch (position 5) is pressed down side shift left is activated. See *Side shift, function description*, page 7:38.

If the pistol trigger (position 8) is pressed in at the same time as side shift right (position 4), spreading out is activated. If the pistol trigger (position 8) is pressed in at the same time as side shift left (position 5), spreading in is activated. See *Spreading, function description*, page 7:50.

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.9.2 *ATTACH*, menu 2.

Rotation

When the potentiometer (position 3) is pressed down on the left-hand side rotation clockwise is activated, and when the right-hand side is pressed down rotation anticlockwise is activated. See *Rotation, function description*, page 7:67.

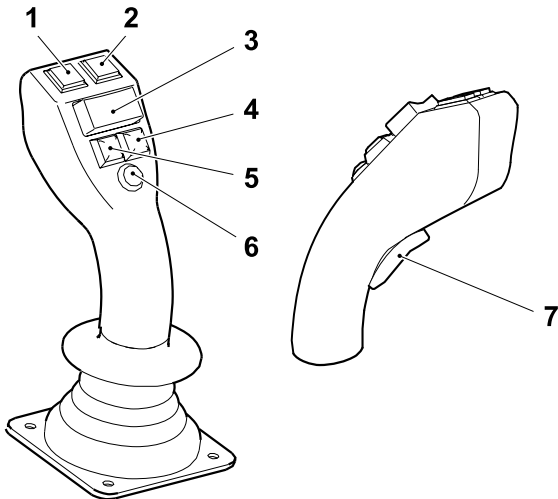
The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.9.1 *ATTACH*, menu 1.

Opening the twistlocks

When the switch (position 6) is activated, the twistlocks are opened if the conditions for this are fulfilled. See *Twistlocks, function description*, page 7:79.

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.9.3 *ATTACH*, menu 3.

 As an option the machine can be equipped with sensors on the attachment that activate damping when the attachment is approaching a container.



1. Not used
2. Not used
3. Rotation (S815-P3)
4. Side shift right (S815-T1.2)
5. Side shift left (S815-T1.1)
6. Opening of twistlocks (S815-T2) at full alignment
7. Pistol trigger (S815-T4): changes the function of side shift to spreading out (S815-T1.2) and spreading in (S815-T1.1) as well as lift to synchronised lift 

Pistol trigger

 The pistol trigger (position 8) activates weighing if the machine is equipped with a weight indicator. See *Weight indicator, description*, page 7:87.

The pistol trigger also changes the function of other buttons of the control lever.

If side shift is activated at the same time as the pistol trigger is pressed in, spreading is activated. See *Spreading, function description*, page 7:50.

 If lift is activated at the same time as the pistol trigger is pressed in, synchronised lift is activated if the machine is equipped with this option. See *Synchronised lift, function description*, page 7:91.

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.9.2 *ATTACH, menu 2*.

7.1.2 Switch, lock twistlocks

Switch, lock twistlocks, description

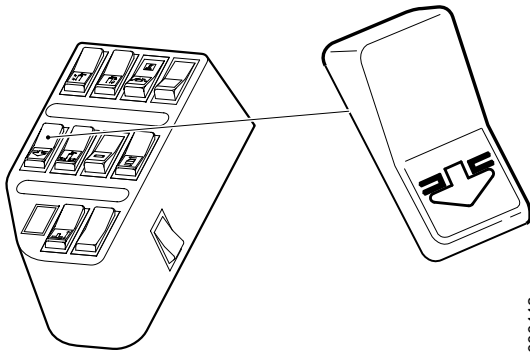
The switch for lock twistlocks (S1001) controls locking the twistlocks. The switch has three positions: two fixed and one rocker with the following functions.

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 (rocker switch).

Twistlocks are opened with the switch on the control lever, see *Control lever, description*, page 7:4.

The switch is supplied voltage by and sends a voltage signal to Control unit, cab (D790-1).

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.9.3 *ATTACH, menu 3*.



000443

Lifting/lowering, function description

Pos	Explanation	Signal description	Reference
1	Control lever (S815-P2) sends a voltage signal proportional to lever movement to Control unit, cab (D790-1).	Lower: $U_{S815/P2} = 0.5\text{--}2.0\text{ V}$ Zero position: $U_{S815/P2} = 2.0\text{--}3.0\text{ V}$ Lift: $U_{S815/P2} = 3.0\text{--}4.5\text{ V}$ 0.5 V is the fastest lowering speed and 4.5 V is the fastest lift speed. Lower voltage than 0.5 V and higher voltage than 4.5 V is used to detect faults in cable harnesses and controls.	<i>Control lever, description, page 7:4</i> D1: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.8.1 <i>BOOM menu 1</i>
2	Control unit, cab (D790-1) transmits the request for Boom up or Boom down with the speed information on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</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).	$I = 380\text{--}650\text{ mA}$	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame front</i> D3: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.8.4 <i>BOOM, menu 4</i> and 8.4.8.5 <i>BOOM, menu 5</i>
4	Control unit, cab (D790-1) transmits a request for increased engine speed on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
5	Control unit, engine (D794) increases the engine speed.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.10 <i>Control unit, engine</i>
6	Servo valve, lift (Y6005) or Servo valve, lower (Y6004) pressurises the control valve's lift slide with servo pressure.	-	7.2.5 <i>Control valve lift, lower and extension</i> , page 7:12 D3: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.8.4 <i>BOOM, menu 4</i> and 8.4.8.5 <i>BOOM, menu 5</i>
7	The control valve's lift slide changes position and pressurises Valve block lift cylinder and sends a load signal to Valve block servo pressure.	-	7.2.5 <i>Control valve lift, lower and extension</i> , page 7:12
8	Valve block servo pressure sends the load signal on to hydraulic oil pump No. 1, No. 2, No. 3 and No. 4.	See pressure plate Servo pressure lift and extension on left-hand frame member.	Section 10 <i>Common hydraulics</i> , group 10.5.7 <i>Valve block servo pressure</i>
9	Hydraulic oil pumps No. 1, No. 2, No. 3 and No. 4 pump oil from the hydraulic oil tank.	See pressure plate Max. pressure hydraulic oil pumps on left-hand frame member.	Section 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
10	The non-return valves prevent the oil being pumped between the pumps.	-	-
11	The priority valve leads feed pressure to Control valve, lifting/lowering.	-	Section 5 <i>Steering</i> , group 5.2.2 <i>Priority valve</i>
12	Valve block servo pressure reduces the oil pressure from the hydraulic pumps to servo pressure for the control valve.	See the pressure plate on the left-hand frame beam.	Section 10 <i>Common hydraulics</i> , group 10.5.7 <i>Valve block servo pressure</i>
13	The accumulator stores servo pressure. The non-return valve in valve block servo pressure makes it possible to store the pressure when the engine is switched off.	See the pressure plate on the left-hand frame beam.	<i>Accumulator servo circuit, description</i> , page 7:10
14	The servo filter cleans the servo oil before the control valve.	-	<i>Servo filter, description</i> , page 7:9
15	With boom down Control unit, frame front (D797-F) activates Solenoid valve, blocking right (Y6001) and Solenoid valve, blocking left (Y6002).	$U = 24\text{ V}$	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame front</i> D15: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.8.2 <i>BOOM menu 2</i>

Pos	Explanation	Signal description	Reference
16	With boom down Solenoid valve, blocking right (Y6001) and Solenoid valve, blocking left (Y6002) act on the blocking valves in the valve blocks for left and right lift cylinder respectively.	-	<i>Valve block lift cylinder, description, page 7:13</i> D15: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.8.2 <i>BOOM menu 2</i>
17	With boom up the blocking valves in the valve blocks are opened for left and right lift cylinder respectively by the hydraulic pressure from the control valve. With boom down the blocking valve opens so that the pressure from the lift cylinder can be released.	-	<i>Valve block lift cylinder, description, page 7:13</i>
18	The lift cylinders' piston side is pressurised and the boom is lifted.	-	<i>Lift cylinder, description, page 7:17</i>
19	Regeneration Sensor, hydraulic pressure lift cylinder, piston side left (B768-L1) sends a voltage signal proportional to the oil pressure to Control unit, frame front (D797-F). NOTE <i>Regeneration is not possible in the proximity of end position or in the event of overload.</i>	$U_{B768-L1/1} = 5\text{ V}$ $U_{B768-L1/2} = 0\text{ V}$ $U_{B768-L1/5} = 0.5\text{--}4.5\text{ V}$ Regeneration is activated when the pressure in the lift cylinders is 8.5 MPa. Regeneration is stopped if the pressure reaches 18.5 MPa.	<i>Sensor, hydraulic pressure lift cylinder, description, page 7:21</i> D19: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.10.3 <i>OP menu 3</i>
20	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.	$U = 24\text{ V}$	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame front</i> D20: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.8.3 <i>BOOM menu 3</i>
21	Solenoid valve, regeneration right (Y6051) and Solenoid valve, regeneration left (Y6052) pressurise the valve block's lift slide with servo pressure.	-	<i>Valve block lift cylinder, description, page 7:13</i>
22	The lift slide changes position and leads oil from the rod side of the lift cylinder to the piston side.	-	<i>Valve block lift cylinder, description, page 7:13</i>
23	Lift speed increases.	-	-
24	Damping When the beam is approx. 4° from an end position then damping is activated. Sensor, boom angle (B771) sends a voltage signal proportional to the boom angle to Control unit, frame rear (D797-R) requesting damping on the CAN bus.	Checked by control system, error shown with error code.	Section 8 <i>Control system</i> , group 8.2.1.5 <i>Sensor, boom angle</i> Section 11 <i>Common electrics</i> , group 11.5.3.3 <i>Control unit, frame rear</i> D24: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.8.8 <i>BOOM menu 8</i>
25	Control unit, frame rear (D797-R) sends damping on the CAN bus.	Checked by control system, error shown as error code.	Section 11 <i>Common electrics</i> , group 11.5.3.3 <i>Control unit, frame rear</i>
26	The pressure limiting valve prevents the pressure to the control valve for lift, lower and extension from being too high.	-	Section 10 <i>Common hydraulics</i> , group 10.2.4 <i>Pressure limiting valve</i>

Hydraulic diagram, see section *E Schematics*, group 10 *Common hydraulics*, *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 rollover.

The machine must absolutely not be operated before lowering speed is verified.

- 1 Operate the machine and hydraulics until the hydraulic oil reaches the operating temperature of **50 °C**.
- 2 Lift a container weighing 35-45 tonnes.
- 3 Move the machine away to a level and a safe place.

NOTE

It is important that the ground is level and without gradient.

- 4 Retract the boom fully and lift to maximum.
- 5 Note the time for how long it takes to lower from the top position until the container is about 20 cm from the ground.
Lowering should take **18-21 seconds**.
- 6 If the time is not correct then contact Cargotec 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*.

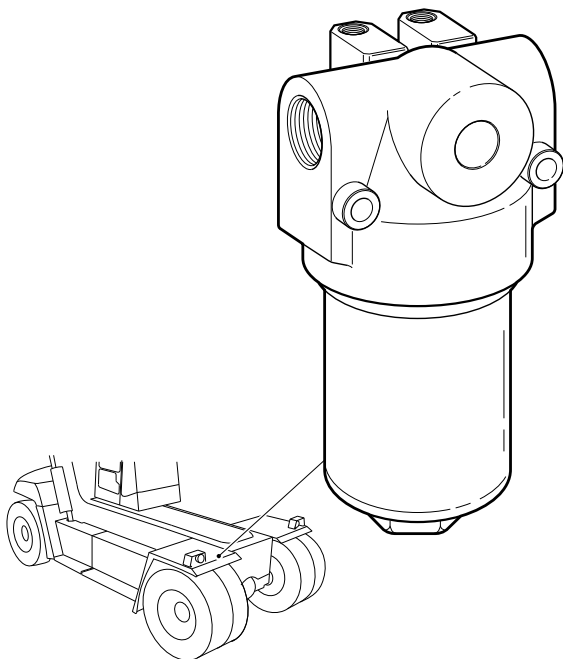
7.2.2 Servo filter

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 lifting beam on the right of the engine compartment, between the pressure reducer and the control valve for lift, lower and extension.

The servo filter is a low-pressure filter with detachable filter insert. The oil is cleaned when it passes through the filter insert's filter material.

The filter insert is pressed against the upper section of the filter housing by a spring. Rubber gaskets seal between the insert and filter housing. If the back pressure through the filter is too great then the insert is pressed down so that the oil passes by the insert. This occurs if the oil is viscous (cold or incorrect viscosity) or if the filter insert is clogged.



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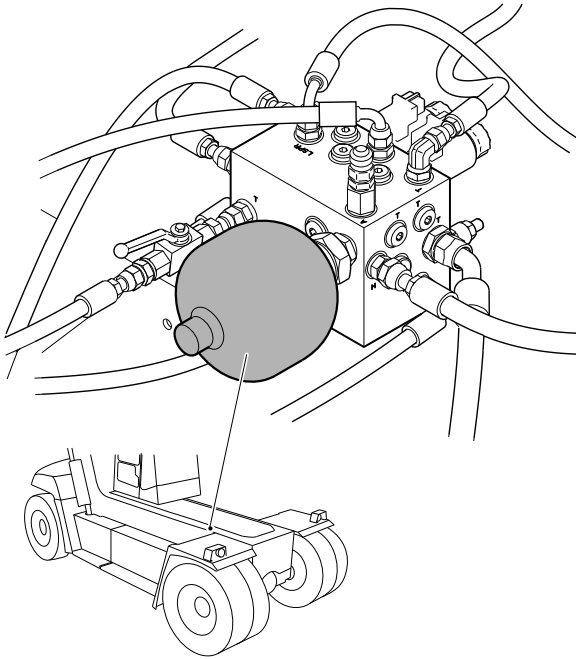
7.2.4 Accumulator servo circuit

Accumulator servo circuit, description

The accumulator stores pressurised oil and ensures that there is servo pressure for activating control valve functions. The accumulator is fitted on valve block servo pressure to the right on the hydraulic plate in the engine compartment in front of the transmission.

The accumulator is a diaphragm type and is divided into two spaces by a diaphragm. One side of the diaphragm is pressurised by nitrogen gas. The other side is pressurised by the hydraulic oil, which compresses the nitrogen gas.

Furtherst up on the accumulator is a test outlet for checking gas pressure and filling gas.



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Accumulator servo circuit, replacement

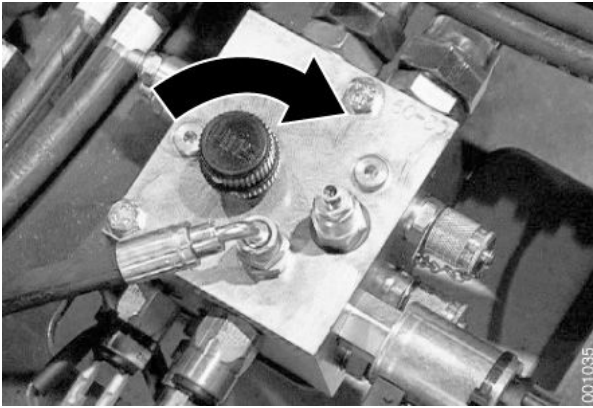
NOTE

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

- 1 Depressurise the brake and hydraulic systems, see section B Safety.
- 2 Machine in service position, see section B Safety.
- 3 Detach the accumulator from its mounting.
- 4 Replace the accumulator.
- 5 Fit in the reverse order.



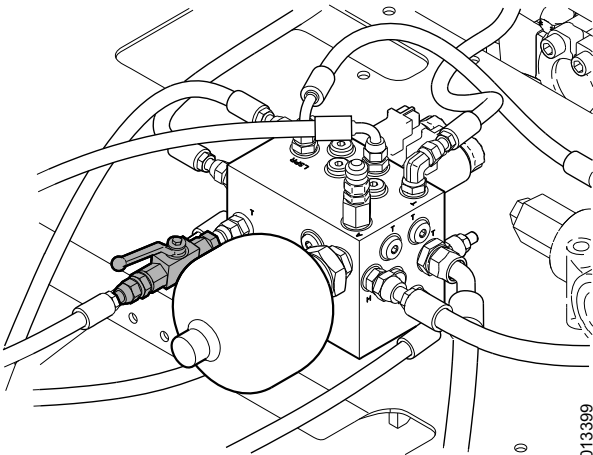
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- 6 Close the drain valve on the accumulator charging valve.

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



Relief valve for top lift, the figure shows an open valve.

- 7 Close the relief valve for top lift.



CAUTION

Hydraulic oil may be directed the wrong way.

Risk of damage to the fine filter for hydraulic oil.

Check that the relief valve for top lift is closed before starting the engine.



- 8 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 centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

Do not overfill!

Leakage and environmental damage!

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

7.2.5 Control valve lift, lower and extension

Control valve lift, lower and extension, description

The control valve controls the speed and direction of lift and extension. The control valve is fitted on a bracket in the space between the lifting beam and front axle.

The valve has two sections, one for the lift function and one for boom extension. The sections have many similarities, but are described separately under the respective function. For extension, see 7.3.5 *Control valve lift, lower and extension*, page 7:29. Electric servo valves control the flow from the valve.

The control valve is a proportional valve controlled by servo valves. This means that both volume and direction of the 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 electric current into a low hydraulic pressure that is proportional to the current, so-called servo pressure. The servo pressure acts on the spring-centred control slide in the control valve for the function in question and thereby controls 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 the direction and flow of the oil to the lift cylinder.

Servo valve, lift

Servo valve, lift controls servo pressure to the lift slide so that it controls oil pressure for lifting. The valve is controlled electrically with the Solenoid valve, lift (Y6005), which is activated by Control unit, frame front (D797-F).

The signals can be checked via the diagnostic menu. See section 8 *Control 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 the Solenoid valve, lower (Y6004), which is activated by Control unit, frame front (D797-F).

The signals can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.8.5 *BOOM*, menu 5.

Control valve lift, lower and extension, replacement

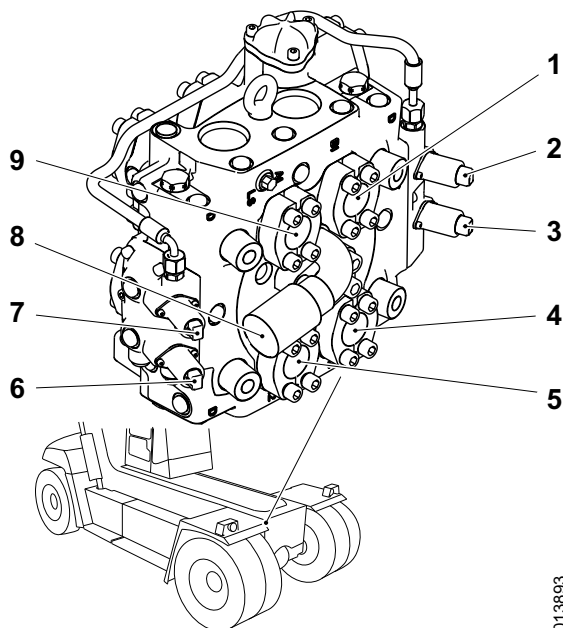


DANGER

The lowering speed must be correct. If lowering speed is too high there is a risk of rollover.

The machine must absolutely not be operated before lowering speed is verified.

After replacing Control valve lift, lower and extension, or parts of the valve, lowering speed must be checked. See *Lowering speed, checking*, page 7:9.

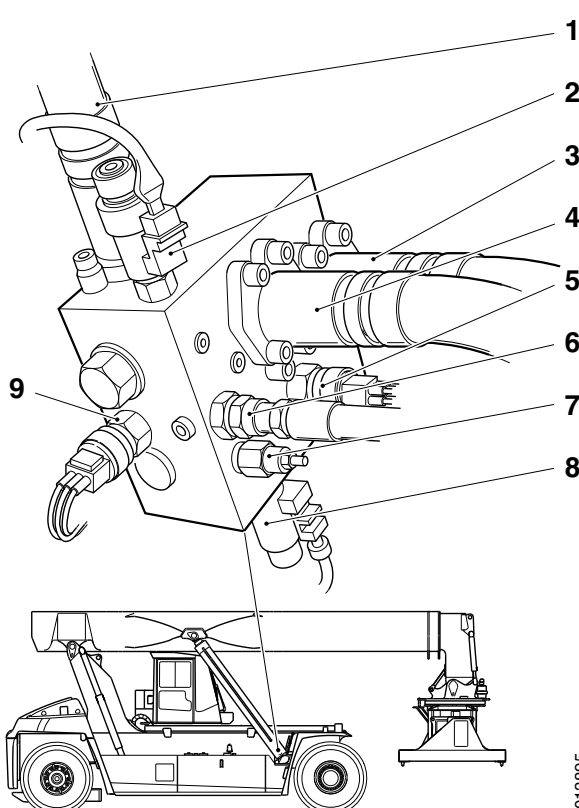


1. Connection, rod side, extension cylinder (B1)
2. Servo valve, boom out (Y6006)
3. Servo valve, lift (Y6005)
4. Connection, rod side, right lift cylinder (B2)
5. Connection, piston side, right lift cylinder (A2)
6. Servo valve, lower (Y6004)
7. Servo valve, boom in (Y6007)
8. Connection, feed from hydraulic oil pumps (P)
9. Connection, piston side, extension cylinder (A1)

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7.2.7 Valve block lift cylinder

Valve block lift cylinder, description



1. Connection, rod side, lift cylinder (C-)
2. Solenoid valve regeneration (Y6051 or Y6052)
3. Pressure feed connection (VA)
4. Connection tank (T)
5. Pressure sensor, piston side (C+M)
6. Draining servo valves (D)
7. Shock valve
8. Solenoid valve blocking (Y6001 or Y6002)
9. Pressure sensor, rod side (C-M)

1 Valve block lift cylinder directs oil to the lift cylinder and is mounted directly on the lower part of the lift cylinder. The valve block contains the blocking valve, regeneration valve, non-return valve and shock valve.

3 Blocking valve

4 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.)

6 Servo valve blocking actuates 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 via the diagnostic menu. See section 8 *Control system*, group 8.4.8.2 *BOOM*, menu 2.

Regeneration valve

The regeneration valve directs oil from the rod side of the cylinder back to the piston side. This allows the oil to be re-used during lifting. For more information on regeneration, see *Lifting/lowering, function description*, page 7:6. The regeneration valve is regulated by servo valve regeneration.

Servo valve 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 via the diagnostic menu. See section 8 *Control system*, group 8.4.8.3 *BOOM*, menu 3.

Shock valve

The shock valve protects the hydraulic system against pressure 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

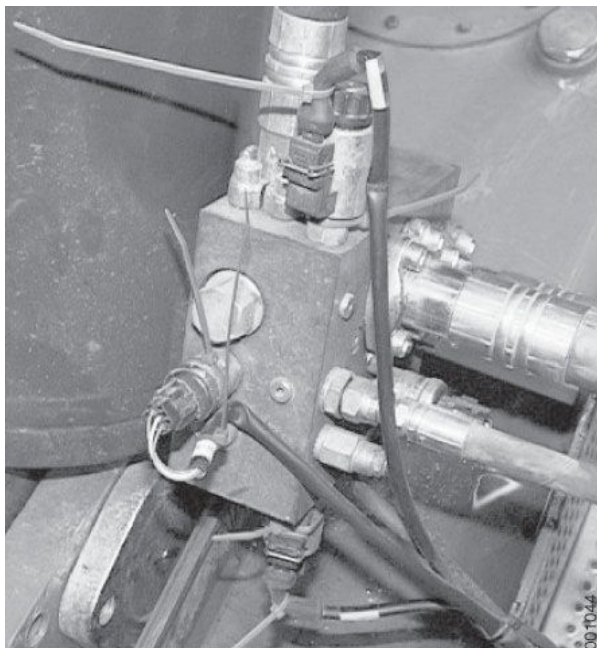
The non-return valve prevents oil from flowing the wrong way during regeneration.

Valve block lift cylinder, replacement

NOTE

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

- 1 Machine in service position, see section B *Safety*.
- 2 Depressurise the brake and hydraulic systems, see section B *Safety*.
- 3 Turn the start key to position 0 and switch off the system voltage.



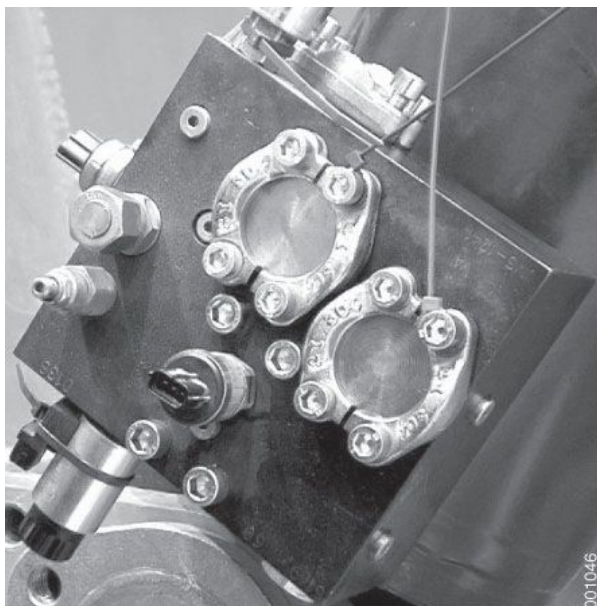
- 4 Mark and disconnect the cable harness from the valve block.
- 5 Remove the cable harness's clamping at the valve block.



- 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

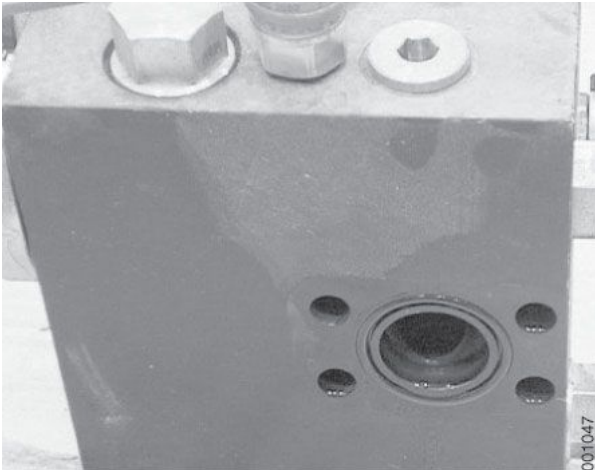
Check that the O-rings are intact, clean and in the correct position.

NOTE

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

NOTE

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



- 9 Fit the new valve on the lift cylinder.

NOTE

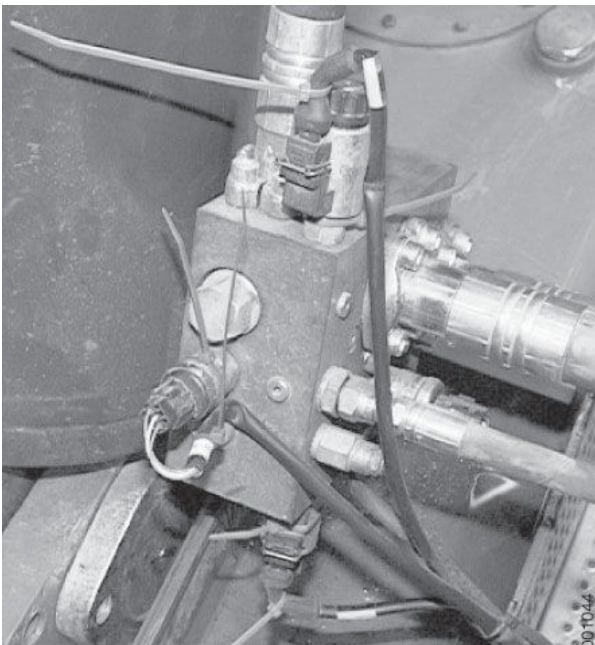
Check that the O-rings are intact, clean and in the correct position.



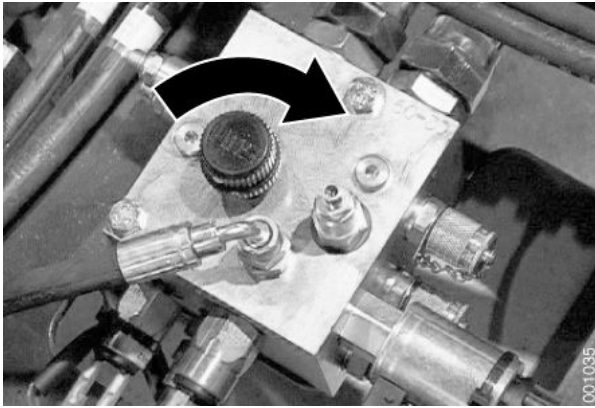
- 10 Connect the hydraulic hoses to the valve block in accordance with the marking.

NOTE

Check that the O-rings are intact, clean and in the correct position.



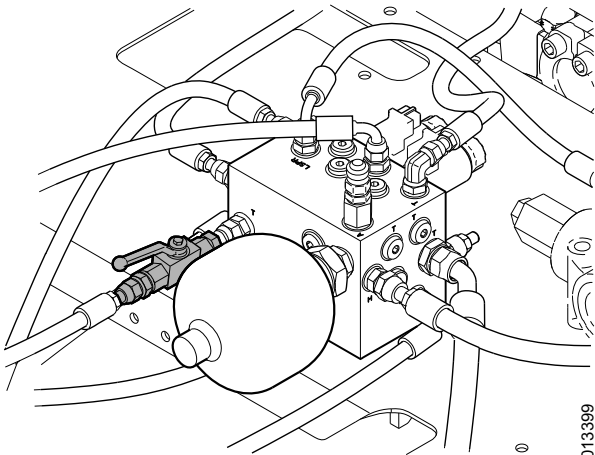
- 11 Connect the cable harness to the valve block in accordance with the marking.
- 12 Clamp the cable harness as before.



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

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



Relief valve for top lift, the figure shows an open valve.

- 14 Close the relief valve for top lift.



CAUTION

**Hydraulic oil may be directed the wrong way.
Risk of damage to the fine filter for hydraulic oil.
Check that the relief valve for top lift is closed before starting the engine.**

- 15 Switch on the system voltage and start the engine.

- 16 Activate the lift carefully.



CAUTION

**Air in the hydraulic system may cavitate and result in product damage.
Activate the steering carefully and operate at the lowest possible speed a couple of times to avoid cavitation.**



CAUTION

**Air in the hydraulic system may cavitate and result in product damage.
Activate the functions carefully and operate at the lowest possible speed a couple of times to avoid cavitation.**

- 17 Check for leaks.



- 18 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 centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

Do not overfill!

Leakage and environmental damage!

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

- 19 Check the lowering speed, see *Lowering speed, checking*, page 7:9.

7.2.8 Lift cylinder

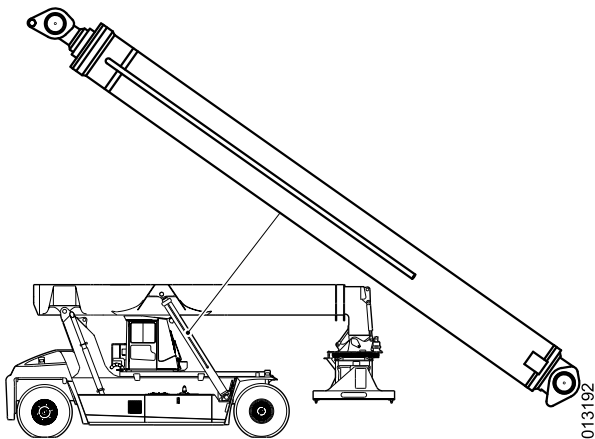
Lift cylinder, description

The lift cylinders lift and lower (angle) the lift boom. The lift cylinders are fitted between boom and frame in the front edge of the machine, one on the right and one on the left-hand side.

Fitted on each lift cylinder is a valve block that controls pressurising and regeneration of the lift cylinder.

The lift cylinder is equipped with guide bearings both in the cylinder end and the piston rod mounting. The piston rod mounting is threaded in the piston rod and locked with a lock nut.

The lift cylinders are connected in parallel and are supplied from the control valve for lift, lower and extension, see 7.2.5 *Control valve lift, lower and extension*, page 7:12.



Lift cylinder, replacement



DANGER

A lift cylinder weighs approx. 2 tonnes.

Extreme danger!

Use wooden blocks as protection between cab and lift cylinder when the lift cylinder is lowered or lifted. Secure the lift cylinders with tensioning straps in between them.



WARNING

The boom may move when the pins are removed.

Risk of personal injury!

Make sure that the pins are unloaded. Stand to the side of the boom mounting so that it provides protection in the event of any movement.

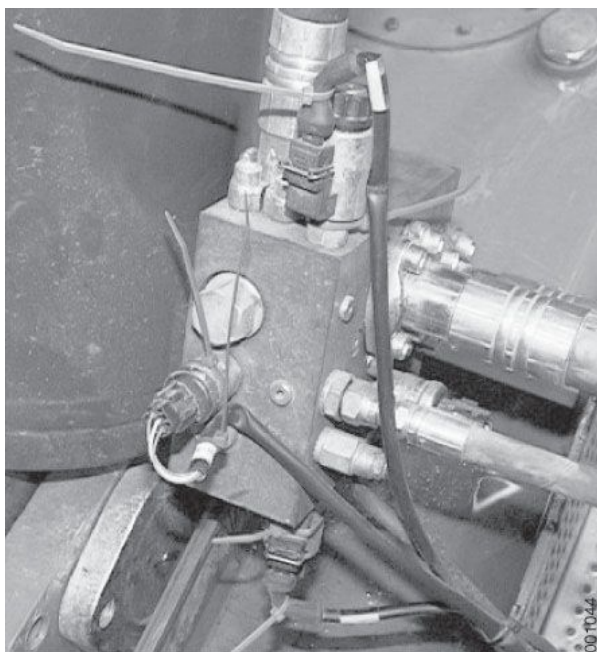


CAUTION

The boom may drop.

Be certain to compensate for the lift cylinder's support of the boom by lifting the boom's leading edge with the lifting equipment.

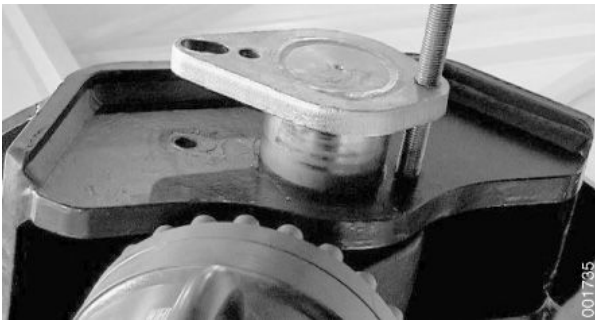
- 1 Move the cab into the front position.
- 2 Machine in service position, see section *B Safety*.
- 3 Depressurise hydraulic and brake systems, section *B Safety*.
- 4 Turn the start key to position 0 and switch off the system voltage.
- 5 Attach hoisting equipment at the front edge of the boom.
- 6 Lift the boom at the front edge so that the bearings on the lift cylinders are unloaded.



- 7 Mark up and detach 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 Unload the lower bearing of the lift cylinder.
11 Remove the lower pin for the lift cylinder.
12 Lift away the lift cylinder.
13 Fit new bearing races in the lift cylinder.
14 Lubricate the lift cylinder's bearing races and the holes for the pins in the frame and the boom with plenty of aluminium paste.

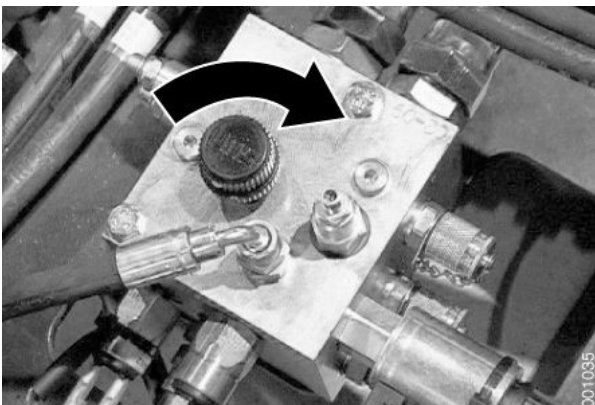
NOTE

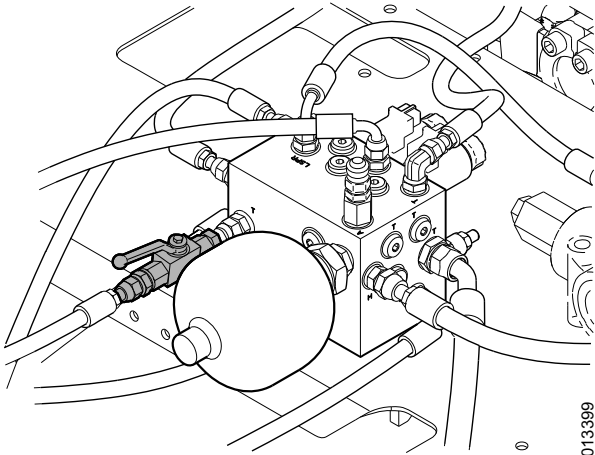
The bearings are only lubricated during replacement.

- 15 Lift the new lift cylinder into place.
16 Fit the pins for the lift cylinder.
17 Connect the hydraulic hoses to the lift cylinder.
18 Close the drain valve on the accumulator charging valve.

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.





Relief valve for top lift, the figure shows a closed valve.

- 19 Close the relief valve for top lift.



CAUTION

**Hydraulic oil may be directed the wrong way.
Risk of damage to the fine filter for hydraulic oil.
Check that the relief valve for top lift is closed before starting the engine.**

- 20 Switch on the system voltage and start the engine.

- 21 Carefully activate the lift function.



CAUTION

**Air in the hydraulic system may cavitate and result in product damage.
Activate the steering carefully and operate at the lowest possible speed a couple of times to avoid cavitation.**

- 22 Check for leaks.

- 23 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 centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

**Do not overfill!
Leakage and environmental damage!
The hydraulic oil level is checked with the boom completely lowered and retracted.**

- 24 Check the lowering speed, see *Lowering speed, checking*, page 7:9.

Hydraulic cylinders, repairs

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

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 fitted on valve block lift cylinder.

Pressure is measured to determine whether regeneration can be activated. A sensor measures the pressure on the piston side of the left-hand lift cylinder.



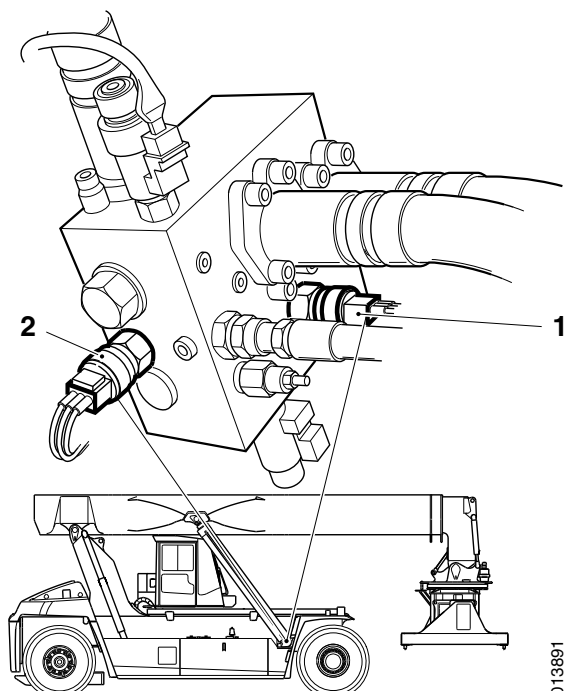
If the machine is equipped with the fixed scale option then an extra pressure sensor is used, on the piston side for the right-hand lift cylinder.



If the machine is equipped with the electrical dynamic scale option then two pressure sensors are used, one for the rod side and one for the piston side on right and left-hand lift cylinders respectively (a total of four pressure sensors).

The sensors are supplied voltage by, and send a voltage signal proportional to the hydraulic oil pressure, to Control unit, frame front (D797-F).

The signals can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.10.3 *OP, menu 3*.



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, rod side, left (B768-L2)

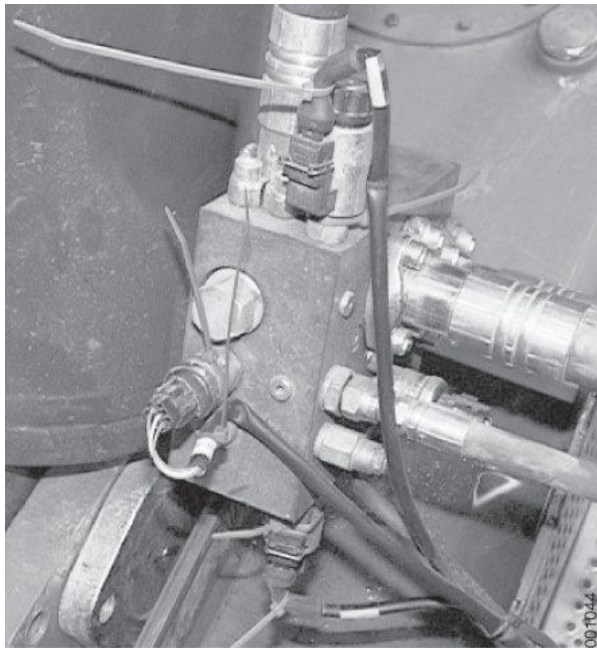
 Sensor, hydraulic pressure lift cylinder, rod side, right (B768-R2)

Sensor, hydraulic pressure lift cylinder, replacement

NOTE

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

- 1 Machine in service position, see section B *Safety*.
- 2 Depressurise the brake and hydraulic systems, see section B *Safety*.



- 3 Disconnect the cable harness from the sensor for hydraulic pressure lift cylinder.
- 4 Remove the sensor for hydraulic pressure lift cylinder.

NOTE

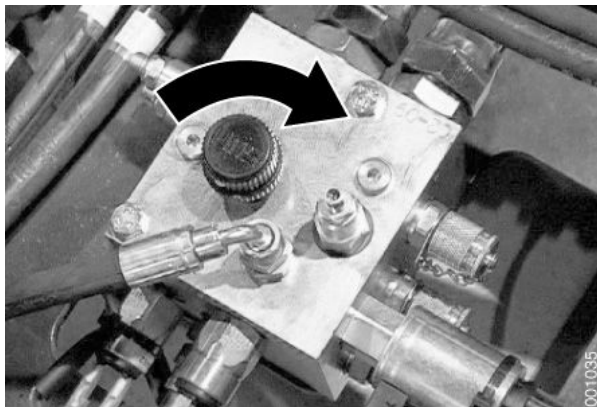
Plug all connections immediately to protect the hydraulic system from impurities.

- 5 Fit the new sensor.

NOTE

Check that the O-rings are intact, clean and in the correct position.

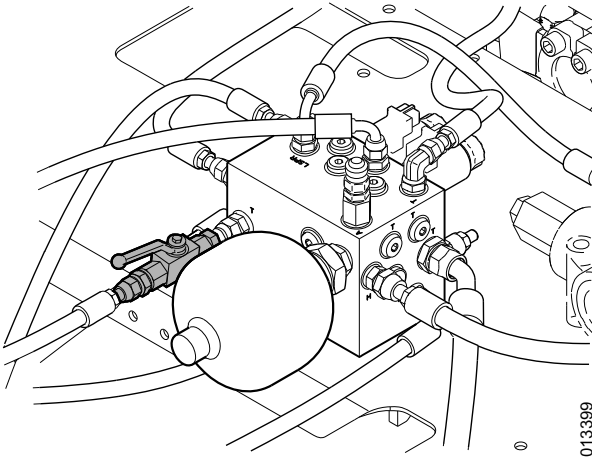
- 6 Connect the cable harness to the sensor for hydraulic pressure.
- 7 Clamp the cable harness as before.



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

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



Relief valve for top lift, the figure shows an open valve.

- 9 Close the relief valve for top lift.



CAUTION

Hydraulic oil may be directed the wrong way.

Risk of damage to the fine filter for hydraulic oil.

Check that the relief valve for top lift is closed before starting the engine.

- 10 Switch on the system voltage and start the engine.

- 11 Activate the lift carefully.



CAUTION

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

Activate the steering carefully and operate at the lowest possible speed a couple of times to avoid cavitation.

- 12 Check that the hydraulic connections of the valve block are sealed tightly and lifting/lowering works correctly.

- 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 centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

Do not overfill!

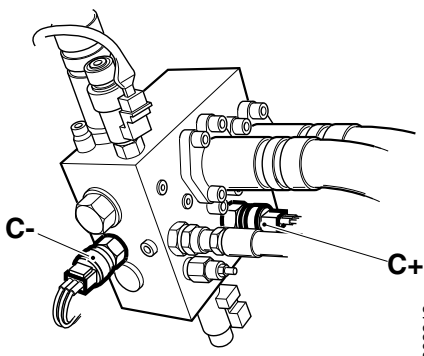
Leakage and environmental damage!

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

DIAG OP		3 (x)
PRESENT INPUT SIGNAL		
LIFT CYL	LE	RI
C-	X.XXV	X.XXV
C+	X.XXV	X.XXV

- 14 Check the function of the sensor from the diagnostic menu. See section *8 Control system*, group *8.4.10.3 OP menu 3*.

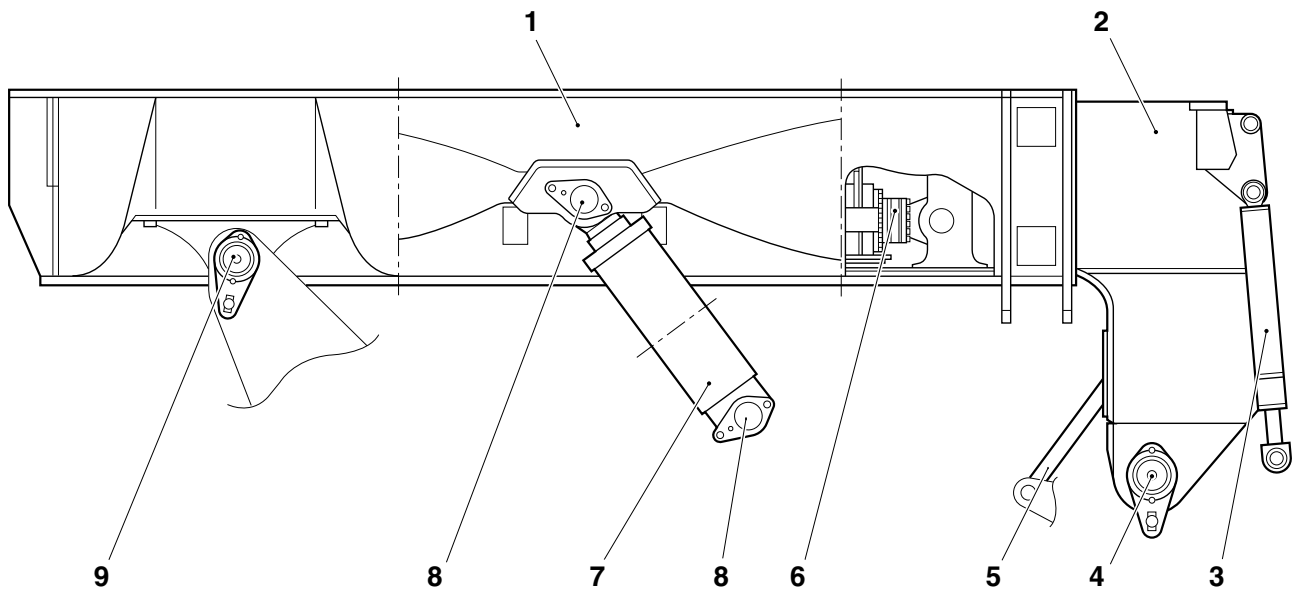
Raise the boom and check that the sensor is sending values. The value should be approximately the same as from the sensor on the second lift cylinder (RI/LE).



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7.2.10 Lift boom

Lift boom, description



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- | | |
|----------------------------------|---------------------------|
| 1. Outer boom | 6. Extension cylinder |
| 2. Inner boom | 7. Lift cylinder |
| 3. Tilt cylinder right-hand side | 8. Mounting lift cylinder |
| 4. Mounting attachment | 9. Rear boom mounting |
| 5. Tilt cylinder left-hand side | |

The lift boom lifts the load. The rear section of the boom is secured into the frame with two bearing-mounted shafts. Fitted in the front edge is the 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 fitted 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.

7.2.11 Sensor boom angle

Sensor, boom angle, general

See section 8 *Control system*, group 8.2.1.5 *Sensor, boom angle*.

7.2.12 Pipes and hoses

Piped and hoses, description

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

7.2.17 Valve block servo pressure

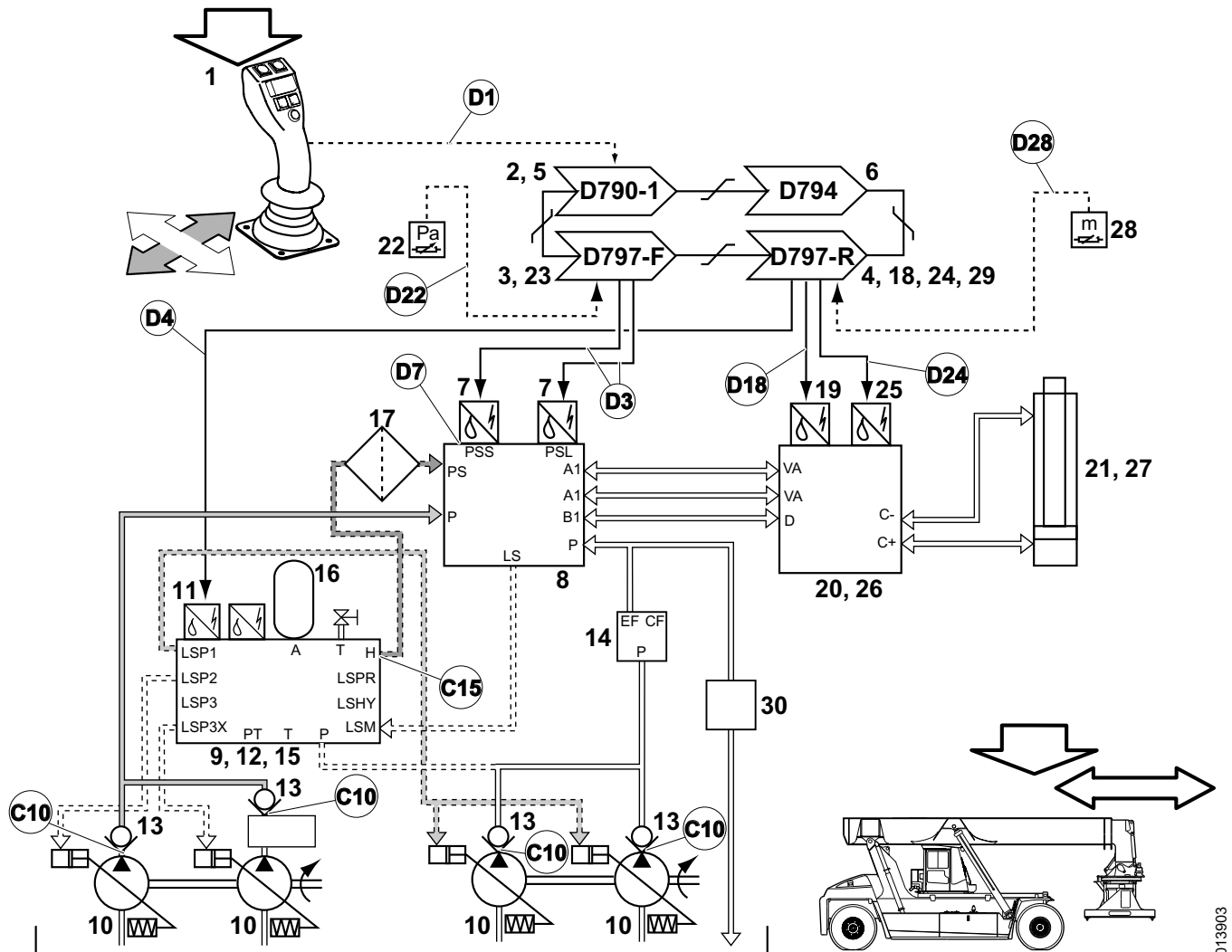
Valve block servo pressure, description

See section *10 Common hydraulics*, group *10.5.7 Valve block servo pressure*.

7.3 Extension

Extension, function description

Condition	Reference value	Reference
Control breaker	Disengaged	Section 11 <i>Common electrics</i> , group 11.5.1.4 <i>Emergency stop switch voltage</i>
Overload system	Boom out: passive	Section 8 <i>Control system</i> , group 8.2.1 <i>Overload system</i>



Pos	Explanation	Signal description	Reference
1	Control lever (S815-P1) sends a voltage signal proportional to lever movement to Control unit, cab (D790-1).	Boom in: $U_{S815/P1} = 0.5-2.0 \text{ V}$ Zero position: $U_{S815/P1} = 2.0-3.0 \text{ V}$ Boom out: $U_{S815/P1} = 3.0-4.5 \text{ V}$ 0.5 V is the fastest retraction speed and 4.5 V is the fastest extension speed. Lower voltage than 0.5 V and higher voltage than 4.5 V is used to detect faults in cable harnesses and controls.	<i>Control lever, description</i> , page 7:4 D1: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.8.1 <i>BOOM menu 1</i>
2	Control unit, cab (D790-1) transmits the request for Boom out or Boom in with the speed information on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>

Pos	Explanation	Signal description	Reference
3	Control unit, frame front (D797-F) activates Servo valve, boom out (Y6006) or Servo valve, boom in (Y6007).	I = 380-650 mA	7.2.5 Control valve lift, lower and extension, page 7:12 D3: Diagnostic menu, see section 8 Control system, group 8.4.8.6 BOOM, menu 6 and 8.4.8.7 BOOM, menu 7
4	For boom in Control unit, frame rear (D797-R) activates Solenoid valve, pump unloading (Y6062).	U = 24 V	D4: Diagnostic menu, see section 8 Control system, group 8.4.8.2 BOOM menu 2
5	Control unit, cab (D790-1) transmits a request for increased engine speed on the CAN bus.	Checked by control system, error shown with error code.	Section 11 Common electrics, group 11.5.3.1 Control unit, cab
6	Control unit, engine (D794) increases the engine speed.	Checked by control system, error shown with error code.	Section 11 Common electrics, group 11.5.3.10 Control unit, engine
7	Servo valve, boom out (Y6006) or Servo valve, boom in (Y6007) pressurises the control valve's extension slide with servo pressure.	-	7.2.5 Control valve lift, lower and extension, page 7:12 D7: Diagnostic menu, see section 8 Control system, group 8.4.8.6 BOOM, menu 6 and 8.4.8.7 BOOM, menu 7
8	The control valve's extension slide changes position and pressurises Valve block extension cylinder and sends a load signal to Valve block servo pressure.	-	7.2.5 Control valve lift, lower and extension, page 7:12
9	Valve block servo pressure sends the load signal on to hydraulic oil pump No. 1, No. 2, No. 3 and No. 4.	See pressure plate Servo pressure lift and extension on left-hand frame member.	Section 10 Common hydraulics, group 10.5.7 Valve block servo pressure
10	Hydraulic oil pumps No. 1, No. 2, No. 3 and No. 4 pump oil from the hydraulic oil tank.	See pressure plate Max. pressure hydraulic oil pumps on left-hand frame member.	Section 10 Common hydraulics, group 10.4.2 Axial piston pump with variable displacement
11	For boom in Solenoid valve, pump unloading (Y6062) actuates the pump unloading slide in valve block servo pressure.	-	Section 10 Common hydraulics, group 10.5.7 Valve block servo pressure
12	For boom in, valve block, servo pressure load signal, drains to two of the hydraulic oil pumps to the tank so that only two pumps generate pressure.	-	Section 10 Common hydraulics, group 10.5.7 Valve block servo pressure
13	The non-return valves prevent the oil being pumped between the pumps.	-	-
14	The priority valve leads feed pressure to Control valve, lift, lower and extension.	-	Section 5 Steering, group 5.2.2 Priority valve
15	Valve block servo pressure reduces the oil pressure from the hydraulic pumps to servo pressure for the control valve.	See the pressure plate on the left-hand frame beam.	Section 10 Common hydraulics, group 10.5.7 Valve block servo pressure
16	The accumulator stores servo pressure. The non-return valve in valve block servo pressure makes it possible to store the pressure when the engine is switched off.	See the pressure plate on the left-hand frame beam.	Accumulator servo circuit, description, page 7:10
17	The servo filter cleans the servo oil before the control valve.	-	Servo filter, description, page 7:9
18	For boom in Control unit, frame rear (D797-R) activates Solenoid valve, blocking extension (Y6050).	U = 24 V	Valve block extension cylinder, description, page 7:30 D18: Diagnostic menu, see section 8 Control system, group 8.4.8.2 BOOM menu 2

Pos	Explanation	Signal description	Reference
19	For boom in Solenoid valve, blocking extension (Y6050) actuates the blocking slide in valve block, extension cylinder.	-	<i>Valve block extension cylinder, description, page 7:30</i>
20	For boom out the blocking slide is opened in valve block, extension cylinder by the hydraulic pressure from the control valve. For boom in the blocking valve opens and releases pressure from the extension cylinder.	-	<i>Valve block extension cylinder, description, page 7:30</i>
21	Extension cylinder extends or retracts the boom.	-	<i>Extension cylinder, description, page 7:30</i>
22	Regeneration Sensor, hydraulic pressure lift cylinder, piston side left (B768-L1) sends a voltage signal proportional to the cylinder pressure in the lift cylinders to Control unit, frame front (D797-F). NOTE <i>Regeneration is not possible in the proximity of end position or in the event of overload.</i>	U _{B768-L1/1} = 5 V U _{B768-L1/2} = 0 V U _{B768-L1/3} = 0.5–4.5 V	<i>Sensor, hydraulic pressure lift cylinder, description, page 7:21</i> D22: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.10.3 <i>OP menu 3</i>
23	Control unit, frame front (D797-F) sends information about the pressure in the lift cylinders on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame front</i>
24	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 7:30</i> D24: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.8.3 <i>BOOM menu 3</i>
25	Servo valve, regeneration (Y6046) pressurises the regeneration valve.	-	<i>Valve block extension cylinder, description, page 7:30</i>
26	The regeneration valve changes position and directs oil from the rod side of the extension cylinder to the piston side.	-	<i>Valve block extension cylinder, description, page 7:30</i>
27	Extension speed increases.	-	<i>Valve block extension cylinder, description, page 7:30</i>
28	Damping Sensor, boom length (B777) sends a voltage signal proportional to the boom extension to Control unit, frame rear (D797-R) which sends damping on the CAN bus. When the extension is about 0.4 m from the end position damping is activated.	-	Section 8 <i>Control system</i> , group 8.2.1.6 <i>Sensor, boom length</i> Electronic overload system: D28: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.10.4 <i>OP, menu 4</i> and 8.4.10.6 <i>OP, menu 6</i>
29	Control unit, frame rear (D797-R) sends information about the pressure in the lift cylinders on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.3 <i>Control unit, frame rear</i>
30	The pressure limiting valve prevents the pressure to the control valve for lift, lower and extension from being too high.	-	Section 10 <i>Common hydraulics</i> , group 10.2.4 <i>Pressure limiting valve</i>

Hydraulic diagram, see section *E Schematics*, group 10 *Common hydraulics*, *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 7:9.

7.3.4 Accumulator servo circuit

Accumulator servo circuit, description

See *Accumulator servo circuit, description*, page 7:10.

7.3.5 Control valve lift, lower and extension

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 many similarities, but are described separately under the respective function.

For general information on the control valve, refer to 7.2.5 *Control valve lift, lower and extension*, page 7:12.

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 via the diagnostic menu. See section 8 *Control 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.

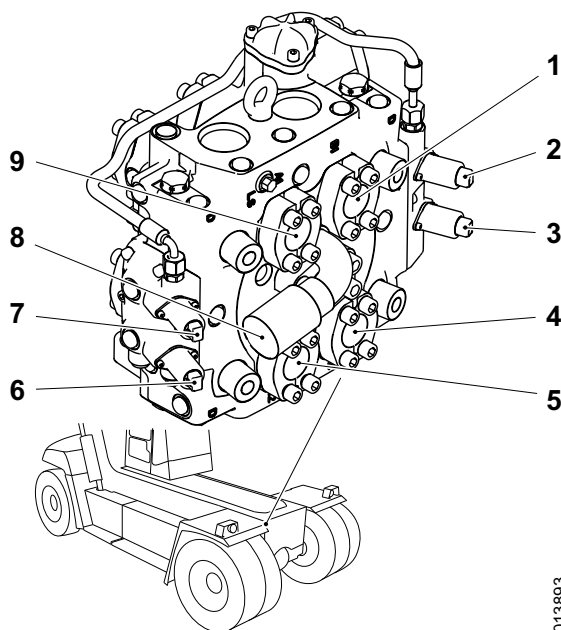
Servo valve boom in is controlled electrically with Solenoid valve, boom in (Y6007) which is activated by Control unit, frame front (D797-F).

The signal can be checked via the diagnostic menu. See section 8 *Control 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 rod side and tank if the pressure becomes too high.



1. Connection, rod side, extension cylinder (B1)
2. Servo valve, boom out (Y6006)
3. Servo valve, lift (Y6005)
4. Connection, rod side, right lift cylinder (B2)
5. Connection, piston side, right lift cylinder (A2)
6. Servo valve, lower (Y6004)
7. Servo valve, boom in (Y6007)
8. Connection, feed from hydraulic oil pumps (P)
9. Connection, piston side, extension cylinder (A1)

7.3.7 Valve block, extension cylinder

Valve block extension cylinder, description

Valve block extension cylinder directs pressure to the extension cylinder. The valve block is fitted at the rear 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) actuates the blocking valve. Solenoid valve, blocking extension (Y6050) which is activated by Control unit, frame rear (D797-R).

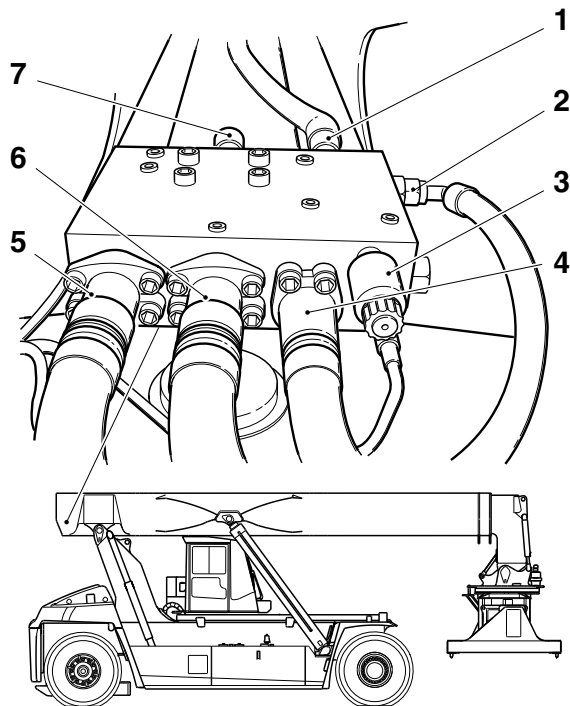
The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.8.2 *BOOM*, menu 2.

Regeneration valve

The regeneration valve directs oil from the rod side back to the piston side. This allows the oil to be re-used during extension. For more information on regeneration, see *Extension, function description*, page 7:26. The regeneration valve is regulated by servo valve regeneration.

Solenoid valve, extension (Y6046) pressurises the regeneration valve. Solenoid valve, extension (Y6046) which is activated by Control unit, frame rear (D797-R).

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.8.3 *BOOM*, menu 3.



1. Connection, rod side (C-)
2. Draining (D)
3. Solenoid valve regeneration (Y6046)
4. Connection control valve (VB)
5. Connection control valve (VA)
6. Connection control valve (VA)
7. Solenoid valve blocking (Y6050)

7.3.8 Extension cylinder

Extension cylinder, description

The extension cylinder forces out and pulls in the inner boom. The extension cylinder is fitted 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.

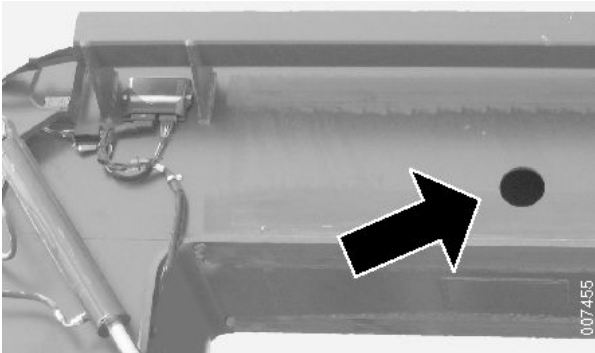
Extension cylinder, replacement

NOTE

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

Removal

- 1 Machine in service position, see section B Safety.
- 2 Operate the boom out until the inspection holes in the side of the inner boom become accessible.
- 3 Depressurise brake and hydraulic systems, see section B Safety.



- 4 Remove the lock rings and press out the shaft for the front cylinder mounting in the inner boom.
- 5 Remove the sensor for boom length from the boom, see section 8 Control systems, group 8.2.1.6 Sensor boom length.
- 6 Mark up and detach the hydraulic hoses from the extension cylinder.



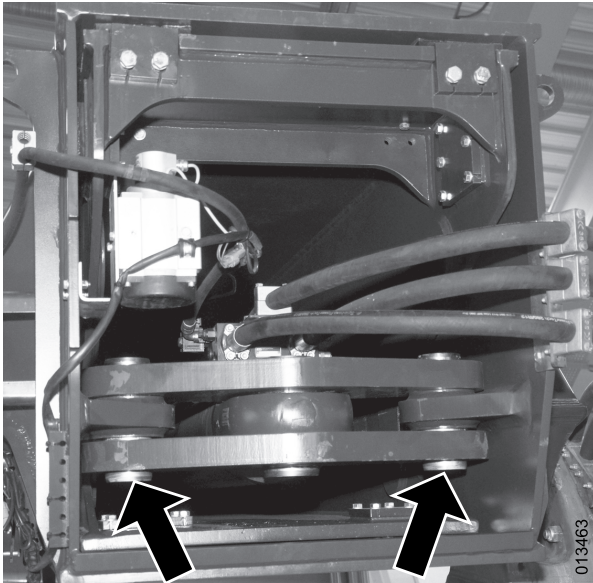
NOTE

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

- 7 Mark and disconnect the cable harness from the valve block on the extension cylinder.
- 8 Remove the valve block from the extension cylinder.

NOTE

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



Outer shafts extension cylinder

- 9 Remove the lock rings and press out the outer shafts for the rear cylinder mountings in the outer boom.
- 10 Attach hoisting equipment to the rear extension cylinder mounting.
- 11 Pull the extension cylinder carefully. When the cylinder has come out slightly connect a second lifting device that is moved forward on the lift cylinder during the entire disassembly in order to stabilise the lifting.
- 12 Place the cylinder on wooden blocks.
- 13 Transfer parts to the new extension cylinder.

Installation

- 14 Clean and lubricate all bearing surfaces with lubricating grease.
- 15 Measure how far the old extension cylinder is extended and extend the new cylinder to the same length.

NOTE

If this is not carried out then the front cylinder mounting will not reach far enough forward.

- 16 Lift the extension cylinder into place.



CAUTION

Use the dual lifting devices to achieve balance during the lifting. The front should be positioned behind the support at the front edge of the cylinder so that it can be slid into the boom.

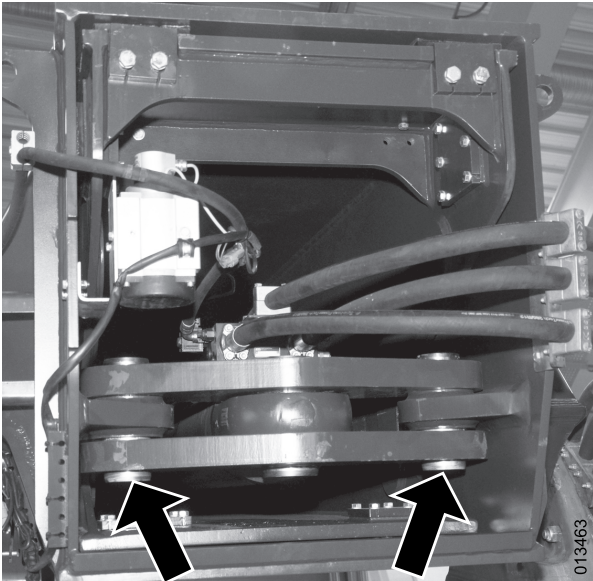


- 17 Fit the shaft at the front cylinder mounting in the inner boom.

NOTE

Lubricate the shaft with lubricating grease before installation.

- 18 Fit the catches on the shaft.



- 19 Fit the shafts at the rear cylinder mountings.

NOTE

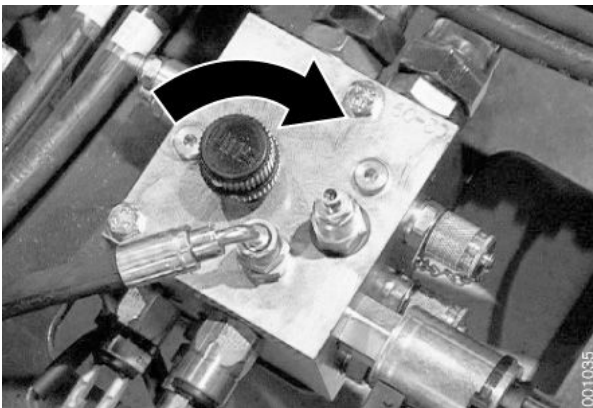
Lubricate the shaft with lubricating grease before installation.

- 20 Fit the catches on the shafts.
21 Fit the valve block on the extension cylinder.

NOTE

Check that the O-rings are intact, clean and in the correct position.

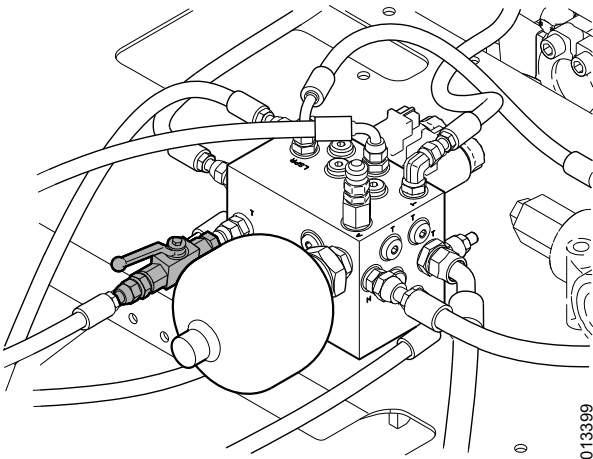
- 22 Connect the hydraulic hoses and the cable harness to the extension cylinder.
23 Fit the sensor for boom length, see section 8 Control system, group 8.2.1.6 Sensor boom length.



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

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



Relief valve for top lift, the figure shows an open valve.

- 25 Close the relief valve for top lift.



CAUTION

Hydraulic oil may be directed the wrong way.

Risk of damage to the fine filter for hydraulic oil.

Check that the relief valve for top lift is closed before starting the engine.

- 26 Start the engine and check for leaks.



- 27 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 centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

Do not overfill!

Leakage and environmental damage!

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

- 28 Calibrate the sensor for boom length, see section *8 Control system*, group *8.5.2.1 Calibrate SCALE* steps 9 - 12.

Hydraulic cylinders, repairs

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

7.3.10 Lift boom

Lift boom, general

See *Lift boom, description*, page 7:24.

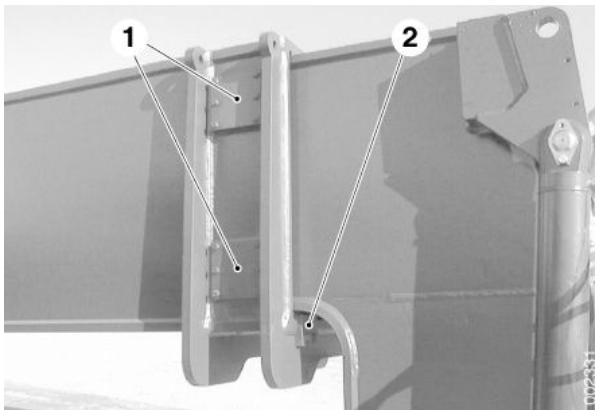
Slide plates, lift boom, replacement

NOTE

When adjusting the side-mounted slide plates, it is important to check the clearance for the whole travel of the boom.

NOTE

The inner boom must be centred in the outer boom.



1. Side-mounted slide plates
2. Lower slide plates

Front slide plates

- 1 Position the boom to the lowest position with the inner boom extended approx. 50 cm.
- 2 Remove the cover plate for the side-mounted slide plates and remove the spacer plates and slid plate.
- 3 Fit in the reverse order.
- 4 Check the clearance between the boom and slide plate, the clearance should be **1 mm**, adjust with spacer plates as required.

NOTE

The inner boom must be centred in the outer boom.

- 5 Remove the lock screws and the slide plates' brackets, and pull out the upper slide plates and the spacer plates.
- 6 Unload the lower slide plates, lift the inner boom at the front edge and use wooden shims.

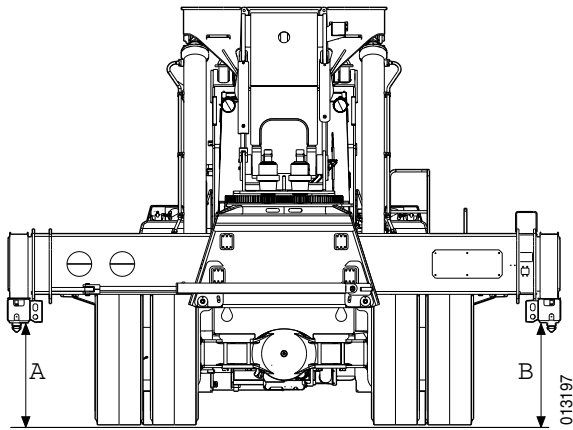


WARNING

Risk of crushing!

Secure the inner boom relative to the outer boom with wooden blocks.

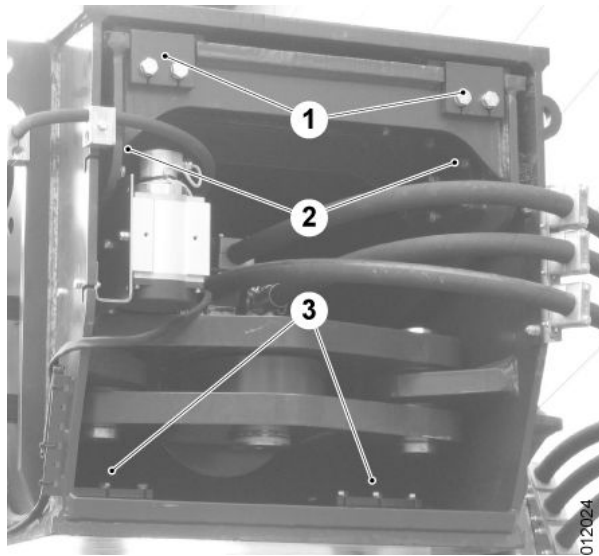
- 7 Remove the lock screws, slide plates' brackets and pull out the lower slide plates.
- 8 Transfer the nuts for the lock screws for the lower slide plates to the new slide plates.
- 9 Fit the new lower slide plates, lock screws and brackets.
- 10 Remove the wooden blocks and ease down the inner boom so that it rests on the lower slide plates.
- 11 Transfer the nuts for the lock screws for the upper slide plates to the new slide plates.
- 12 Fit the new slide plates, spacer plates, lock screws and brackets.
- 13 Check the clearance between the boom and stop at the front edge/top edge of the boom, the clearance must be **max. 2 mm**, adjust the slide plates with spacer plates if necessary.



Measuring points, levelling, attachment

Checking the attachment's levelling

- 14 Park the machine on level ground.
- 15 Lower the boom fully and centre the attachment.
- 16 Measure the distance between the extension beam and the ground on the right and left-hand sides of the attachment.
 The difference between the dimensions for right (A) and left-hand (B) sides must not be more than 50 mm at 20" position, or 100 mm for 40" position.
 Check both the dimensions with the boom fully retracted and fully extended.
- 17 If necessary, adjust the lower slide plates so that the attachment is straight.



1. Upper slide plates
2. Side-mounted slide plates
3. Lower slide plates

Rear slide plates

- 18 Start the engine and operate the boom inwards completely (fully retracted).
- 19 Remove the cover plate for the side-mounted slide plates and remove the spacer plates and slid plate.
- 20 Fit in the reverse order.
- 21 Check the clearance between the boom and slide plate, the clearance should be **1 mm**, adjust with spacer plates as required.
- 22 Unload the lower slide plates, use wooden shims.



WARNING

Risk of crushing!

Secure the inner boom relative to the outer boom with wooden blocks.

- 23 Remove the cover plates, spacer plates and the lower slide plates.
- 24 Fit new slide plates, spacer plates and cover plate.
- 25 Unload the upper slide plates, use wooden shims.



WARNING

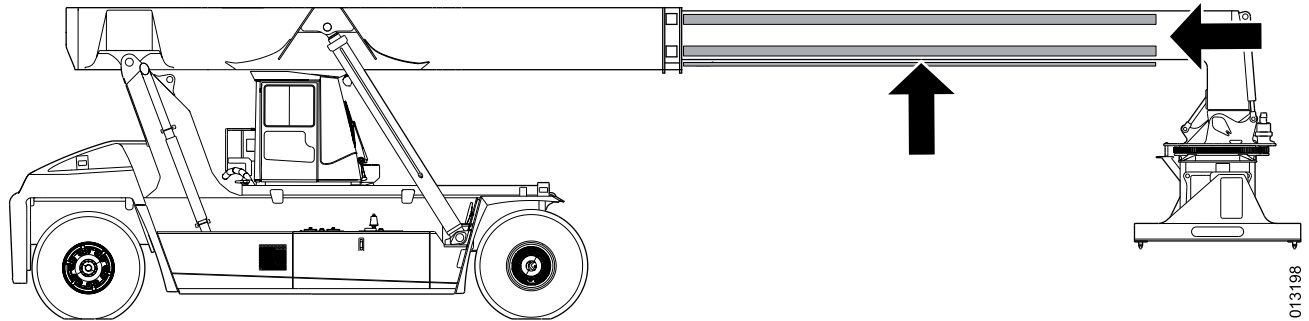
Risk of crushing!

Secure the inner boom relative to the outer boom with wooden blocks.

- 26 Remove the lock screws, the slide plates' brackets, and pull out the upper slide plates and the spacer plates.
- 27 Transfer the nuts for the lock screws for the upper slide plates to the new slide plates.
- 28 Fit the new slide plates, spacer plates, lock screws and brackets.
- 29 Check the clearance between the outer and inner boom, the clearance should be **max. 2 mm**, adjust the slide plates with spacer plates as required.

Lubrication

- 30 Operate the inner boom outwards completely and lubricate the slide surfaces inside the outer boom and on the inner boom with white lubricating paste.



Slide surfaces, boom

- 31 Operate the boom in and out about 10 times and stop with the boom fully out.
- 32 Wipe away excess lubricating paste at the slide plates and on the slide surfaces.

7.3.11 Sensor boom length

Sensor, boom length, general

See section 8 *Control system*, group 8.2.1.3 *Sensor, boom length*.

7.3.12 Pipes and hoses

Piped and hoses, description

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

7.3.17 Valve block servo pressure

Valve block servo pressure, description

See section 10 *Common hydraulics*, group 10.5.7 *Valve block servo pressure*.

Pos	Explanation	Signal description	Reference
6	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See the pressure plate on the left-hand frame beam.	Section 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
7	The non-return valve prevents oil being pumped between the pumps.	-	-
8	Control unit, attachment (D791-1) activates Servo valve, side shift left (Y6020) or Servo valve, side shift right (Y6021).	U = 24 V	Section 11 <i>Common electrics</i> , group 11.5.3.5 <i>Control unit, attachment</i> D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.8 <i>ATTACH</i> , menu 8
9	Servo valve, side shift left (Y6020) or Servo valve, side shift right (Y6021) pressurises the side shift slide in control valve attachment.	-	<i>Attachment control valve, description</i> , page 7:40 D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.8 <i>ATTACH</i> , menu 8
10	The control valve's side shift slide changes position and pressurises the side shift cylinders.	-	<i>Attachment control valve, description</i> , page 7:40
11	The side shift cylinders push the main beam laterally in relation to the side shift frame.	-	<i>Side shift cylinder, description</i> , page 7:44

Hydraulic diagram, see section *E Schematics*, group 10 *Common hydraulics*, *Hydraulic diagram, top lift*.

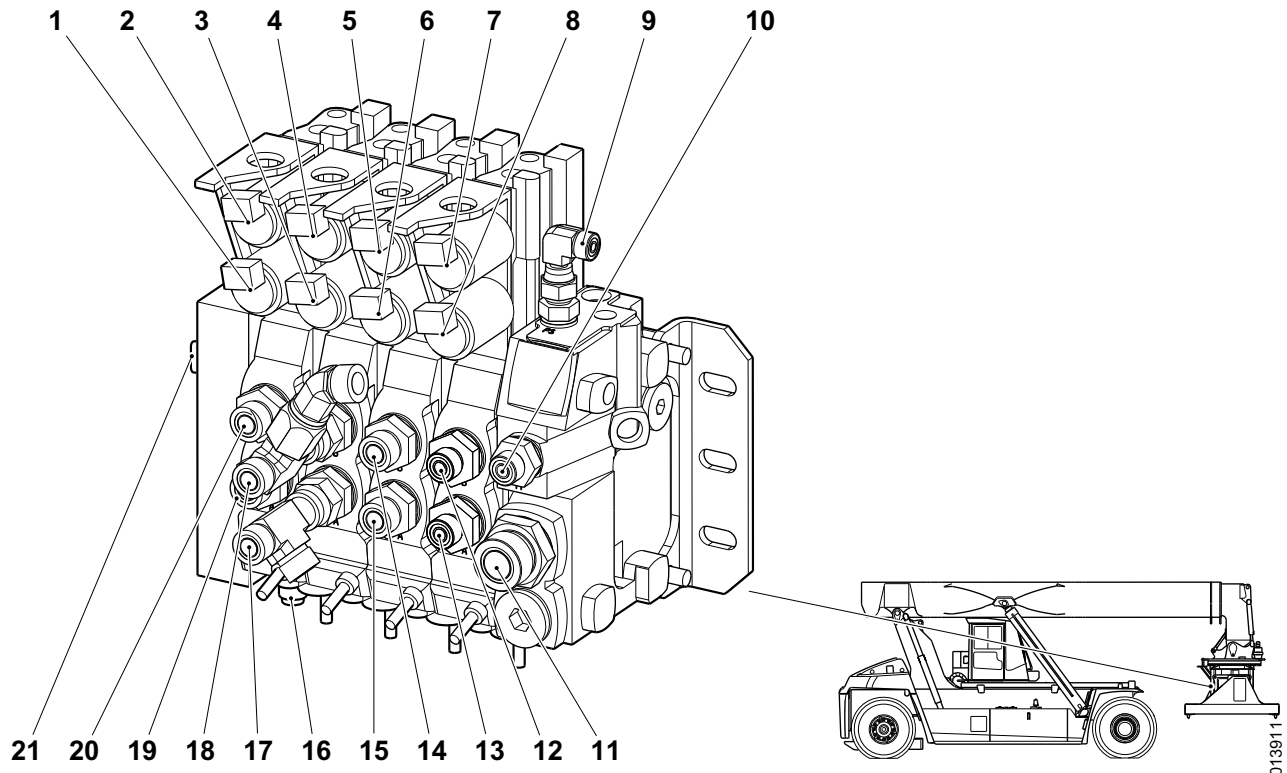
7.4.1 Hydraulic oil pump

Hydraulic oil pump, general

See section 10 *Common hydraulics*, group 10.4.2 *Axial piston pump with variable displacement*.

7.4.3 Control valve, attachment

Attachment control valve, description



- | | |
|--|--|
| 1. Solenoid valve rotation anticlockwise (Y6009) | 12. Connection to lock cylinder |
| 2. Solenoid valve rotation clockwise (Y6008) | 13. Connection to lock cylinder |
| 3. Solenoid valve, side shift left (Y6020) | 14. Connection to spreader motor |
| 4. Solenoid valve, side shift right (Y6021) | 15. Connection to spreader motor |
| 5. Solenoid valve, spreading out (Y6018) | 16. Test outlet, feed pressure to control valve (PX) |
| 6. Solenoid valve, spreading in (Y6019) | 17. Connection to side shift cylinder |
| 7. Solenoid valve, lock twistlocks (Y6040) | 18. Connection to side shift cylinder |
| 8. Solenoid valve, open twistlocks (Y6039) | 19. Connection to rotation motor |
| 9. Connection, damping block (PS) | 20. Connection to rotation motor |
| 10. Drain to tank (TP) | 21. Feed from hydraulic oil pump 2 (P) |
| 11. Return to tank (through tank filter) (TP) | |

Side shift is controlled by a separate section in control valve attachment.

Control valve attachment controls the hydraulic functions on the attachment. The control valve is fitted at the centre rear of the attachment. Electric servo valves control the flow from the valve.

The control valve is an electro-hydraulically controlled, proportional and pressure-compensated directional control 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 so that several functions can be used simultaneously. This enables them to control the main flow.

The control valve has built-in supply of pilot pressure. This means that the valve has built-in pressure reduction which converts feed pressure to servo pressure for the various functions. Supply of pilot pressure 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:

- Side shift
- Spreading (positioning)
- Rotation
- Twistlocks

Side shift slide

The valve slide controls the direction and speed of side shift.

The valve slide is controlled by a servo valve for side shift right and a servo valve for side shift left.

Servo valve, side shift left

Servo valve, side shift left directs pressure to the side shift slide so that the side shift slide opens and pressurises the side shift cylinders.

Servo valve, side shift left is controlled electrically by Solenoid valve, side shift left (Y6020), which is activated by Control unit, attachment (D791-1). The servo valve directs servo pressure to the side shift slide in proportion to the control current to the solenoid valve.

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.9.8 *ATTACH*, menu 8.

Servo valve, side shift right

Servo valve, side shift right directs pressure to the side shift slide so that the side shift slide opens and pressurises the side shift cylinders.

Servo valve, side shift is controlled electrically by Solenoid valve, side shift right (Y6021), which is activated by Control unit, attachment (D791-1). The servo valve directs servo pressure to the side shift slide proportional to the control current to the solenoid valve.

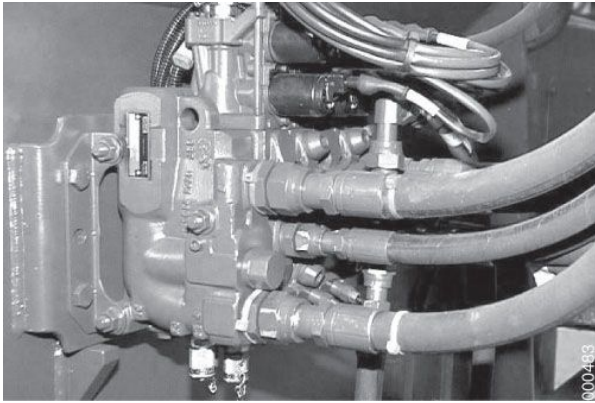
The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.9.8 *ATTACH*, menu 8.

Control valve attachment, replacement

NOTE

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

- 1 Machine in service position, see section *B Safety*.
- 2 Depressurise the brake and hydraulic systems, see section *B Safety*.



- 3 Mark and disconnect the hydraulic hoses from the control valve.

NOTE

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

- 4 Mark 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 and protected surface.

- 6 Transfer the connection adapters to the new control valve.

NOTE

Check that the O-rings are intact, clean and in the correct position.

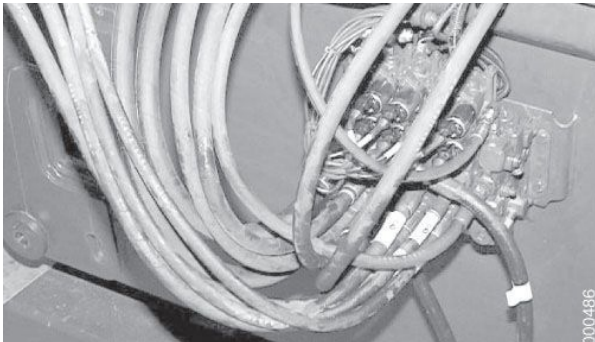
NOTE

Transfer one connection 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.

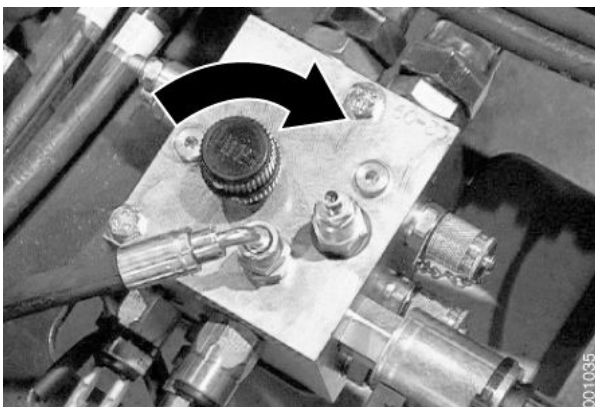


- 9 Connect the cable harness to the control valve according to the marking.

- 10 Connect the hydraulic hoses to the control valve in according to the marking.

NOTE

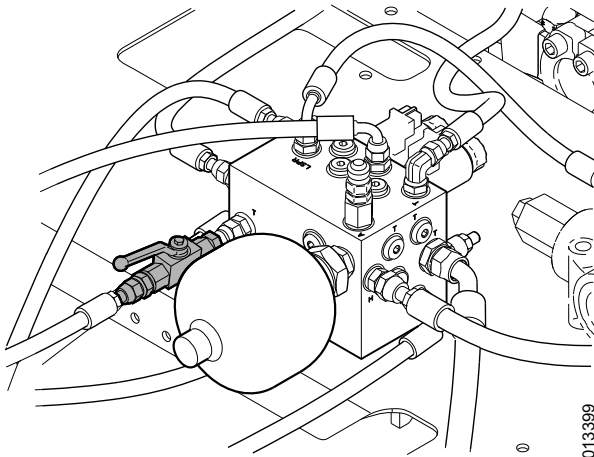
Check that the O-rings are intact, clean and in the correct position.



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

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



Relief valve for top lift, the figure shows an open valve.

- 12 Close the relief valve for top lift.



CAUTION

Hydraulic oil may be directed the wrong way.

Risk of damage to the fine filter for hydraulic oil.

Check that the relief valve for top lift is closed before starting the engine.

- 13 Switch on the system voltage and start the engine.

- 14 Check that the valve's hydraulic connections are sealed.

- 15 Check that the attachment is working.



CAUTION

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

Activate the steering carefully and operate at the lowest possible speed a couple of times to avoid cavitation.



- 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 in the centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

Do not overfill!

Leakage and environmental damage!

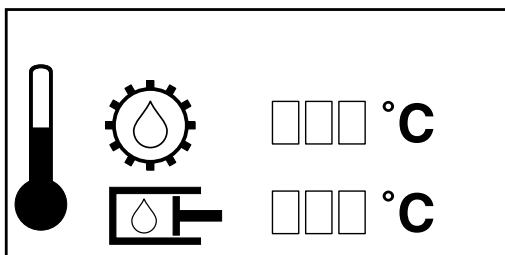
The hydraulic oil level is checked with the boom completely lowered and retracted.

Control valve attachment, checking hydraulic pressure

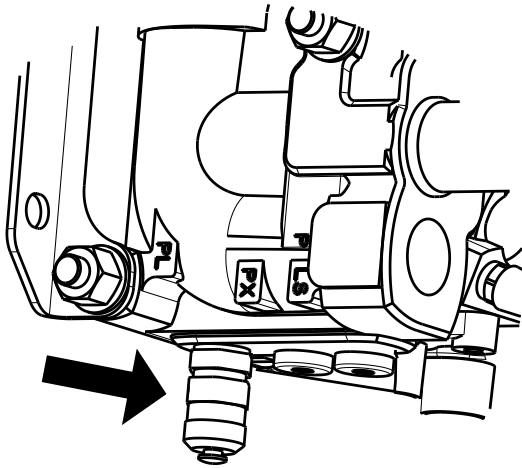
NOTE

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

- 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 section *B Safety*.



Operating menu, hydraulic oil temperature



Measuring outlet, control valve, attachment

- 3 Connect a pressure gauge to measuring outlet PL on control valve attachment.
- 4 Start the engine and run it at idle. Check the pressures in the attachment's different functions by letting each function go to its end-position and then reading off the pressure gauge.

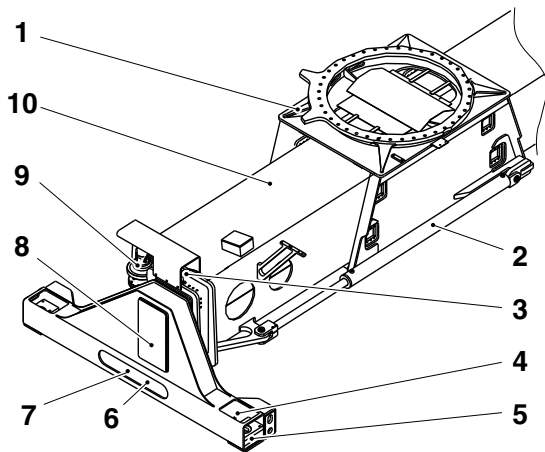
Function	Pressure
Side shift	16,0 MPa
Spreading (positioning)	12,0 MPa
Rotation	15,0 MPa
Twistlocks	Same as feed pressure.

- 5 Remove the pressure gauge and fit the protective cap on the measuring outlet.

7.4.5 Side shift cylinder

Side shift cylinder, description

The side shift cylinders are two cross connected hydraulic cylinders which extend the attachment's main beam laterally in relation to the side shift frame. The side shift cylinders are fitted along the front and rear of the attachment and are used to centre the load's centre of gravity.



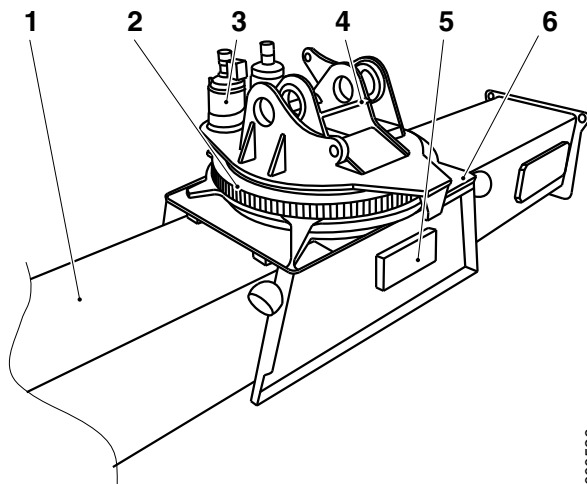
1. Side shift frame
2. Side shift cylinder
3. Position sensor, spreading
4. Sensor, alignment
5. Twistlock
6. Sensor twistlocks
7. Lock cylinder, twistlocks
8. Spreading boom
9. Spreading (positioning) motor
10. Main beam, attachment

Hydraulic cylinders, repairs

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

7.4.6 Side shift frame

Side shift frame, description



1. Main beam
2. Ring gear
3. Rotation motor unit
4. Rotation bar
5. Control valve, attachment
6. Side shift frame

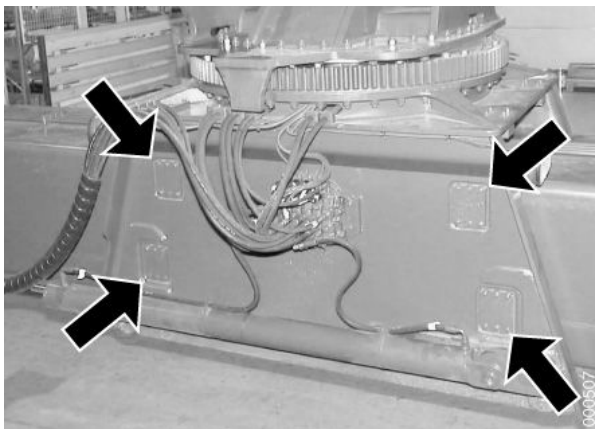
The attachment is secured in the boom with the rotation yoke. The side shift frame is fitted under the rotation yoke. The attachment's main beam is fitted in the side shift frame. The main beam can be extended laterally in relation to the side shift frame with two hydraulic cylinders. Inside the main 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 side shift frame. The main beam runs on slide plates in the sides and in the bottom. The side shift cylinders secure the lateral position.

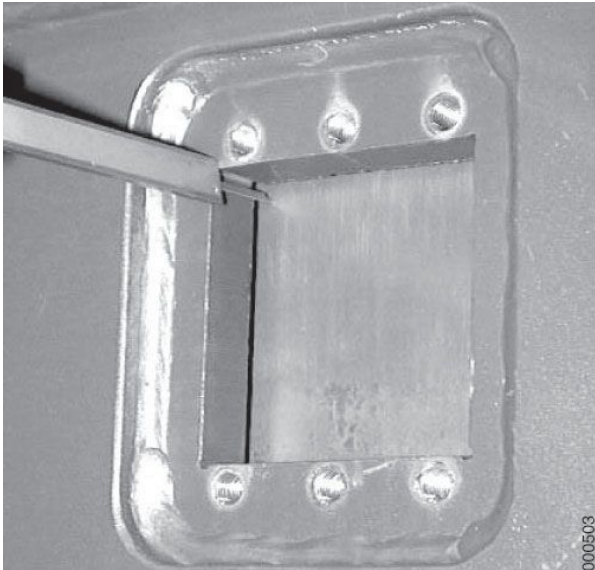
The side shift frame is available in two versions:

- Standard top lift. The side shift frame allows the main beam to be levelled 5°. Side shift 800 mm.

Slide plates, side shift frame, replacement



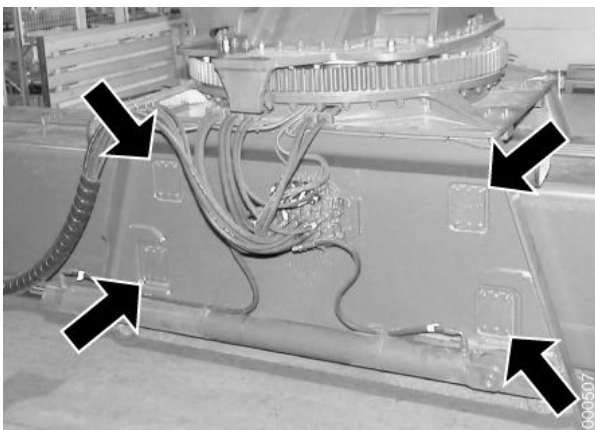
- 1 Undo the cover plate's attaching bolt and remove the cover plate.
- 2 Remove the spacer plates and slide plate.
- 3 Repeat steps 1 - 3 on the other slide plates.



- 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.



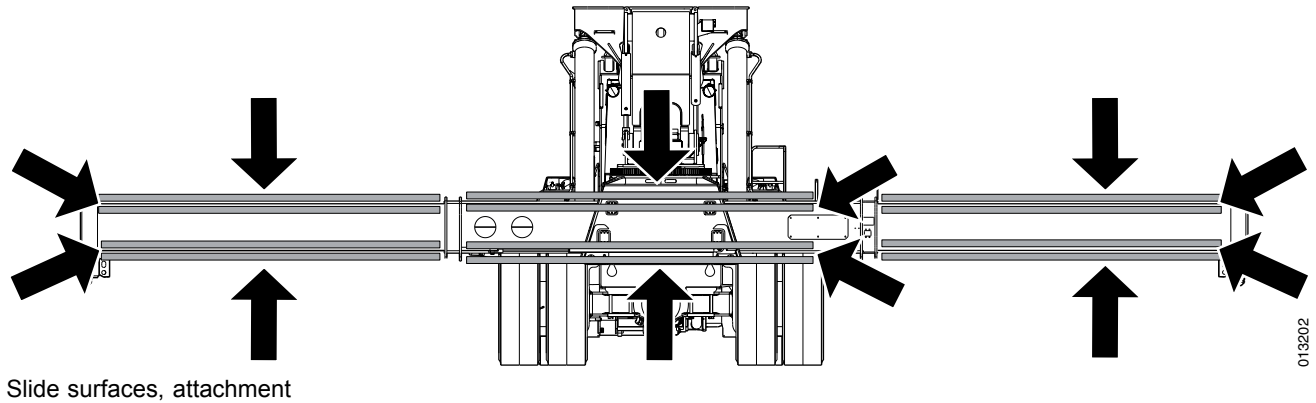
- 6 Fit the new slide plate.
- 7 Check the slide plate's clearance by measuring the distance between the slide plate and the edge of the cover plate. The clearance between the attachment's main beam and slide plates must be **1 mm**.
- 8 Fit the spacer plates until the distance is correct.



- 9 Fit the cover plate.
- 10 Repeat steps 7 - 10 on the other slide plates.

Lubrication

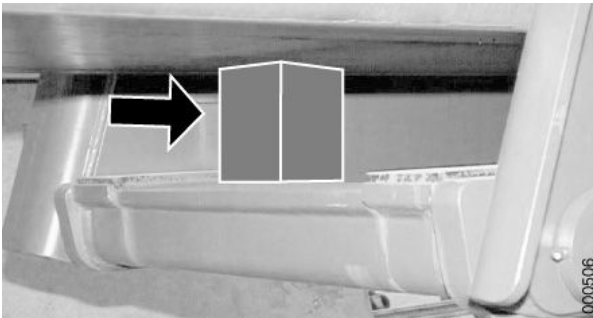
- 11 Lubricate the slide surfaces of the attachment with white lubricating paste.



- 12 Operate full side shift from right to left approx. 10 times.
- 13 Wipe away excess lubricating paste at the slide plates and on the slide surfaces.

Lower slide plates, side shift frame, replacement

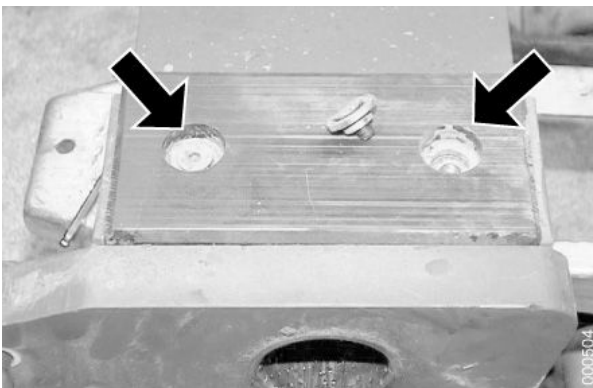
- 1 Position axle stands or similar under the attachment's spreader booms and lower the attachment on the stands so that the side shift frame's lower slide plates are released.
- 2 Switch off the engine and switch off the system voltage.



DANGER

Risk of crushing!

Place spacers between the crossmember and the attachment's main boom for both crossmembers.

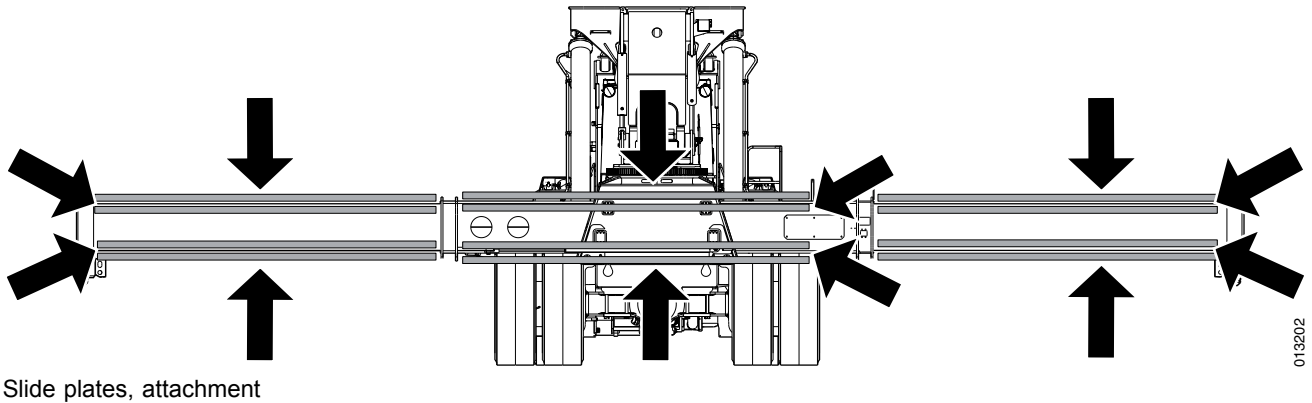


The illustration shows a loose crossmember

- 3 Remove the attaching bolts and remove the slide plates.
- 4 Fit new slide plates.
- 5 Remove the spacer.
- 6 Switch on the system voltage and start the engine.
- 7 Lift the attachment and remove the stands.

Lubrication

- 8 Lubricate the slide surfaces of the attachment with white lubricating paste.



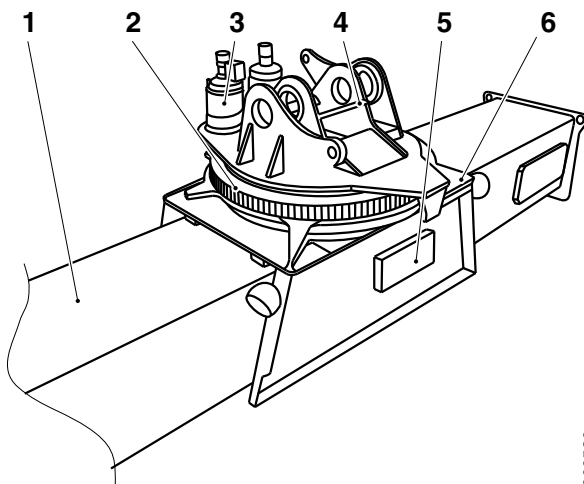
- 9 Operate full side shift from right to left approx. 10 times.

- 10 Wipe away excess lubricating paste at the slide plates and on the slide surfaces.

7.4.7 Main beam, attachment

Main beam attachment, description

The main beam attachment is fitted in the side shift frame. The main beam contains equipment for spreading (spreader beams, hydraulic motor, chains, slide plates and sensors). The control valves for the attachment's hydraulic functions are also fitted on the attachment's main beam.



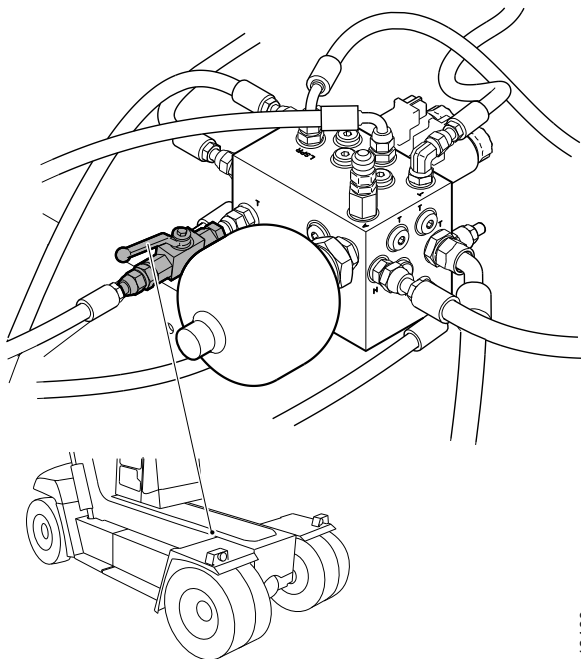
1. Main beam
2. Ring gear
3. Rotation motor unit
4. Rotation bar
5. Control valve, attachment
6. Side shift frame

7.4.8 Relief valve, attachment

Relief valve attachment, description

Relief valve attachment 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 fitted on valve block servo pressure on the hydraulic plate in the engine compartment in front of the transmission.

See section 10 *Common hydraulics*, group 10.5.7 *Valve block servo pressure*.



013400

7.4.9 Pipes and hoses

Piped and hoses, description

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

7.4.11 Valve block servo pressure

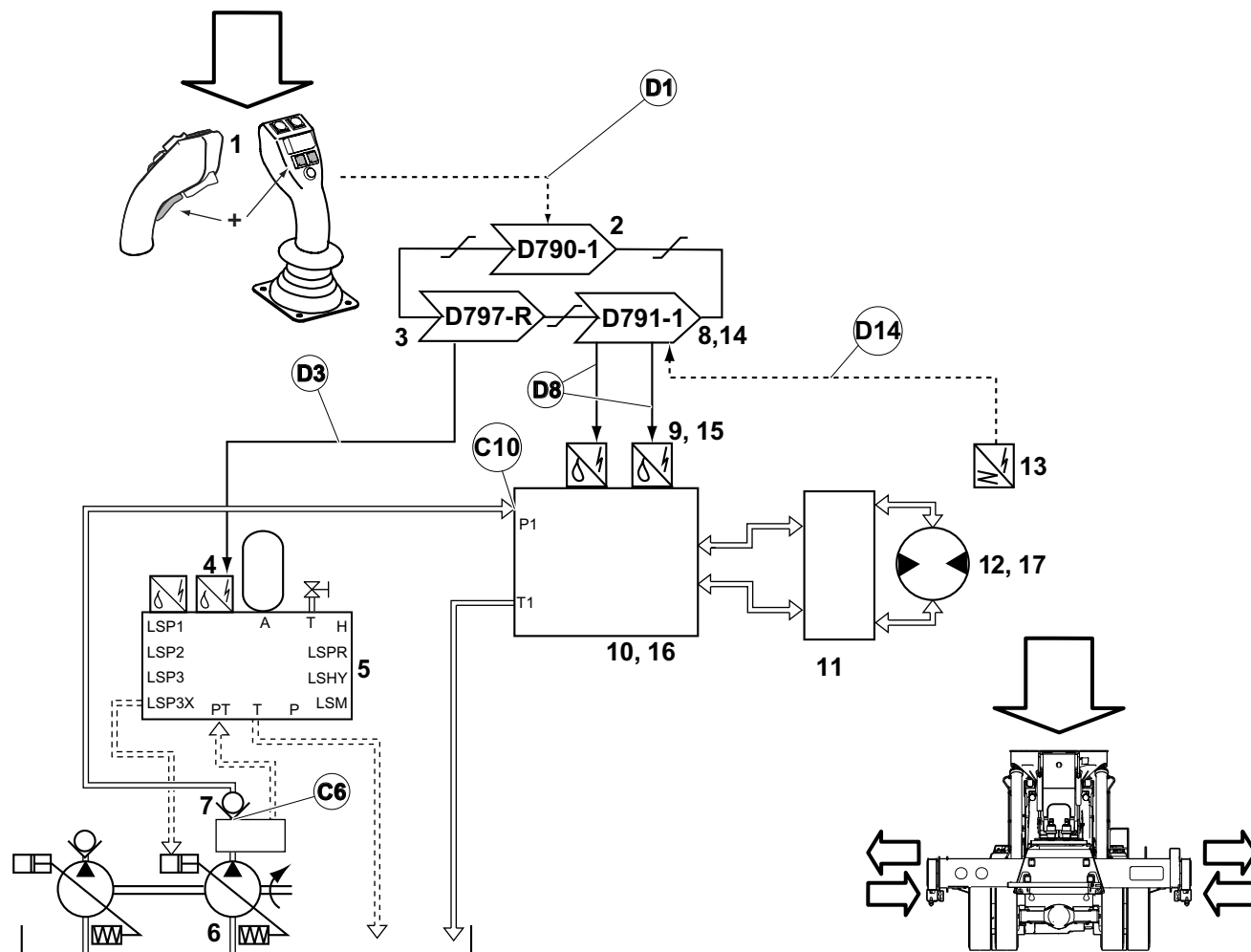
Valve block servo pressure, description

See section 10 *Common hydraulics*, group 10.5.7 *Valve block servo pressure*.

7.5 Spreading (positioning)

Spreading, function description

Condition	Reference value	Reference
Control breaker	Disengaged	Section 11 <i>Common electrics</i> , group 11.5.1.4 <i>Emergency stop switch voltage</i>
Twistlocks	Unlocked or bypass activated	<i>Twistlocks, description</i> , page 7:83 Section 8 <i>Control system</i> , group 8.2.2 <i>Bypass</i>
Overload system	Passive	Section 8 <i>Control system</i> , group 8.2.1 <i>Overload system</i>



Pos	Explanation	Signal description	Reference
1	Control lever (S815-T1.x and S815-T4) sends a 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</i> , page 7:4 D1: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.2 <i>ATTACH</i> , menu 2
2	Control unit, cab (D790-1) sends a signal on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</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).	$U = 24\text{ V}$	Section 11 <i>Common electrics</i> , group 11.5.3.3 <i>Control unit, frame rear</i> D3: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6

Pos	Explanation	Signal description	Reference
4	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens and pressurises the top lift slide in valve block servo pressure.	-	Section 10 <i>Common hydraulics</i> , group 10.5.7 <i>Valve block servo pressure</i> D3: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
5	Valve block servo pressure sends a load signal to hydraulic oil pump 2.	-	Section 10 <i>Common hydraulics</i> , group 10.5.7 <i>Valve block servo pressure</i>
6	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See the pressure plate on the left-hand frame beam.	Section 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
7	The non-return valve prevents oil being pumped between the pumps.	-	-
8	Control unit, attachment (D791-1) activates Servo valve, spreading out (Y6018) or Servo valve, spreading in (Y6019).	I = 350–600 mA	Section 11 <i>Common electrics</i> , group 11.5.3.5 <i>Control unit, attachment</i> D8: Diagnostic menu, see section 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	Servo valve, spreading out (Y6018) or Servo valve, spreading in (Y6019) pressurises the spreader slide in the attachment's control valve.	-	<i>Attachment control valve, description</i> , page 7:40 D8: Diagnostic menu, see section 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
10	The control valve's spreader slide changes position and directs pressure to the spreader motor.	-	<i>Attachment control valve, description</i> , page 7:40
11	The motor valve block directs the pressure to the motor and prevents the motor from pumping (rotating faster than supplied pressure).	-	<i>Valve block spreader motor, description</i> , page 7:53
12	The motor drives the chains that extend or retract the spreader beams.	-	<i>Spreader motor, description</i> , page 7:53
13	The sensor for end position 20'-40' (B769) sends a voltage signal to the Control unit, attachment (D791-1).	Sensor directly opposite indicator plate: U > 24 V	<i>Position sensor spreading, description</i> , page 7:66 D13: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.5 <i>ATTACH</i> , menu 5
14	Control unit, attachment (D791-1) reduces the control current to Servo valve, spreading out (Y6018) or Servo valve, spreading in (Y6019).	-	Section 11 <i>Common electrics</i> , group 11.5.3.5 <i>Control unit, attachment</i> D8: Diagnostic menu, see section 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
15	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>Attachment control valve, description</i> , page 7:52 D8: Diagnostic menu, see section 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
16	The control valve's spreader slide changes position and reduces the pressure to the spreader motor.	-	<i>Attachment control valve, description</i> , page 7:52
17	The speed of the spreader motor is reduced.	-	<i>Spreader motor, description</i> , page 7:53

Hydraulic diagram, see section *E Schematics*, group 10 *Common hydraulics*, *Hydraulic diagram, top lift*.

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*.

7.5.3 Control valve, attachment

Attachment control valve, description

Spreading is regulated by a separate section in the attachment's control valve. For a more detailed description of the valve and component locations, see *Attachment control valve, description*, page 7:40.

Spreader slide

The valve slide controls the direction and speed of spreading. The valve slide is controlled by a servo valve for spreading out and a servo valve for spreading in.

Servo valve, spreading out

The servo valve for spreading out directs pressure to the spreader slide so that it opens and pressurises the spreader motor.

The servo valve is controlled electrically by Solenoid valve, spreader out (Y6018), which is activated by Control unit, attachment (D791-1). The servo valve directs servo pressure to the spreader slide proportional to the control current to the solenoid valve.

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.9.13 *ATTACH, menu 13*.

Servo valve, spreading in

The servo valve for spreading in directs pressure to the spreader slide so that it opens and pressurises the spreader motor.

The servo valve is controlled electrically by Solenoid valve, spreader in (Y6019), which is activated by Control unit, attachment (D791-1). The servo valve directs servo pressure to the spreader slide proportional to the control current to the solenoid valve.

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.9.14 *ATTACH, menu 14*.

Control valve attachment, replacement

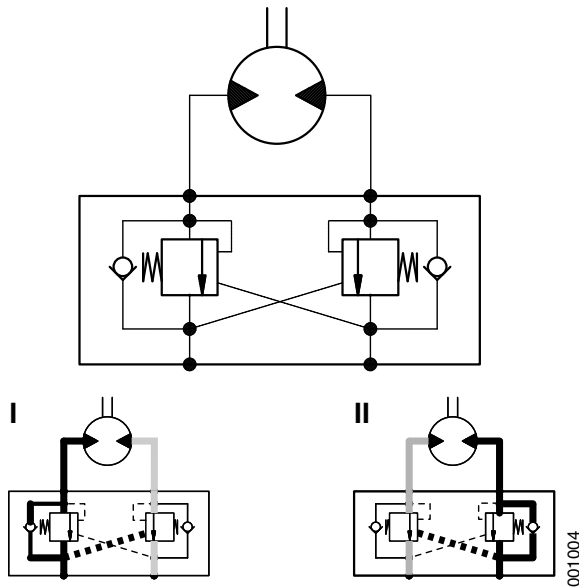
See *Control valve attachment, replacement*, page 7:41.

7.5.5 Valve block spreader motor

Valve block spreader motor, description

Valve block spreader motor regulates the oil's direction to the spreader motor. The valve block is fitted on the spreader motor all the way out to the left on the front side of the attachment's main beam.

The valve block maintains a balance between supply and spreading speed. Balance means that the valve block prevents the motor from pumping oil, i.e. rotates faster than the supply of oil allows. Valve block spreading contains overcentre valves that block the outlet if the pressure on the outlet side is higher than the pressure on the inlet side.



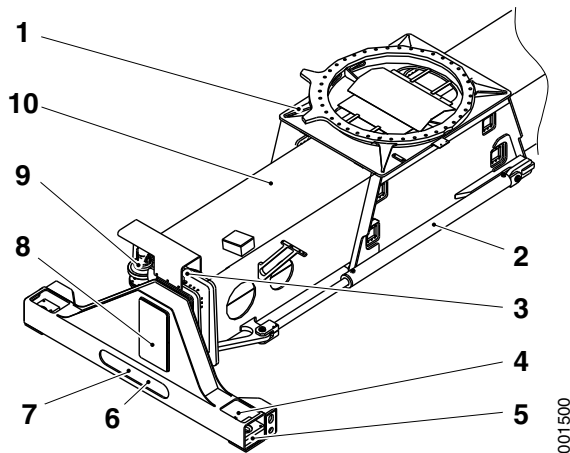
Hydraulic diagram, valve block spreader motor

7.5.6 Spreading (positioning) motor

Spreader motor, description

Via two chains, the spreader motor moves the spreader beams in and out in the attachment's main beam. The spreader motor is fitted all the way out to the left on the front side of the attachment's main beam.

The hydraulic motor is integrated with a planetary gear that reduces speed and makes the motor more powerful. Fitted on the hydraulic connections is a valve block with two overcentre valves that prevents the motor from rotating faster than the supplied hydraulic pressure.



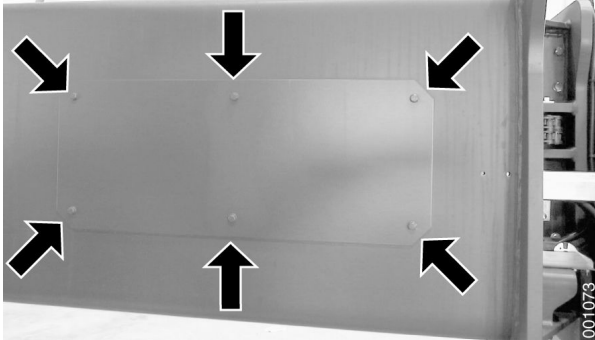
1. Side shift frame
2. Side shift cylinder
3. Position sensor, spreading
4. Sensor, alignment
5. Twistlock
6. Sensor twistlocks
7. Lock cylinder, twistlocks
8. Spreading boom
9. Spreading (positioning) motor
10. Main beam, attachment

Spreader motor, replacement

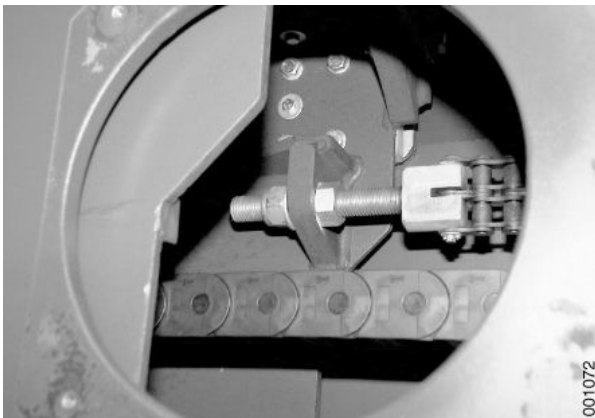
NOTE

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

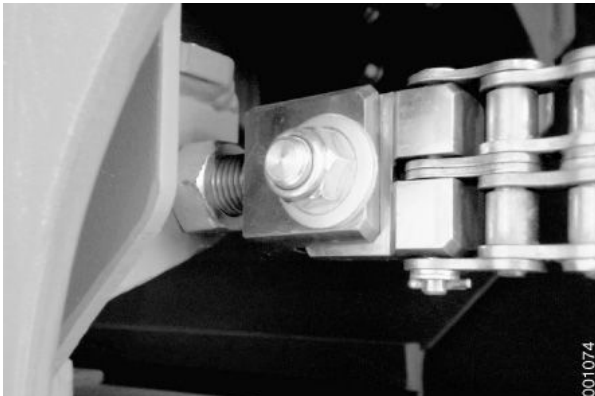
- 1 Machine in service position, see section B Safety.
- 2 Remove the cover plate on the left-hand side of the attachment's main beam.



- 3 Start the engine and run spreading out until the chain tensioners are visible in the inspection holes.
- 4 Stop the engine and turn the start key to position I.
- 5 Depressurise the brake and hydraulic systems, see section B Safety.
- 6 Turn the start key to position 0 and switch off the system voltage.

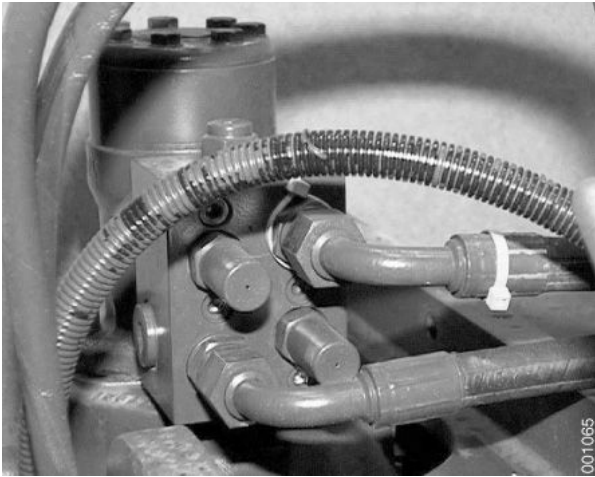


- 7 Measure and note the chain tensioners' length to attain the correct chain tension when refitting.
- 8 Slacken the chain tensioner on the engine side and remove the chain from the tensioner.

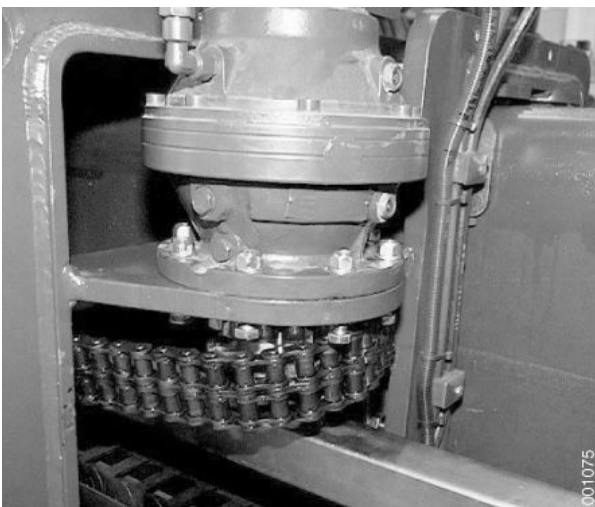


- 9 Remove the protective plate from over the spreader motor.

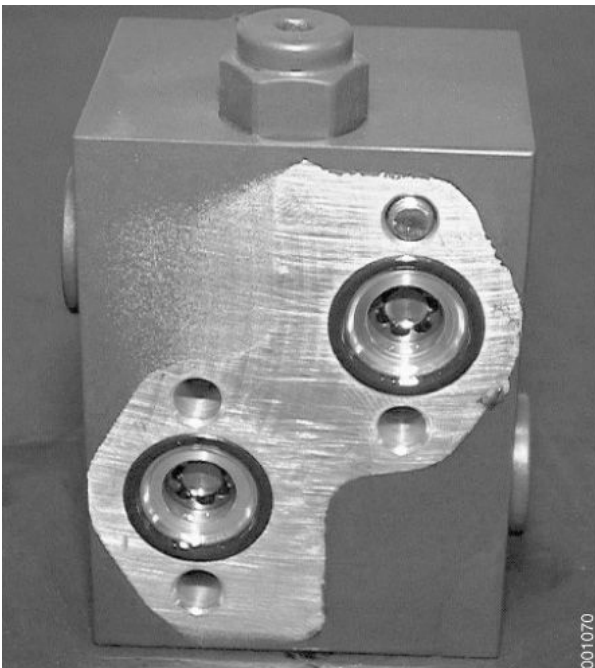




- 10 Mark up and detach the hydraulic hoses from the valve block for the spreader motor.



- 11 Remove the spreader motor unit.

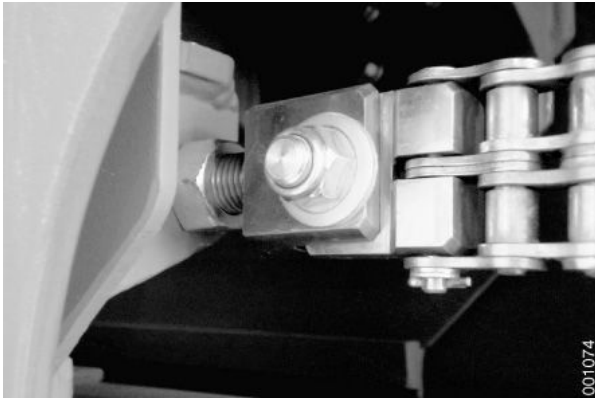


- 12 Transfer the valve block to the new motor unit.

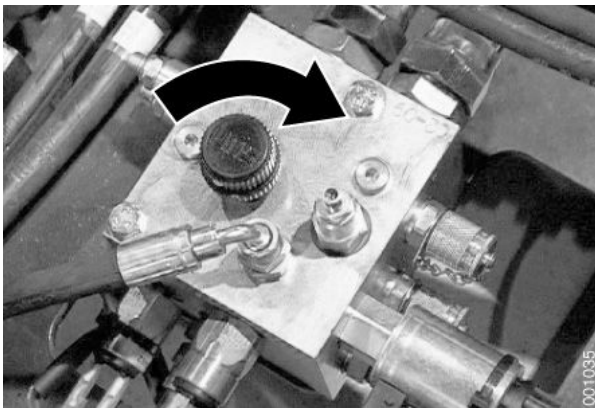
NOTE

Check that the O-rings are intact, clean and in the correct position.

- 13 Clean the contact surfaces between the planetary gear and the attachment's main beam.
- 14 Fit the motor unit. Tighten the bolts crosswise in steps until **117 Nm** is achieved.
- 15 Attach the hydraulic hoses to the valve block on the motor.



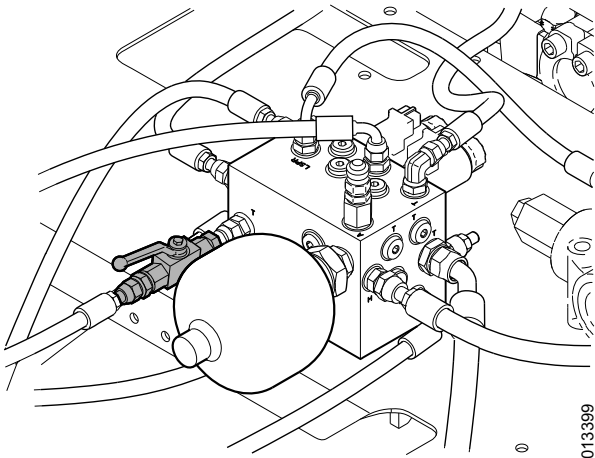
- 16 Connect the spreader chain to the chain tensioner. Check that the chain runs straight in the chain wheel on the hydraulic motor.
- 17 Tension the spreader chain to the same degree as before.
- 18 Switch on the system voltage and start the engine.
- 19 Check that the hydraulic connections are sealed tightly.
- 20 Check that the spreading is working.
- 21 Fit the protective plate over the motor.
- 22 Brush the spreader chain with lubricating grease.
- 23 Fit the cover plates on the attachment's main beam.



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

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



Relief valve for top lift, the figure shows an open valve.

- 25 Close the relief valve for top lift.



CAUTION

Hydraulic oil may be directed the wrong way.

Risk of damage to the fine filter for hydraulic oil.

Check that the relief valve for top lift is closed before starting the engine.



- 26 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 centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

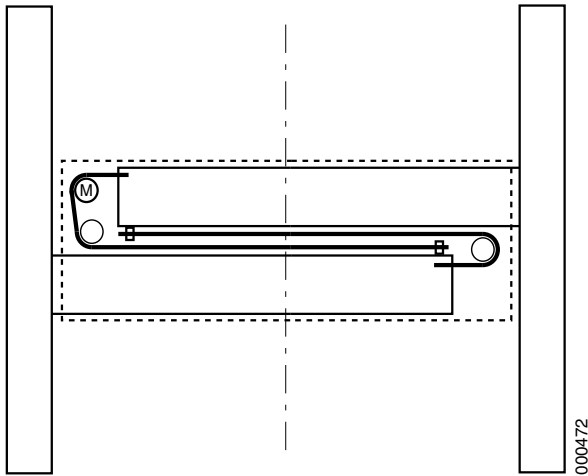
Do not overfill!

Leakage and environmental damage!

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

7.5.7 Spreader chains

Spreader chains, description



Principle diagram, spreader chains

The spreader chains move the extension beams in and out of the attachment's main beam. The force from the spreader motor is transferred to extension beams via two chains. The chains run inside the attachment between the extension beams.

The chains are fastened crosswise with one end at the bottom of one extension beam and the other end 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 purposes.

Spreader chains, checking

- 1 Before adjustment, the clearance between the slide plates and extension beams must be checked so that the chain mountings are not damaged. See *Maintenance manual*, section 7 Load handling, group 7.5.8 Spreader beam.

20-foot position

- 2 Start the engine, run spreading in to the 20-foot position and switch off the engine.
- 3 Check that both spreader beams are against the 20-foot stop and that the distance between the spreader beam and the spreader motor mounting is at least 3 mm.
- 4 Check the C-C measurement between the twistlocks.
C-C 20 feet: 5853±3 mm.
If the 20-foot setting is correct proceed to step 8.
- 5 If necessary, adjust the distance by moving washers between the right and left 20-foot stop. Do not change the number of washers.

NOTE

Note the distance the stop was adjusted.

Run spreading out a little to make it possible to move the washers.



20-foot stop

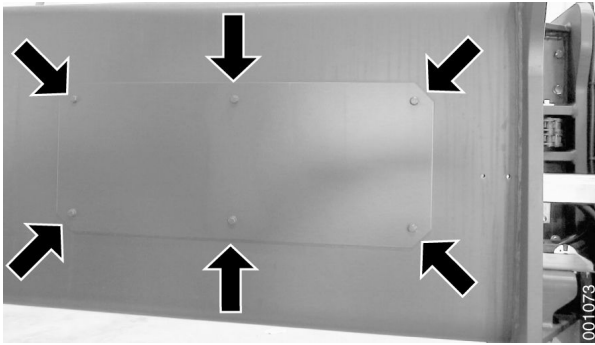


CAUTION

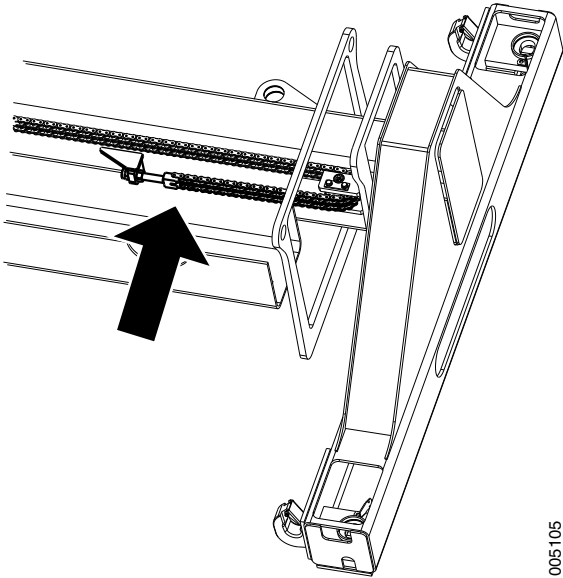
Incorrect chain tension.

Risk of damage to the attachment.

If the 20-foot stop is adjusted, the spreader chains must be adjusted by the same amount.



- 6 Remove the cover plates on the attachment's main beam.



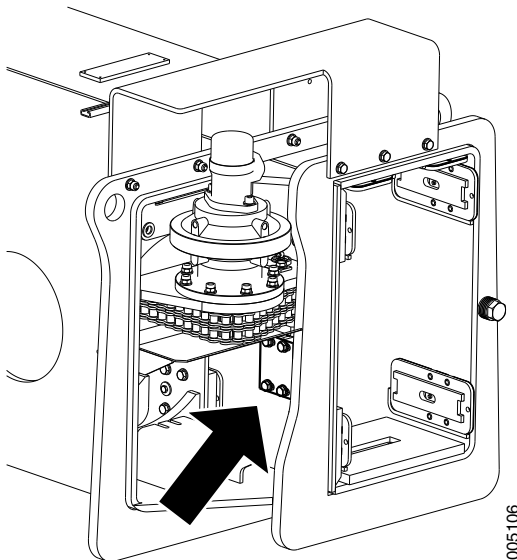
- 7 If the 20-foot stop is adjusted, the spreader chains must be adjusted by the same amount, see step 14.

NOTE

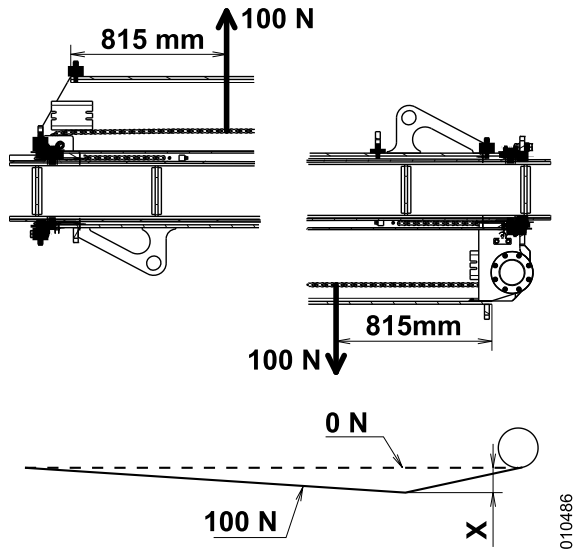
Check the vertical position of the chain tensioner so that the chain runs straight to the chain wheel.

40-foot position

- 8 Start the engine, run spreading out to the 40-foot position and switch off the engine.
- 9 Check the C-C measurement between the twistlocks.
C-C 40 feet: 11985±3 mm.
 If the 40-foot setting is correct proceed to step 11.
- 10 Adjust the 40-foot stop if necessary.
- 11 Start the engine and run spreading out to the 40-foot position.
- 12 Wait 2 minutes and then check the tension of the chains.



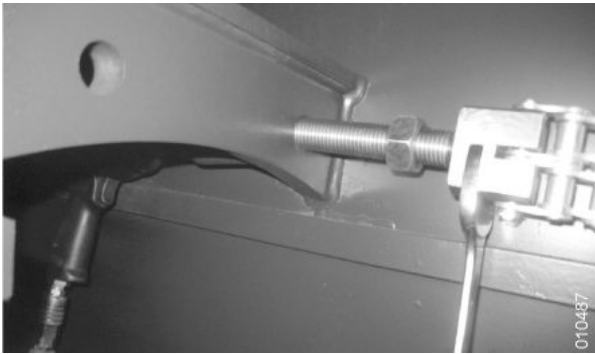
40-foot stop



- 13 Use suspension scales and measure how far the chain moves when pulled outward with a force of **100 N** at **815 mm** in from the main beam's internal reinforcement collar as illustrated.

Standard attachment: **X = 8-13 mm.**

Overheight attachment: **X = 5-6 mm.**



- 14 Adjust chain tension if necessary.

Start the engine and run spreading out until the chain tensioners are visible in the inspection holes (approx. 250 mm). Adjust the chains, hold the chain tensioner in place with a spanner so that the chain does not rotate during adjustment.

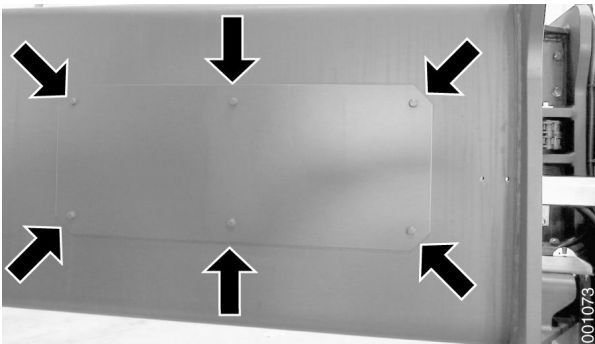
NOTE

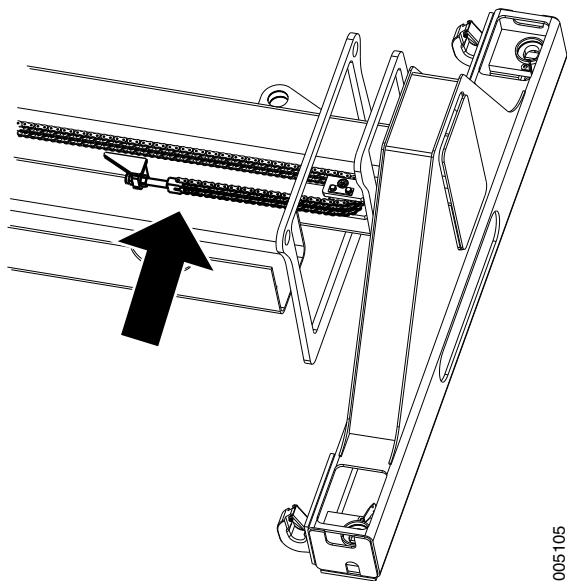
Adjust max. 2 mm on the chain tightener at a time.

- 15 Repeat steps 11–14 until the chains have the correct tension.
16 Brush the spreader chain with lubricating grease.
17 Fit the cover plates on the attachment's main beam.

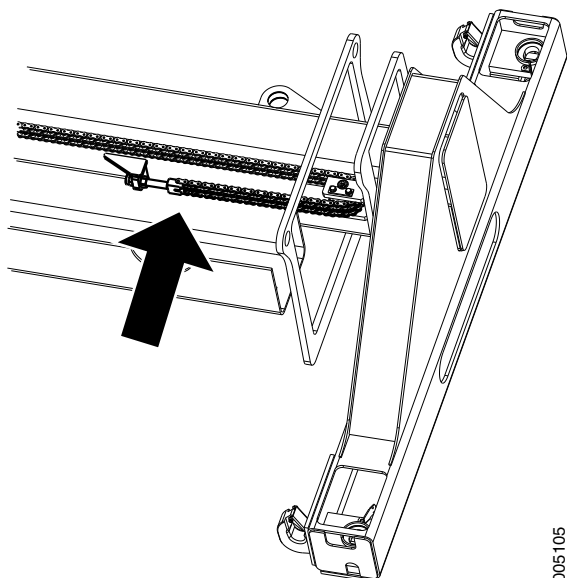
Spreader chain, replacement

- 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 spreading out until the chain tensioners are visible in the inspection holes.
- 4 Switch off the engine and switch off the system voltage.



- 5 Slacken the chain tensioner of the defective chain in question and remove it from the tensioner.

NOTE

Measure and note the chain tensioners' length to attain the correct chain tension when refitting.

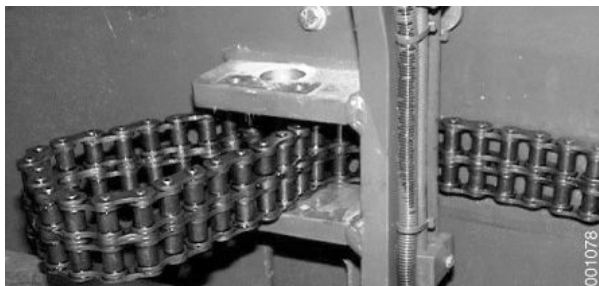


- 6 Remove the chain wheel for the defective chain in question.

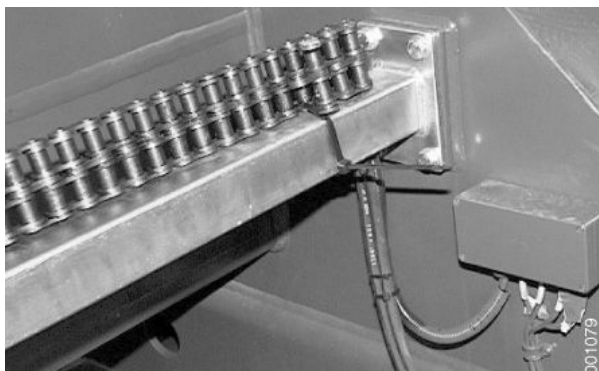
NOTE

Note the location of the spacer ring.

If the chain wheel on the engine side must be removed, first remove the spreader motor. See *Spreader motor, replacement*, page 7:54.



- 7 Pull the chain out through the hole for the chain wheel so that the chain runs along the spreader beam.



- 8 Temporarily fasten the chain along the cable rack to prevent the chain from being pinched.



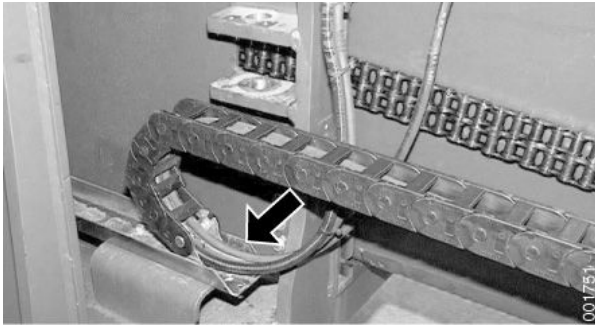
- 9 Pull out the spreader beam.
Use a machine or similar to pull the spreader beam out of the attachment's main beam. Stop when the spreader beam is close to the 40-foot stop.

NOTE

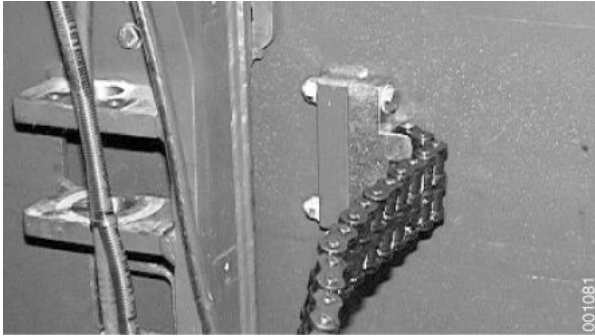
Support the spreader beam to minimise breaks. If necessary, remove the upper slide plates to reduce resistance.



- 10 Remove the boom stop from the attachment's main beam.
11 Remove the hydraulic hoses' clamping on the attachment's main beam.



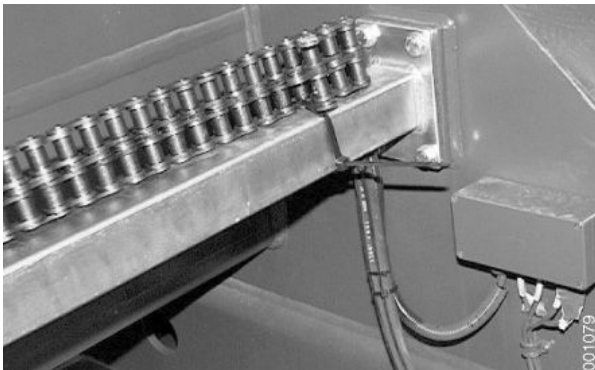
- 12 Detach the cable rack from the attachment's main beam. Support the cable rack so that it is not damaged.



- 13 Pull out the spreader beam until the chain mounting becomes accessible.

- 14 Detach the chain from the spreader beam and cable rack.

- 15 Connect the new chain to the spreader beam.



- 16 Fasten the chain along the cable rack so that it runs straight along the spreader beam.

- 17 Brush the chain with lubricating grease.



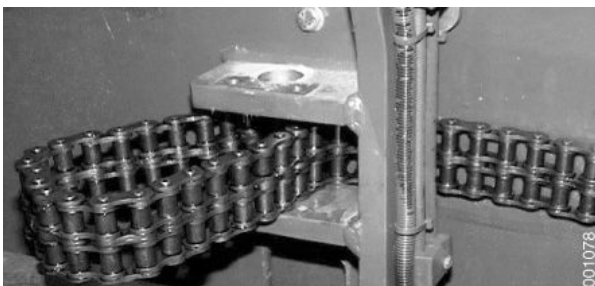
- 18 Slide in the spreader beam so that the extension stop can be fitted.

- 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 Slide in the spreader beam until it is inserted the same amount as the other one. This is important in order to facilitate the fitting of the chains.



- 23 Detach the chain from the cable rack and insert it through the chain wheel's hole.

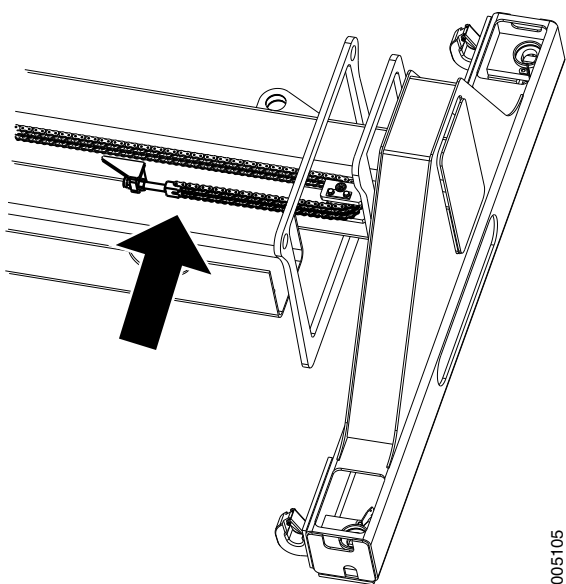


- 24 Fit the chain wheel. The spacer ring must be fitted on the underside of the chain wheel.

If the rotation motor has been removed, refit it. See *Spreader motor, replacement*, page 7:54.

NOTE

Check that the chain runs straight in the chain wheels.



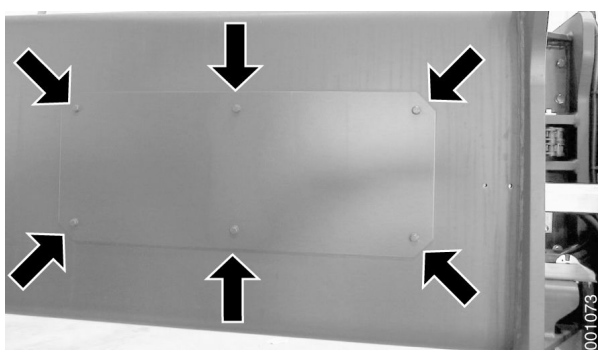
- 25 Connect the chain to the chain tensioner.

NOTE

Use a new split pin.



- 26 Lubricate the chain wheel's bearings with lubricating grease.
- 27 Tension the spreader chain to the same degree as before. Tighten the lock nut.
- 28 If the slide plates have been removed, refit them.
- 29 Switch on the system voltage and start the engine.
- 30 Check that the spreading is working correctly.
- 31 Turn off engine.
- 32 Check chain tension. See *Spreader chains, checking*, page 7:57.



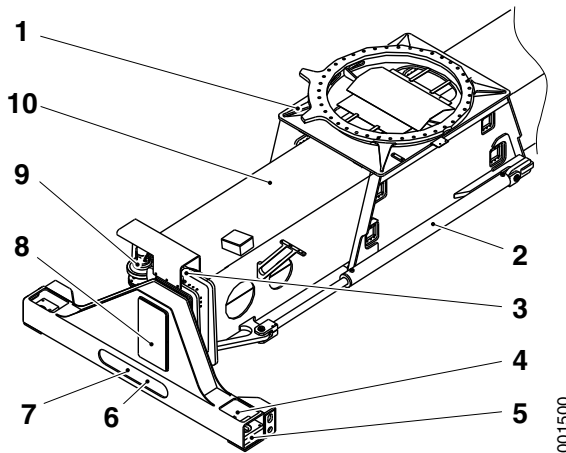
- 33 Fit the cover plates on the attachment's main beam.

7.5.8 Spreader beam

Spreader beam, description

The spreader beams are the part of the attachment that grips the container. Two spreader beams run along the main beam. The spreader beams are slid in and out via the spreader motor and spreader chains.

The spreader beam houses twistlocks. See *Twistlocks, description*, page 7:83.



1. Side shift frame
2. Side shift cylinder
3. Position sensor, spreading
4. Sensor, alignment
5. Twistlock
6. Sensor twistlocks
7. Lock cylinder, twistlocks
8. Spreading boom
9. Spreading (positioning) motor
10. Main beam, attachment

Slide plates, extension beam, replacement

- 1 Machine in service position, see section *B Safety*.
- 2 Unload the tension from the slide plate in question.



The illustration shows inner slide plates in the attachment's main beam.

The tension can be unloaded from the slide plates by raising the outer edge of the extension beam, or by inserting wedges to alter the position of the extension beam in the attachment's main beam.



The illustration shows inner slide plates in the attachment's main beam.

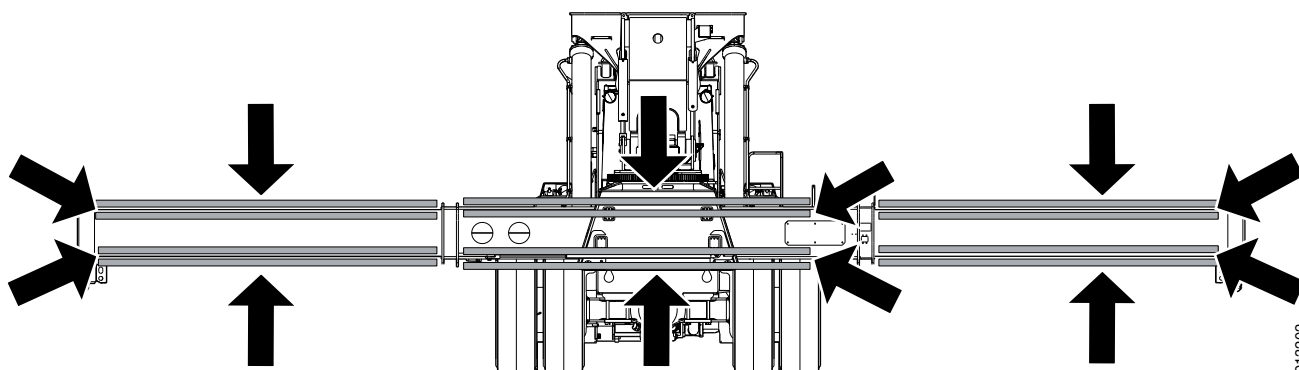
- 3 Remove the attaching bolts for the slide plate's bracket.
- 4 Remove the slide plate's guide screw.
- 5 Pull out the slide plate with spacer plate and bracket.



- 6 Align the new slide plate in the correct position.
Check the clearance between extension beam and slide plate.
Clearance should be max. **1 mm** with all slide plates fitted.
Use a spacer plate to adjust the clearance.
- 7 Fit the slide plate's bracket and guide screw.

Lubrication

- 1 Lubricate the slide surfaces of the attachment with white lubricating paste.



- 2 Operate spreading in and out fully approximately 10 times and check the spreading function.
- 3 Wipe away excess lubricating paste at the slide plates and on the slide surfaces.
- 4 Try to lift 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 7:48.

7.5.10 Position sensor, spreading

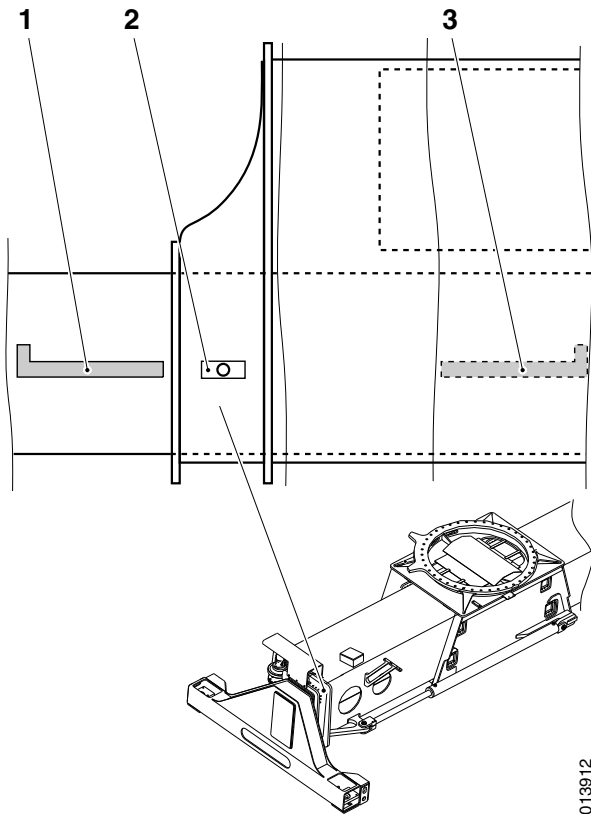
Position sensor spreading, description

The spreading position sensors indicate the position of the spreader beams. The position sensors are used to control spreading so that the twistlocks fit the container. The position sensors are fitted under the protective plate on the top of the attachment's main beam on the left-hand side.

The end position sensor (B769) indicates the end position of 20 and 40-foot containers. The sensor detects the spreader beam end positions via two indicator plates on the top of the spreader beams. The sensor is used to activate damping.

The sensors are supplied power by and send a 24 V signal to Control unit, attachment (D791-1) when the indicator plates pass the sensor. Indicator plates on the spreader units are mounted so that the sensors generate a signal when the spreader unit passes the sensor. The indicator plates and the position of the sensors are designed so that the distance between the spreaders becomes 20' (30') and 40'.

The signals can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.9.5 *ATTACH, menu 5*.



1. Indicator plate 20'
2. Sensor, damping 20' and 40'
3. Indicator plate 40'

Position sensor, checking and adjustment

See *Position sensor, checking and adjustment*, page 7:3.

7.5.11 Relief valve, attachment

Relief valve attachment, description

See *Relief valve attachment, description*, page 7:49.

7.5.12 Pipes and hoses

Piped and hoses, description

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

7.5.16 Valve block servo pressure

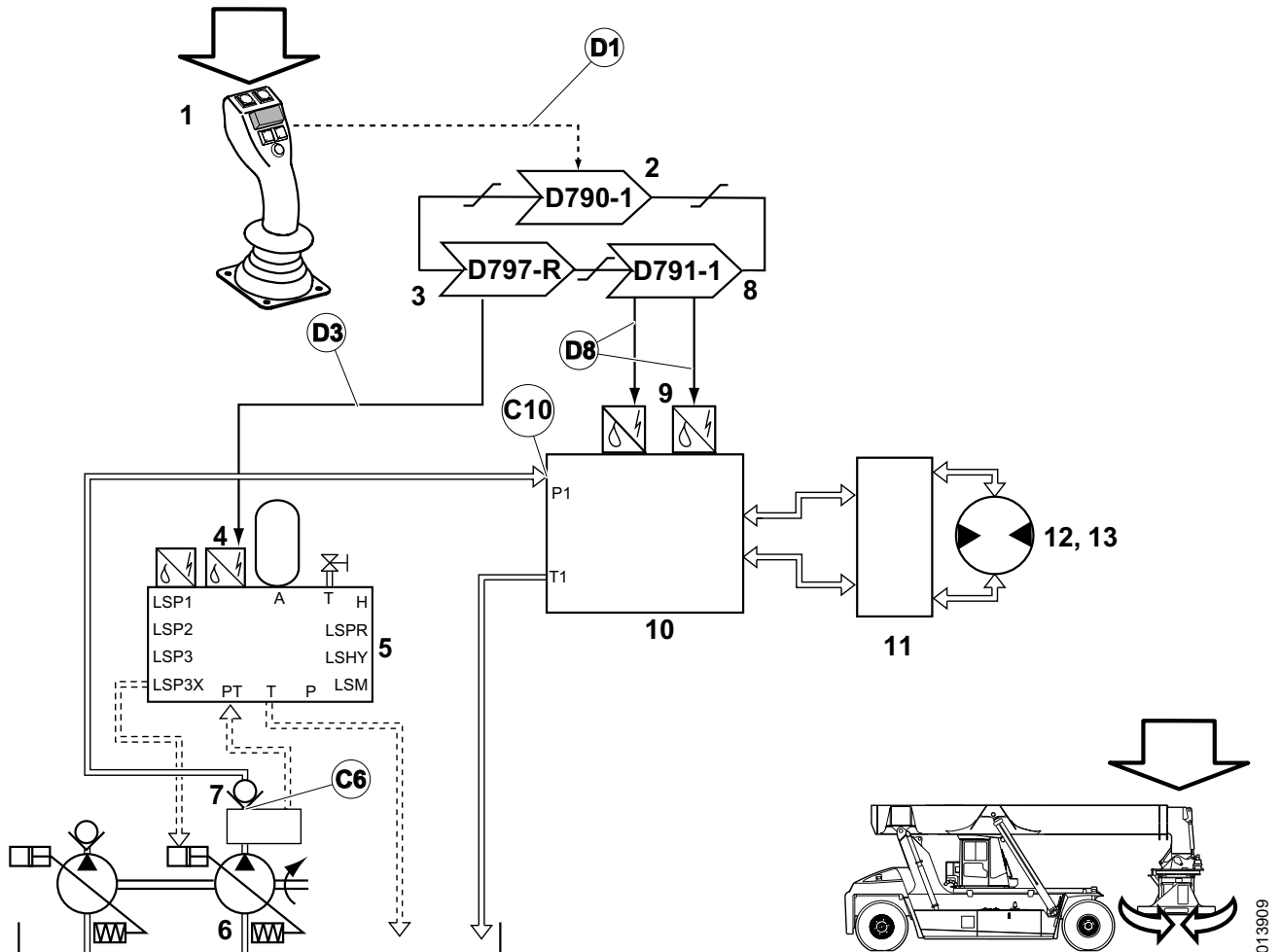
Valve block servo pressure, description

See section 10 *Common hydraulics*, group 10.5.7 *Valve block servo pressure*.

7.6 Rotation

Rotation, function description

Condition	Reference value	Reference
Control breaker	Disengaged	Section 11 <i>Common electrics</i> , group 11.5.1.4 <i>Emergency stop switch voltage</i>
Overload system	Passive	Section 8 <i>Control system</i> , group 8.2.1 <i>Overload system</i>



Pos	Explanation	Signal description	Reference
1	Control lever (S815-P3) sends a voltage signal proportional to lever movement to Control unit, cab (D790-1).	Anticlockwise: $U_{S815/P3} = 0.5-2.0 \text{ V}$ Zero position: $U_{S815/P3} = 2.0-3.0 \text{ V}$ Clockwise: $U_{S815/P3} = 3.0-4.5 \text{ V}$ 0.5 V and 4.5 V represent the maximum rotation speed. Lower voltage than 0.5 V and higher voltage than 4.5 V is used to detect faults in cable harnesses and controls.	Section 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instruments</i> D1: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.1 <i>ATTACH, menu 1</i>
2	Control unit, cab (D790-1) transmits clockwise rotation or anticlockwise rotation on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>

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	Section 11 <i>Common electrics</i> , group 11.5.3.3 <i>Control unit, frame rear</i> D4: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
4	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens and pressurises the top lift slide in valve block servo pressure.	-	Section 10 <i>Common hydraulics</i> , group 10.5.7 <i>Valve block servo pressure</i> D3: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.5.6 <i>HYD</i> , menu 6
5	Valve block servo pressure sends a load signal to hydraulic oil pump 2.	-	Section 10 <i>Common hydraulics</i> , group 10.5.7 <i>Valve block servo pressure</i>
6	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See the pressure plate on the left-hand frame beam.	Section 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
7	The non-return valve prevents oil being pumped between the pumps.	-	-
8	Control unit, attachment (D791-1) activates Servo valve, rotation clockwise or Servo valve, rotation anticlockwise.	I = 435–650 mA	Section 11 <i>Common electrics</i> , group 11.5.3.5 <i>Control unit, attachment</i> D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.11 <i>ATTACH</i> , menu 11 and 8.4.9.12 <i>ATTACH</i> , menu 12
9	Servo valve, rotation clockwise (Y6008), or Servo valve, rotation anticlockwise (Y6009), pressurises the rotation slide in the attachment control valve.	-	<i>Attachment control valve, description</i> , page 7:69 D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.11 <i>ATTACH</i> , menu 11 and 8.4.9.12 <i>ATTACH</i> , menu 12
10	The rotation slide in Control valve, attachment changes position and controls the pressure to the Valve block hydraulic motor.	-	<i>Attachment control valve, description</i> , page 7:69
11	Valve block hydraulic motor controls the pressure to both motors.	-	<i>Valve block rotation motor, description</i> , page 7:70
12	The hydraulic motors' disc brakes are disengaged.	-	<i>Rotation motor unit, description</i> , page 7:71
13	The hydraulic motors rotate the attachment.	-	<i>Rotation motor unit, description</i> , page 7:71

Hydraulic diagram, see section *E Schematics*, group 10 *Common hydraulics*, *Hydraulic diagram, top lift*.

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*.

7.6.3 Control valve, attachment

Attachment control valve, description

Rotation is regulated by a separate section in the attachment's control valve. For a general description of the valve and component locations, see *Attachment control valve, description*, page 7:40.

Rotation slide

The valve slide controls the direction and speed of rotation. 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 by 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 via the diagnostic menu. See section 8 *Control system*, group 8.4.9.11 *ATTACH, menu 11*.

Servo valve, spreading anticlockwise

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 by 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 via the diagnostic menu. See section 8 *Control system*, group 8.4.9.12 *ATTACH, menu 12*.

Control valve attachment, replacement

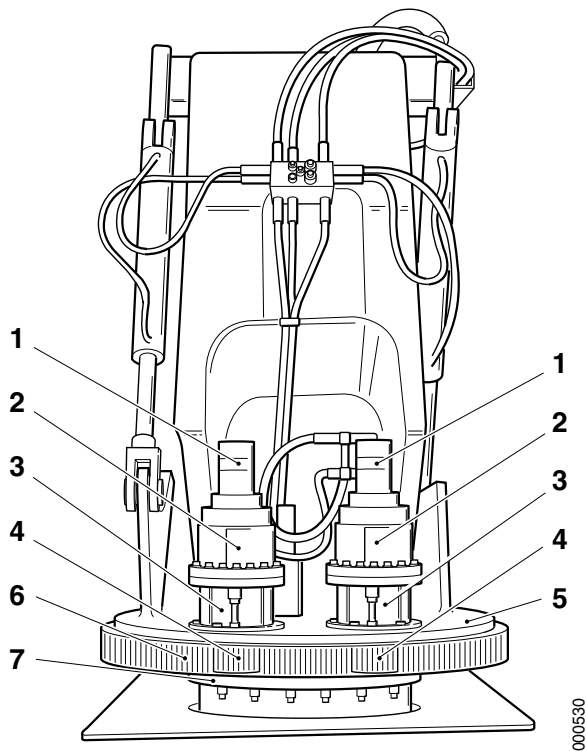
See *Control valve attachment, replacement*, page 7:41.

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 fitted 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 that provided by the hydraulic motor. The valve block contains a shuttle valve and overcentre valves.



1. Hydraulic motor rotation
2. Disc brake
3. Planetary gear
4. Gear wheel
5. Rotation bar
6. Ring gear
7. Side shift frame

7.6.6 Rotation motor unit

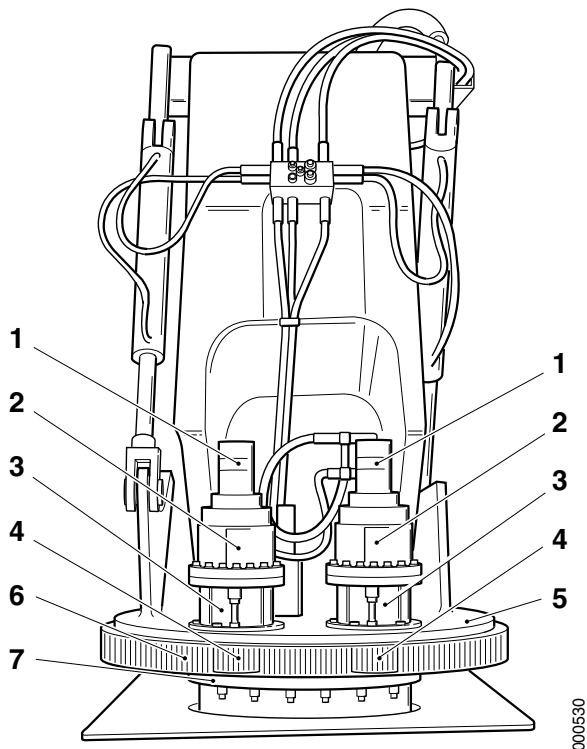
Rotation motor unit, description

The rotation motors rotate the attachment in relation to the boom. The motors are fitted along the front of the attachment's rotation yoke. The motors work against the ring gear between the rotation yoke and the side shift frame. The rotation motor unit consists of hydraulic motor, disc brake and planetary gear which are built together into one unit.

The hydraulic motor is fitted on the disc brake housing. Fitted 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's speed down so that motor power is greater.



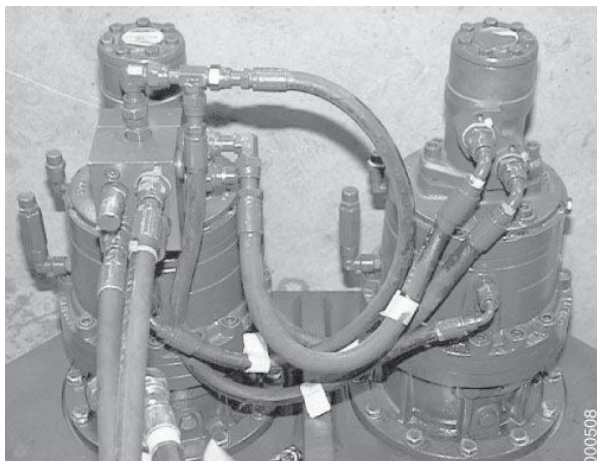
1. Hydraulic motor rotation
2. Disc brake
3. Planetary gear
4. Gear wheel
5. Rotation bar
6. Ring gear
7. Side shift frame

Rotation motor unit, replacement

NOTE

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

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



- 3 Mark up and detach the hydraulic hoses from the motor.

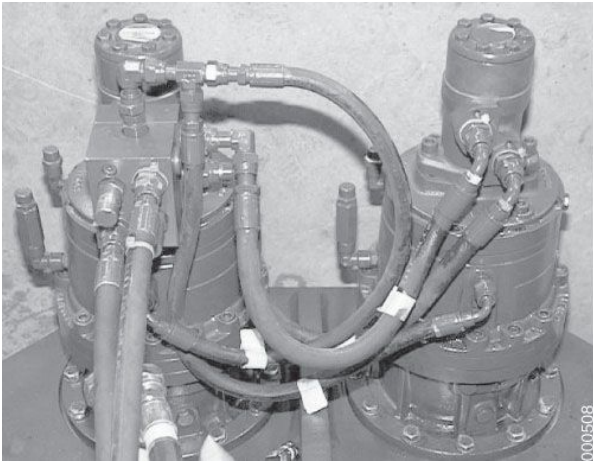
NOTE

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

- 4 Remove the hydraulic motor's attaching bolts.



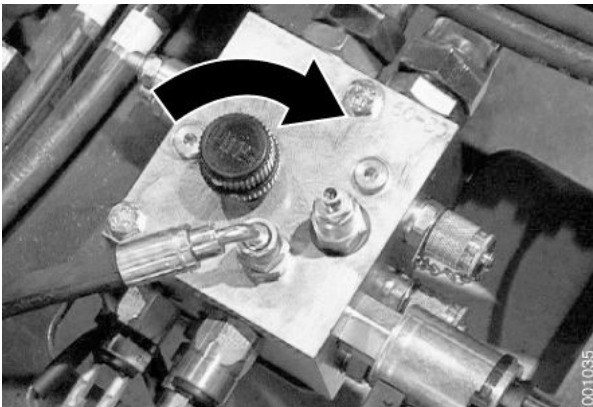
- 5 Lift away the rotation motor unit. Position the motor unit so that the pinion and planetary gear are not damaged.
- 6 Clean the contact surfaces on the motor unit and rotation yoke.
- 7 Lift the new motor unit into place.
- 8 Fit the motor unit. Tighten the bolts crosswise in steps until **117 Nm** is achieved.



- 9 Connect the hydraulic hoses to the motor and brake in accordance with the marking.

NOTE

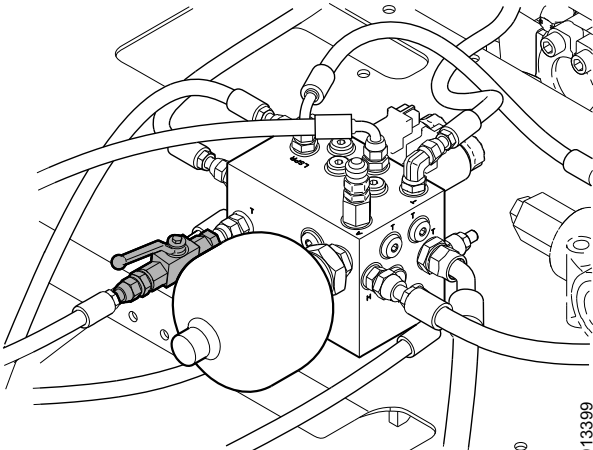
Check that the O-rings are intact, clean and in the correct position.



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

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



Relief valve for top lift, the figure shows an open valve.

- 11 Close the relief valve for top lift.



CAUTION

Hydraulic oil may be directed the wrong way.

Risk of damage to the fine filter for hydraulic oil.

Check that the relief valve for top lift is closed before starting the engine.

- 12 Switch on the system voltage and start the engine.
13 Check that the hydraulic connections are sealed tightly.
14 Check that the rotation is working.



- 15 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 centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

Do not overfill!

Leakage and environmental damage!

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

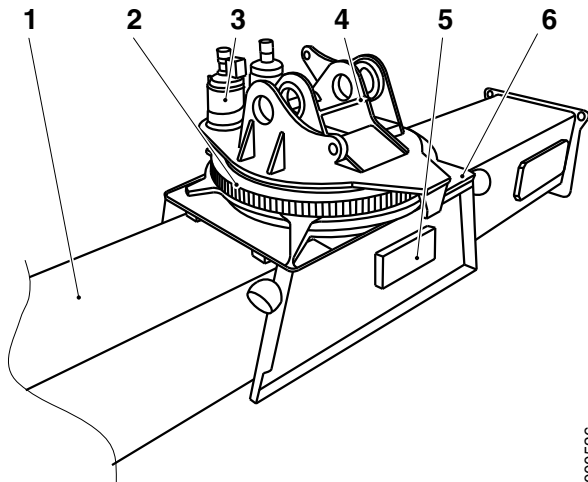
7.6.7 Rotation bar

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. Fitted 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.



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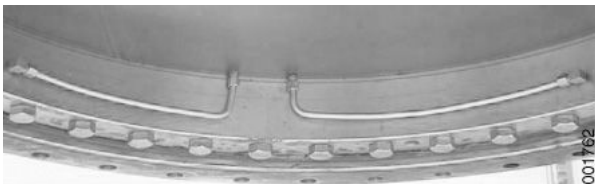
1. Main beam
2. Ring gear
3. Rotation motor unit
4. Rotation bar
5. Control valve, attachment
6. Side shift frame

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.



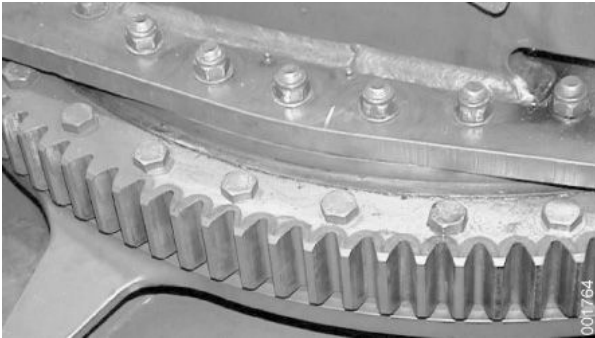
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001762

- 5 Remove the pipes for ring gear lubrication.

The illustration shows removed rotation yoke and ring gear.



- 6 Remove the rotation yoke's 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 shafts

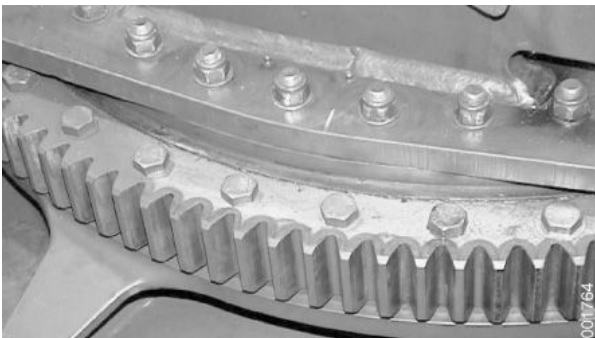


- 11 Transfer the lifting equipment to the new rotation yoke.
- 12 Lift the new rotation yoke into place.

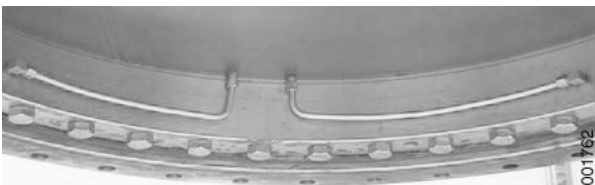
NOTE

Align the position against that of the ring gear so that the lubrication lines can be fitted.

- 13 Brush the rotation yoke's mounting shafts with lubricating grease and fit them in the rotation yoke.



- 14 Tighten the rotation yoke's attaching bolts to a torque of **331 Nm**.



- 15 Fit the pipes for the ring gear's lubrication lines.
- 16 Lubricate the ring gear with lubricating grease.
Rotate the yoke during lubrication it so that the grease is distributed evenly.
- 17 Rotate the yoke so that it is aligned straight.
- 18 Fit the rotation motors. See *Rotation yoke, description*, page 7:74.

NOTE

If necessary, rotate the rotation yoke slightly so that the rotation motor's gear wheel aligns 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 sight glass. Top up if necessary.



CAUTION

Do not overfill!

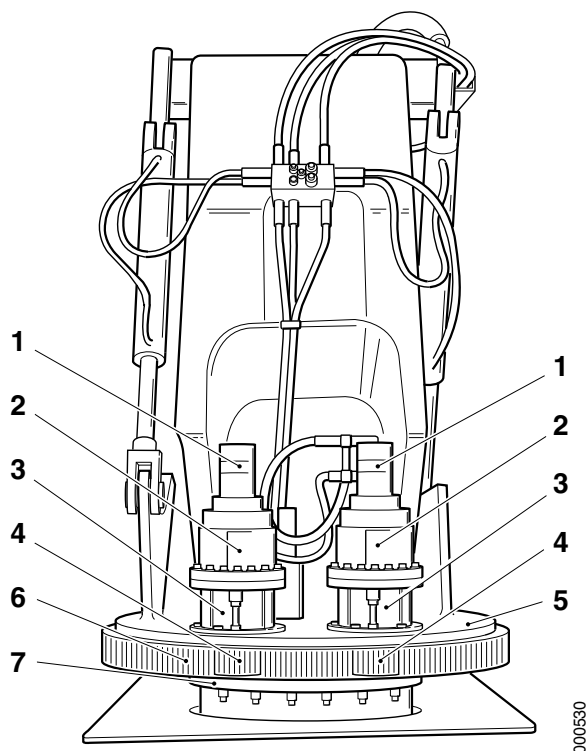
Leakage and environmental damage!

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

7.6.8 Ring gear

Ring gear, description

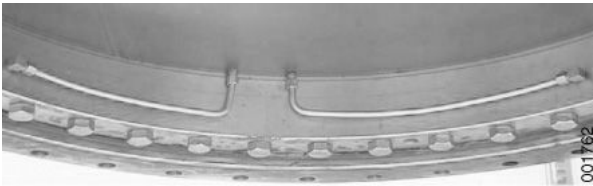
The ring gear is the joint between the rotation yoke and the side shift frame. The ring gear consists of gear wheel, bearings and mounting parts. The unit is bolted into the rotation yoke and side shift frame.



1. Hydraulic motor rotation
2. Disc brake
3. Planetary gear
4. Gear wheel
5. Rotation bar
6. Ring gear
7. Side shift frame

Ring gear, replacement

- 1 Remove the rotation yoke, see *Rotation yoke, replacement*, page 7:74.



The illustration shows removed rotation yoke and ring gear.

- 2 Remove the lubricating pipes from the ring gear.

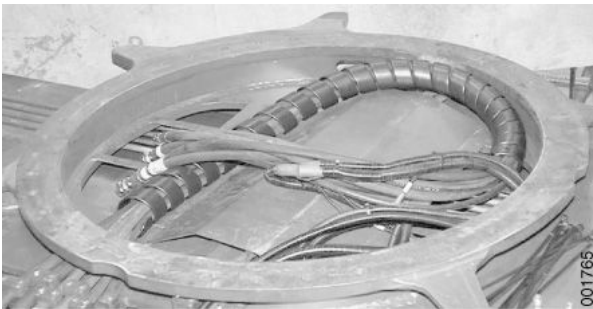
NOTE

Note down the locations of the lubricating pipes to facilitate refitting.

- 3 Remove the attaching bolts between the ring gear and the side shift frame.
- 4 Lift away the ring gear.
- 5 Clean the contact surfaces on the side shift frame and ring gear.
- 6 Lift the new ring gear into place.

NOTE

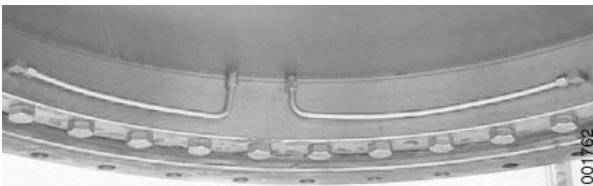
Rotate it so that the connections for the lubricating pipes are in the same positions as before.



- 7 Lubricate the inner attaching bolts with lubricating grease and fit them. Tighten the bolts crosswise in steps until a torque of **331 Nm** is achieved.

- 8 Fit the rotation yoke, see *Rotation yoke, replacement*, page 7:74.

- 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 sight glass. Top up if necessary.



CAUTION

Do not overfill!

Leakage and environmental damage!

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



7.6.9 Side shift frame

Side shift frame, description

See *Side shift frame, description*, page 7:45.

7.6.11 Relief valve, attachment

Relief valve attachment, description

See *Relief valve attachment, description*, page 7:49.

7.6.12 Pipes and hoses

Piped and hoses, description

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

7.6.14 Valve block servo pressure

Valve block servo pressure, description

See section *10 Common hydraulics*, group *10.5.7 Valve block servo pressure*.

Twistlocks, function description

Pos	Explanation	Signal description	Reference
1	The switch for locking the twistlocks (S1003) (automatic mode) sends a voltage signal to Control unit, cab (D790-1).	U = 24 V	Section 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instruments</i> D1: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.3 <i>ATTACH, menu 3</i>
2	The control lever (S815-T2) sends a voltage signal to Control unit, cab (D790-1) for opening twistlocks. If Switch, lock twistlocks (S1003) is in manual position then no signal is required from the control lever to open twistlocks.	U _{S815/T2} = 24 V	Section 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instruments</i> D2: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.3 <i>ATTACH, menu 3</i>
3	Sensor, alignment left front (7202L), Sensor, alignment right front (7202R), Sensor, alignment left rear (Y7203L) and Sensor, alignment right rear (Y7203R) send a voltage signal to Control unit, attachment (D791-1).	Sensor directly opposite indicator plate: U = 24 V	<i>Sensor, alignment, description</i> , page 7:84 D3: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.6 <i>ATTACH, menu 6</i>
4	Control unit, attachment (D791-1) transmits alignment on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.5 <i>Control unit, attachment</i>
5	Control unit KID (D795) activates the event menu for alignment.	-	Section 11 <i>Common electrics</i> , group 11.5.3.12 <i>Control unit, KID</i>
6	Control unit, attachment (D791-1) activates the indicator light for alignment on the boom's light panel.	U = 24 V	D19: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.10 <i>ATTACH, menu 10</i>
7	Control unit KID (D790-2) activates the indicator light for alignment on the cab's light panel.	-	Section 11 <i>Common electrics</i> , group 11.5.3.11 <i>Control unit, KIT</i>
8	Control unit, cab (D790-1) transmits "open twistlocks" or "lock twistlocks" on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</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 V	Section 11 <i>Common electrics</i> , group 11.5.3.3 <i>Control unit, frame rear</i> D9: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.5.6 <i>HYD, menu 6</i>
10	Solenoid valve, engagement of hydraulics for top lift (Y6003) opens and pressurises the top lift slide in valve block servo pressure.	-	Section 10 <i>Common hydraulics</i> , group 10.5.7 <i>Valve block servo pressure</i> D9: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.5.6 <i>HYD, menu 6</i>
11	Valve block servo pressure sends a load signal to hydraulic oil pump 2.	-	Section 10 <i>Common hydraulics</i> , group 10.5.7 <i>Valve block servo pressure</i>
12	Hydraulic oil pump 2 pumps oil from the hydraulic oil tank.	See the pressure plate on the left-hand frame beam.	Section 10 <i>Common hydraulics</i> , group 10.4.2 <i>Axial piston pump with variable displacement</i>
13	The non-return valve prevents oil being pumped between the pumps.	-	-
14	Control unit, attachment (D791-1) activates the Servo valve "open twistlocks" (Y6039) or Servo valve "lock twistlocks" (Y6040).	U = 24 V	Section 11 <i>Common electrics</i> , group 11.5.3.5 <i>Control unit, attachment</i> D14: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.9 <i>ATTACH, menu 9</i>
15	Servo valve "open twistlocks" (Y6039) or Servo valve "lock twistlocks" (Y6040) pressurises the twistlocks slide with servo pressure.	-	<i>Attachment control valve, description</i> , page 7:81 D14: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.9 <i>ATTACH, menu 9</i>

Pos	Explanation	Signal description	Reference
16	The control valve's twistlocks slide changes position and pressurises the lock cylinders.	-	<i>Attachment control valve, description, page 7:81</i>
17	The lock cylinders rotate the twistlocks.	-	<i>Lock cylinder, description, page 7:82</i>
18	Sensor "unlocked twistlocks" (B7204) or Sensor "locked twistlocks" (B7205) sends a signal to Control unit, attachment (D791-1).	Sensor directly opposite indicator plate: U = 24 V	<i>Sensor, twistlocks, description, page 7:85</i> D18: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.7 <i>ATTACH, menu 7</i>
19	Control unit, attachment (D791-1) supplies voltage to Indicator light "unlocked twistlocks" (H562) or Indicator light "locked twistlocks" (H563) on the boom's lamp panel.	U = 24 V	D19: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.10 <i>ATTACH, menu 10</i>
20	Control unit, attachment (D791-1) transmits "twistlocks unlocked" or "twistlocks locked" on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.5 <i>Control unit, attachment</i>
21	Control unit KIT (D790-2) supplies voltage to Indicator light "unlocked twistlocks" or Indicator light "locked twistlocks" on the cab lamp panel.	-	Section 11 <i>Common electrics</i> , group 11.5.3.11 <i>Control unit, KIT</i>
22	Control unit KID (D795) activates the event menu for twistlocks.	-	Section 11 <i>Common electrics</i> , group 11.5.3.12 <i>Control unit, KID</i>

Hydraulic diagram, see section *E Schematics*, group 10 *Common hydraulics*, *Hydraulic diagram, top lift*.

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*.

7.9.1.3 Control valve, attachment

Attachment control valve, description

The twistlocks function is regulated by a separate section in the attachment's control valve. For a general description of the valve and component locations, see *Attachment control valve, description*, page 7:40.

Twistlocks slide, description

The valve slide controls the 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" directs pressure to the twistlocks slide so that the slide opens and pressurises the lock cylinders.

Servo valve lock twistlocks is controlled electrically by 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 via the diagnostic menu. See section 8 *Control system*, group 8.4.9.9 *ATTACH, menu 9*.

Servo valve, open twistlocks, description

Servo valve "open twistlocks" directs pressure to the twistlocks slide so that the slide opens and pressurises the lock cylinders.

Servo valve open twistlocks is controlled electrically by 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 via the diagnostic menu. See section 8 *Control system*, group 8.4.9.9 *ATTACH, menu 9*.

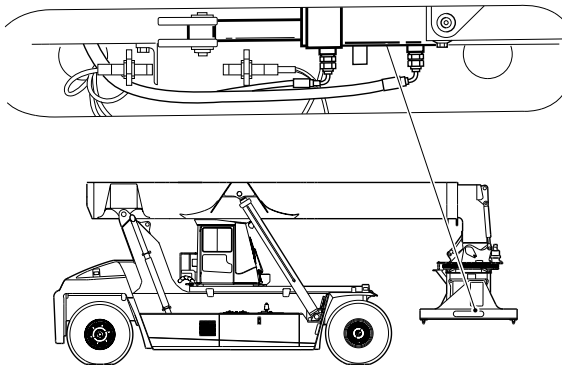
Control valve attachment, replacement

See *Control valve attachment, replacement*, page 7:41.

7.9.1.5 Lock cylinder

Lock cylinder, description

The lock cylinder activates the lock mechanism so that the twistlocks are rotated. Two lock cylinders, one in the right and one in the left spreader beam, activate the lock mechanism. The lock cylinders are fitted in the centre of the spreader beam's longitudinal section.



013210

Hydraulic cylinders, repairs

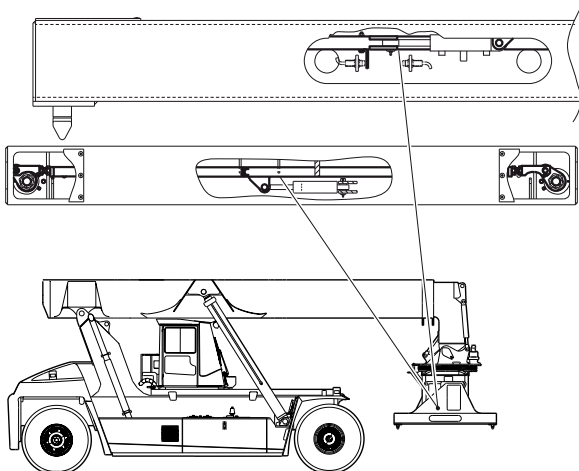
See section 10 *Common hydraulics*, group 10.7.1 *Hydraulic cylinders*.

7.9.1.6 Lock mechanism

Lock mechanism, description

The lock mechanism transfers the force of the lock cylinders to the twistlocks. Two lock mechanisms, one in the right and one in the left spreader beam, actuate the twistlocks. The lock mechanism runs along the longitudinal section of the spreader beam between the twistlocks.

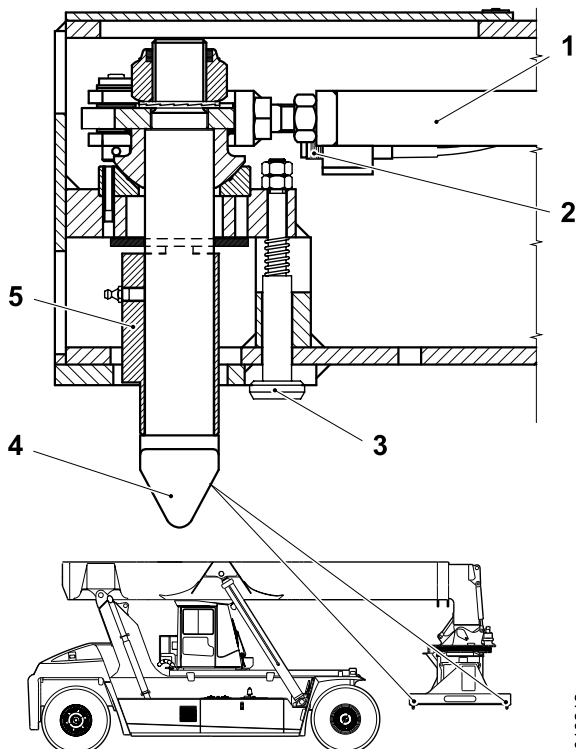
The lock mechanism consists of a rod with spherical plain bearings in the end. The rod is fastened in levers that rotate the twistlocks. A retaining lug for the lock cylinder is fitted in the centre of the rod.



013211

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.

Extreme danger!

Twistlocks hold the load during load handling and therefore it is of the utmost importance 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 out in the corners of the spreader beam's longitudinal section.

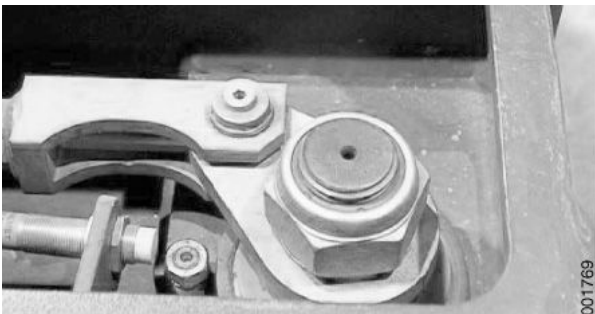
Twistlocks are manufactured from high-strength steel in accordance with international standards. The lift pins are marked with serial numbers.

Twistlocks are connected in pairs via a linkage system to a hydraulic cylinder which in turn is controlled via a section in the attachment's control valve. Inductive sensors send signals when the twistlocks are locked and unlocked, respectively.

013212

Twistlock, replacement

- 1 Machine in service position, see section *B Safety*.
- 2 Depressurise the brake and hydraulic systems, see section *B Safety*.
- 3 Clean the twistlocks and the surrounding area.
- 4 Detach the centre nut of the twistlocks.
- 5 Tap on the nut so that the lift pin releases from the wedge.
- 6 Hold the lift pin while removing the centre nut.

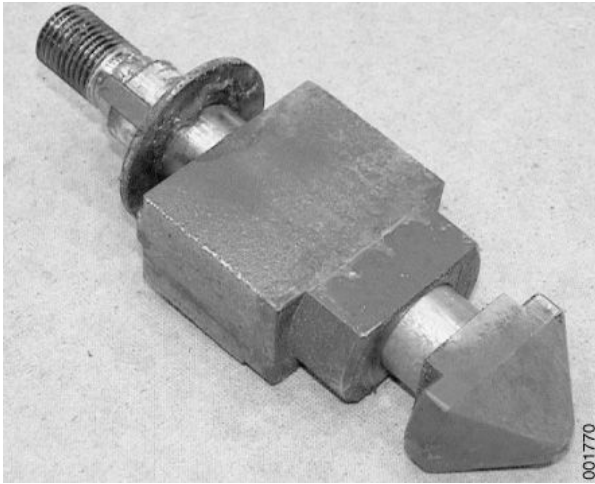


WARNING

Dropped component.

Risk of pinch injury or product damage.

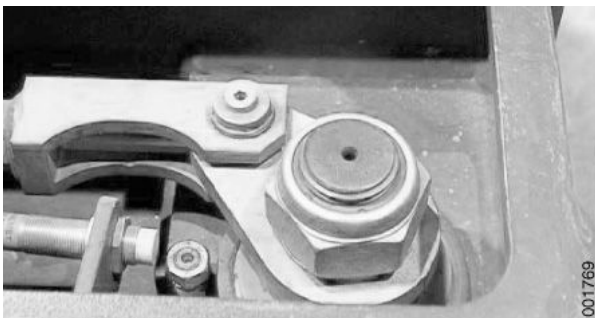
Twistlock weighs approx. 30 kg.



- 7 Remove the centre nut and lift away the twistlock.
- 8 Fit a new lift pin in the guide pin. Brush the lift pin with lubricating grease.
- 9 Position the lift pin and guide pin in the extension beam. Position 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 guide pin.



- 10 Position the wedge, bearing, lever, **new locking washers** and **new lock nuts** on the lock pin.
Apply lubricating grease to the parts before fitting.
- 11 Check the positions of the parts and that the twistlock can move.
- 12 Tighten the lock nut to a torque of **300 Nm**.
- 13 Lubricate the guide pin, lever and bearing with lubricating grease.
- 14 Check that the twistlock mechanism can move.
- 15 Switch on the system voltage and start the machine.
- 16 Check that the twistlock is working.

7.9.1.8 Sensor, alignment

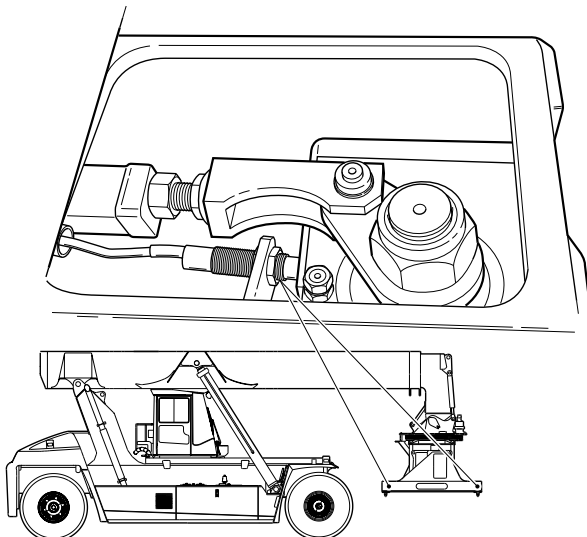
Sensor, alignment, description

Sensor, alignment detects when the attachment has contact with the container. Four inductive sensors, one at each twistlock out in the corners the longitudinal section of the spreader beam, 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 above 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 lower edge of the spreader beam. The clearance between the attachment and the container's corner boxes means the sensors stop sending signals when the attachment is lifted.

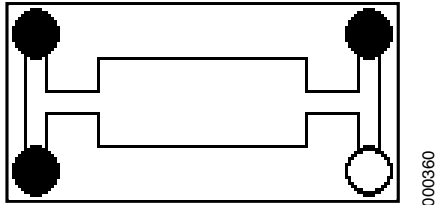
The sensors are supplied voltage by and send a 24 V signal to Control unit, attachment (D791) when the indicator pin is pressed in.

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.9.6 *ATTACH*, menu 6.



Sensor, alignment, checking

- 1 Machine in service position, see section *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 to a container and check that all twistlocks indicate alignment, filled circles in the event menu for alignment, and that the indicator light for alignment illuminates.
- 6 Lift the attachment slightly so that alignment is just broken (unfilled circles in the event menu for contact or the indicator light for alignment goes out).
- 7 Check how much indicator pin movement is required to detect alignment. The movement should be 3–4 mm.
- 8 Adjust sensor position if necessary. See *Position sensor, checking and adjustment*, page 7:3.



Event menu, alignment

Position sensor, checking and adjustment

See *Position sensor, checking and adjustment*, page 7:3.

7.9.1.9 Sensor twistlocks

Sensor, twistlocks, description

The twistlocks sensors detect when the twistlocks are locked or unlocked. Four inductive position sensors, two in each spreader beam, detect the position of the lock mechanism. The sensors are located at the lock cylinder in the centre of the longitudinal section of the spreader beam.

Both sides function in the same way independently of one another. An indicator plate is fitted on the lock mechanism by the lock cylinder. When the lock mechanism is in the position that locks the twistlocks, one of the sensors sends a signal to Control unit, attachment (D791). When the lock mechanism is in the position that unlocks the twistlocks, the second sensor sends signal to Control unit, attachment (D791). No signals are sent if the lock mechanism stops midway.

The sensors are supplied power by 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 via the diagnostic menu. See section 8 *Control system*, group 8.4.9.7 *ATTACH, menu 7*.

Position sensor, checking and adjustment

See *Position sensor, checking and adjustment*, page 7:3.

7.9.1.10 Relief valve, attachment

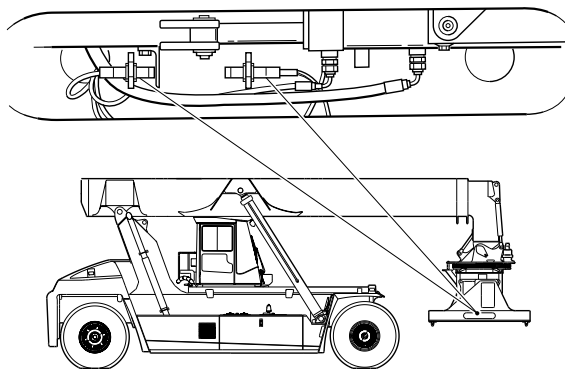
Relief valve attachment, description

See *Relief valve attachment, description*, page 7:49.

7.9.1.11 Pipes and hoses

Piped and hoses, description

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



7.9.1.14 Valve block servo pressure

Valve block servo pressure, description

See section 10 *Common hydraulics*, group 10.5.7 *Valve block servo pressure*.

7.10 Other functions

7.10.2 Weight indicator

Weight indicator, description



The weight indicator shows the weight of the raised load. The dynamic scale shows the load regardless of the position of the boom and extension.

The weight indicator uses Sensor boom length (R777), Sensor boom angle (R771) and Sensor hydraulic pressure, lift cylinder (B768), to calculate the weight of the load. For more information about the sensors see section 8 *Control system*, group 8.2.1 *Overload System*.

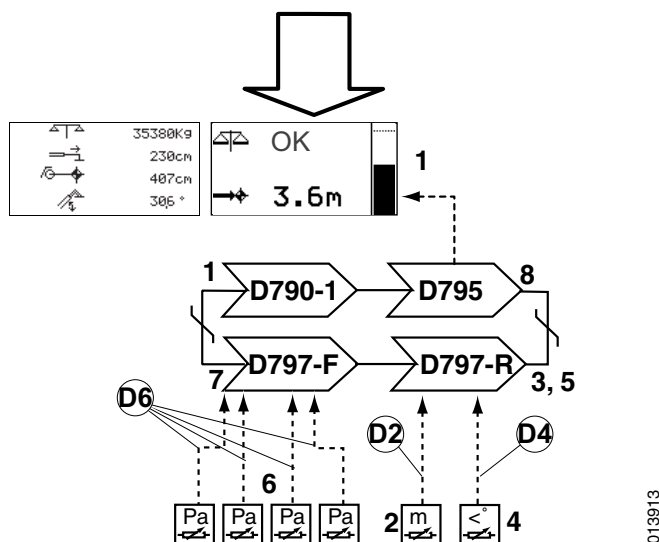
The pressure sensors can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.5.3 *HYD, menu 3*.

The dynamic scale weighs the load regardless of boom 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



Condition	Reference value	Reference
Control breaker	Disengaged	Section 11 <i>Common electrics</i> , group 11.5.1.4 <i>Emergency stop switch voltage</i>



Pos	Explanation	Signal description	Reference
1	Operating menu dynamic scale is selected in the display.	-	Section 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instruments</i>
2	Sensor, boom length (B777) sends a voltage signal proportional to boom length to Control unit, frame rear (D797-R).	U = 0.5-4.5 V	Section 8 <i>Control system</i> , group 8.2.1.6 <i>Sensor, boom length</i> D2: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.10.4 <i>OP menu 4</i>
3	Control unit, frame rear (D797-R) transmits boom length information on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.3 <i>Control unit, frame rear</i>

Pos	Explanation	Signal description	Reference
4	Sensor, boom angle (B771) sends a voltage signal proportional to boom angle to Control unit, frame rear (D797-R).	U = 0.5-4.5 V	Section 8 <i>Control system</i> , group 8.2.1.5 <i>Sensor, boom angle</i> D4: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.10.4 <i>OP menu 4</i>
5	Control unit, frame rear (D797-R) transmits boom angle information on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.3 <i>Control unit, frame rear</i>
6	Sensor hydraulic pressure lift cylinder piston side left (B768-L1), Sensor hydraulic pressure lift cylinder rod side left (B768-L2), Sensor hydraulic pressure lift cylinder piston side right (B768-R1) and Sensor hydraulic pressure lift cylinder rod side right (B768-R2) 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</i> , page 7:21 D6: Diagnostic menu, see section 8 <i>Control 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 by a machine-unique load curve based on sensor values for boom angle, boom length and pressure in the lift cylinders. NOTE <i>The load curve is unique for each machine.</i>	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame front</i>
8	Control unit KID (D795) shows weight information in the display.	-	Section 11 <i>Common electrics</i> , group 11.5.3.12 <i>Control unit, KID</i>

7.10.2.1 Sensor, hydraulic pressure lift cylinder

Sensor, hydraulic pressure lift cylinder, general

See *Sensor, hydraulic pressure lift cylinder, description*, page 7:21.

7.10.2.2 Sensor boom angle

Sensor, boom angle, general

See section 8 *Control system*, group 8.2.1.2 *Sensor, boom angle*.

7.10.2.3 Sensor boom length

Sensor, boom length, general

See section 8 *Control system*, group 8.2.1.3 *Sensor, boom length*.

7.10.3 Container counter

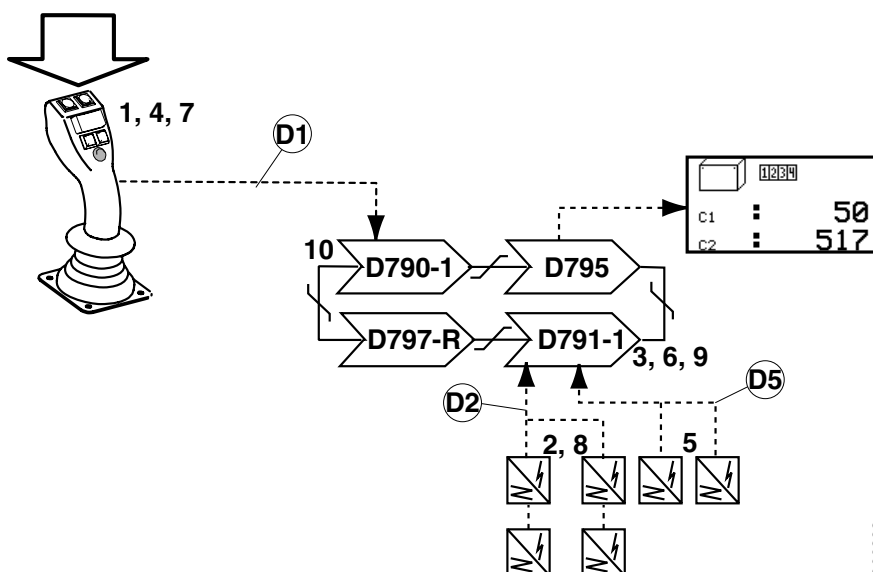
Container counter, function description



The container counter counts the number of lifted containers. The counter has two counters that can be reset separately.

The container counter counts lifting when alignment is broken with locked twistlocks and twistlocks are not opened within 8 seconds.

Condition	Reference value	Reference
Control breaker	Disengaged	Section 11 <i>Common electrics</i> , group 11.5.1.4 <i>Emergency stop switch voltage</i>



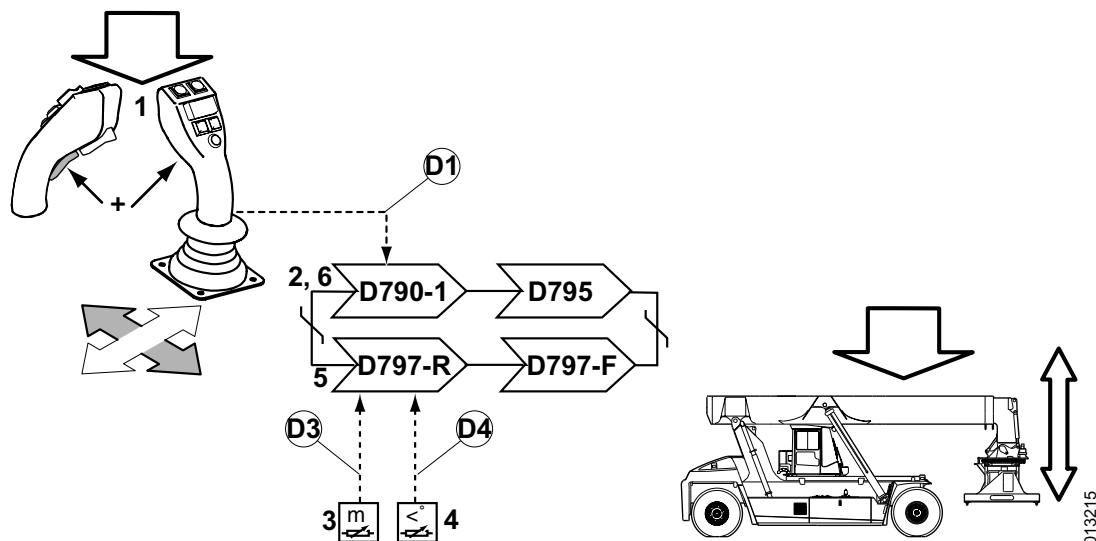
Pos	Explanation	Signal description	Reference
1	The attachment is positioned over a container with the functions 7.2 <i>Lifting/lowering</i> and 7.3 <i>Extension</i> .	-	<i>Lifting/lowering, function description</i> , page 7:6 <i>Extension, function description</i> , page 7:26 D1: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.8.1 <i>BOOM menu 1</i>
2	Sensor, alignment left front (7202L), Sensor, alignment right front (7202R), Sensor, alignment left rear (Y7203L) and Sensor, alignment right rear (Y7203R) send a voltage signal to Control unit, attachment (D791-1).	Sensor directly opposite indicator plate: U = 24 V	<i>Sensor, alignment, description</i> , page 7:84 D2: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.6 <i>ATTACH, menu 6</i>
3	Control unit, attachment (D791-1) sends alignment on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.5 <i>Control unit, attachment</i>
4	Twistlocks are rotated to the locked position and are closed with the 7.9.1 <i>Twistlocks</i> function.	-	<i>Twistlocks, function description</i> , page 7:79
5	Sensor, locked twistlocks left (B7205L) and Sensor, locked twistlocks right (B7205R) send a voltage signal to Control unit, attachment (D791-1).	Sensor directly opposite indicator plate: U = 24 V	<i>Sensor, twistlocks, description</i> , page 7:85 D5: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.7 <i>ATTACH, menu 7</i>
6	Control unit, attachment (D791-1) sends locked twistlocks on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.5 <i>Control unit, attachment</i>
7	The container is lifted with the function 7.2 <i>Lifting/lowering</i> .	-	<i>Lifting/lowering, function description</i> , page 7:6

Pos	Explanation	Signal description	Reference
8	Sensor, alignment left front (7202L), Sensor, alignment right front (7202R), Sensor, alignment left rear (Y7203L) and Sensor, alignment right rear (Y7203R) stop sending a voltage signal to Control unit, attachment (D791-1).	U = 0 V	<i>Sensor, alignment, description</i> , page 7:84 D2: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.9.6 <i>ATTACH</i> , menu 6
9	Control unit, attachment (D791-1) sends no alignment on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.5 <i>Control unit, attachment</i>
10	If the twistlocks remain locked for 8 seconds then Control unit, cab (D790-1) adds one lift to the container counter.	-	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>

7.10.4 Synchronised lift

Synchronised lift, function description

Condition	Reference value	Reference
Control breaker	Disengaged	Section 11 <i>Common electrics</i> , group 11.5.1.4 <i>Emergency stop switch voltage</i>



Pos	Explanation	Signal description	Reference
1	The control lever sends for lift or lower and pistol trigger voltage signal 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: $U_{S815-T4} = 24 \text{ V}$	Section 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instruments</i> D1: Diagnostic menu, see section 8 <i>Control 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 synchronised lift on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
3	Sensor, boom angle (B771) sends a voltage signal to Control unit, frame rear (D797-R).	$U = 0.5-4.5 \text{ V}$	Section 8 <i>Control system</i> , group 8.2.1.5 <i>Sensor, boom angle</i> D3: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.10.1 <i>OP</i> , menu 1
4	Sensor, boom length (B777) sends a voltage signal to Control unit, frame rear (D797-R).	$U = 0.5-4.5 \text{ V}$	Section 8 <i>Control system</i> , group 8.2.1.6 <i>Sensor, boom length</i> D4: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.10.4 <i>OP menu 4</i>
5	Control unit, frame rear (D797-R) transmits length and angle information on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.3 <i>Control unit, frame rear</i>
6	Control unit, cab (D790-1) controls the functions 7.2 <i>Lifting/lowering</i> and 7.3 <i>Extension</i> at the same time so that the lifting movement is vertical.	-	<i>Lifting/lowering, function description</i> , page 7:6 <i>Extension, function description</i> , page 7:26

Contents 8 Control system

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8 Control system

Control system, general

In many cases, the machine's functions are controlled electrically. The signals that control the machine are monitored to warn the operator or limit the machine's functions in the event of certain dangerous situations or if there are malfunctions in the machine.

The control system function is subdivided into the following functions:

- Monitoring
- Error codes
- Diagnostics
- Setup
- Software

Monitoring functions describe 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.

Diagnostic test is tool for performing service and troubleshooting with 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 system.

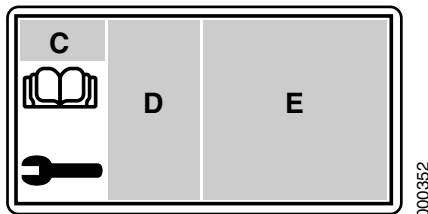
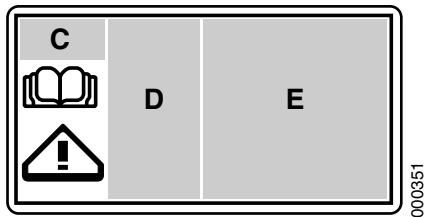
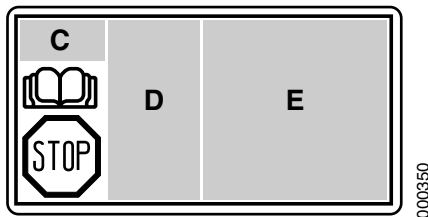
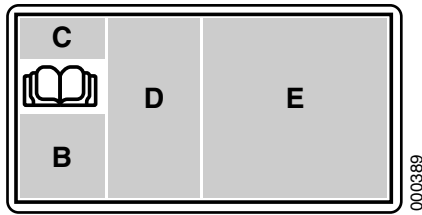
8.1 Controls and instruments

8.1.10 Error code menu

Error code menu, description

The control and monitoring system's display is divided into four fields where the information is shown (see figure to the left).

- Field B: Error code level is shown with a symbol.
- Field C: Shows error code.
- Field D: Shows type of error.
- Field E: Indicates which function is affected by error code.
- Book symbol means that information is available in the operator's manual.



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 jeopardise the operator's safety or cause machine failure. The error code must be attended to immediately. Stop working with the machine and contact service immediately.

The error code is shown automatically on the display.

- Warning

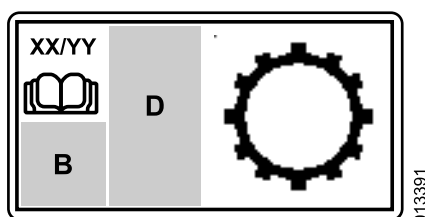
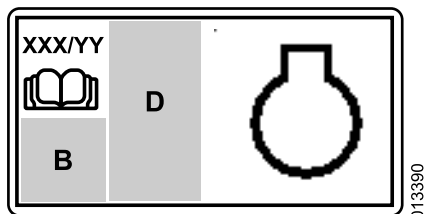
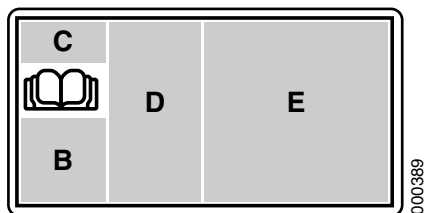
Indicates malfunction in machine that should be taken care of as soon as possible. After the finished work shift with the machine, contact service as soon as possible.

The error code is shown automatically on the display.

- Information

Information to the operator that something should be rectified, e.g. broken bulb. Take action to rectify 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



2



3



4



5



6



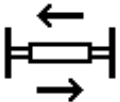
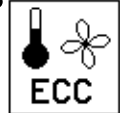
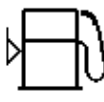
7



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		2		3		1. Attachment
4		5		6		2. Rotation of attachment
7		8		9		3. Side shift-attachment
10		11		12		4. Length adjustment attachment
13		14		15		5. Twistlocks
16		17		18		6. Boom up/down
19		20		21		7. Pressure sensor lift cylinder (overload system, OP)
22		23				8. Overload system
						9. Boom in/out
						10. Brake system
						11. Hydraulic functions
						12. Steering
						13. Engine
						14. Transmission
						15. Control unit
						16. Hardware-related error
						17. Cab
						18. Air conditioning
						19. Fuel system
						20. Headlights
						21. Windscreen wipers
						22. Battery voltage
						23. Bulb for lighting

014163

Pos	Explanation	Signal description	Reference
7	Control unit, transmission (D793) transmits speed information on the CAN bus.	Checked by the control system, error indicated with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.9 <i>Control unit, transmission</i>
8	In the event of overload on the steering axle the speed is limited gradually with the increasing load.	Checked by the control system, error indicated with error code	

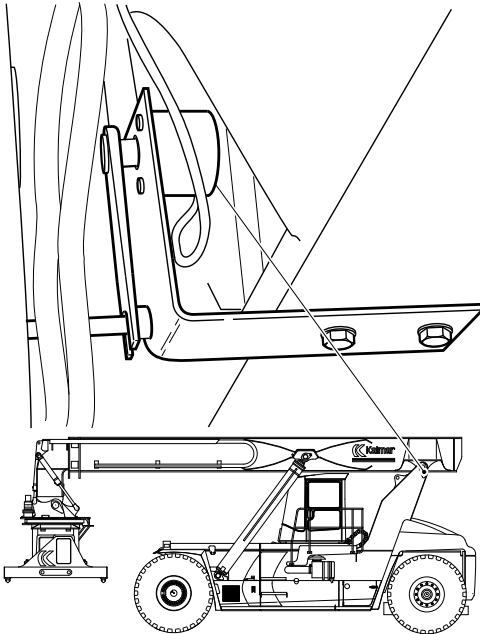
8.2.1.5 Sensor boom angle

Sensor, boom angle, description

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 mounted 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 by and sends a signal proportional to the angle to Control unit, frame rear (D797-R).

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.10.4 *OP, menu 4*.



Sensor, boom angle (B771)

001093

Sensor, boom angle, replacement

- 1 Machine in service position, see section *B Safety*.
- 2 Replace the sensor.
- 3 Switch on the system voltage and turn the start key to position I.
- 4 Calibrate Sensor, boom angle, see *Weight indicator, calibration*, page 8:113.
- 5 Check that the end position damping is working in both outer and inner end positions.



001732

8.2.1.6 Sensor boom length

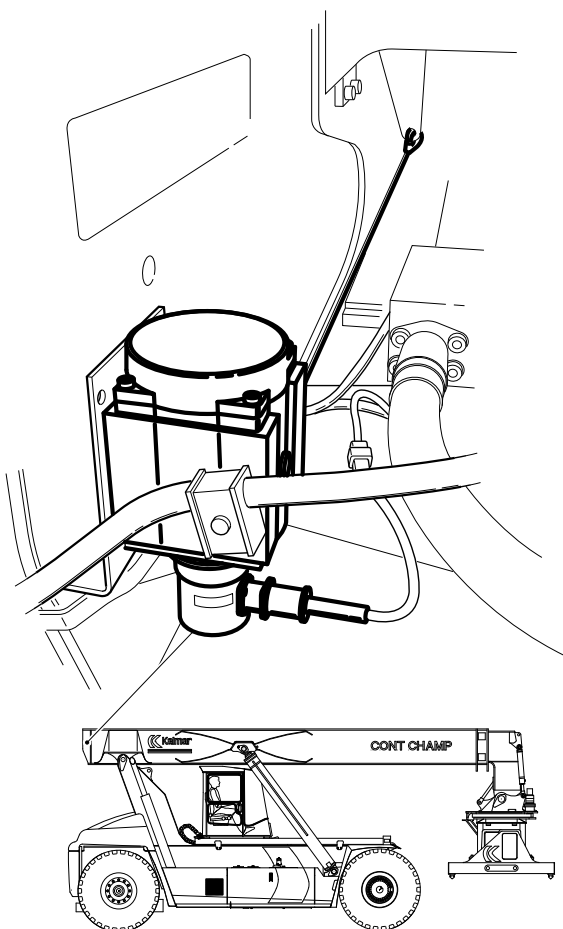
Sensor, boom length, description

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 acts on the potentiometer and the signal is changed.

The sensor is supplied with voltage by and sends a voltage signal proportional to the length to Control unit, frame rear (D797-R).

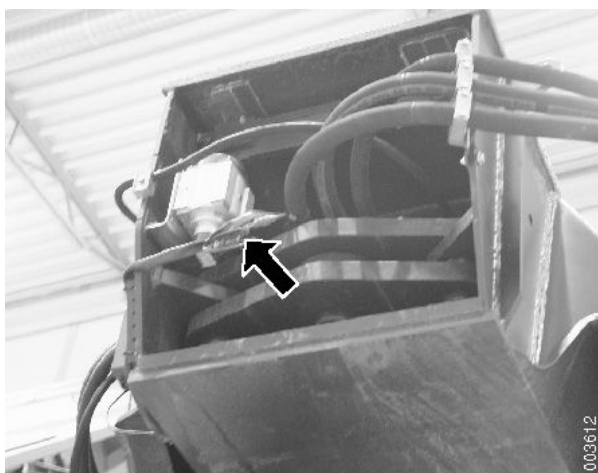
The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.10.4 *OP*, menu 4.



Sensor, boom length (R777)

Sensor, boom length, replacement

- 1 Machine in service position, see section *B Safety*.
- 2 Replace the sensor.
- 3 Switch on the system voltage and turn the start key to position I.
- 4 Calibrate the sensor, see *Weight indicator, calibration*, page 8:113.
- 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 lift cylinder

Sensor, hydraulic pressure lift cylinder, general

See section 7 *Load handling*, group 7.2.9 *Sensor, hydraulic pressure lift cylinder*.

8.2.2 Bypass

Bypass, description

When the overload system engages and turns off the hydraulic controls, it may take place in a situation where it is necessary to bypass the safety system.

By-passing the safety system allows:

- lowering of load in case of overload
- locking and opening of twistlocks without complete alignment
- 20'-40' spreading with locked twistlocks
- manual control of the recirculation damper for ECC or EHC
- release of parking brake in the event of malfunction of Switch, parking brake or Sensor, operator-in-seat
- lift, lower and extension with active error in the overload system
- selection of travel direction in the event of malfunction of Sensor, operator-in-seat, speed is limited to 10 km/h



DANGER

Bypassing the safety systems results in a risk of tipping. Use at your own risk.

Extreme hazard to personal health and risk of property damage!

Only use the bypass of safety systems in emergency situations.

8.2.3 Speed limitation

Speed limitation, description



Speed limitation prevents the machine's speed from exceeding the preset value by limiting gear position and engine speed.

Speed limitation is set via the initiation menu, see section *8 Control system*, group *8.5.1.5 INIT DRIVE-TRAIN*, menu 9.

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 content of the menu figures and which functions can be controlled.

The diagnostic test is divided into the following groups:

- Voltage feed and communication for the Control system, *CAN/POWER*, *description*, page 8:13.
- Lighting, *LIGHTS*, *description*, page 8:27.
- Cab functions, *CAB*, *description*, page 8:40.
- Air conditioning, *CLIMATE*, *description*, page 8:48.
- Hydraulic functions, *HYD*, *description*, page 8:54.
- Engine, *ENGINE*, *description*, page 8:59.
- Transmission, *TRANSM*, *description*, page 8:65.
- Boom functions, *BOOM*, *description*, page 8:72.
- Attachment functions, *ATTACH*, *description*, page 8:79.
- Overload system, *OP*, *description*, page 8:91.
- Optional functions, *EXTRA* (not used).
- RMI (Remote Machine Interface), *RMI* (not used).

DIAGNOSIS
CAN/POWER LIGHTS CAB
CLIMATE HYD ENGINE
TRANSM BOOM ATTACH
OP EXTRA RMI

009268

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	
	OUTPUT	11	
	FEEDBACK	0	
		5	

004856

1. DIAG = Diagnostic menus
2. Menu group
3. Menu number
4. Total number of menus in the 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 8:13.</i> <i>LIGHTS, description, page 8:27.</i> <i>CAB, description, page 8:40.</i> <i>CLIMATE, description, page 8:48.</i> <i>HYD, description, page 8:54.</i> <i>ENGINE, description, page 8:59.</i> <i>TRANSM, description, page 8:65.</i> <i>BOOM, description, page 8:72.</i> <i>ATTACH, description, page 8:79.</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 the 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 the 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 circuit. 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 circuit. 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
CAN/POWER LIGHTS CAB
CLIMATE HYD ENGINE
TRANSM BOOM ATTACH
OP EXTRA RMI

009268

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 to control units and CAN bus communication.

Confirm selections with function key for Enter.

8.4.1.1 CAN/POWER, menu 1

PRESENT REDCAN STATUS, COMMUNICATION MODE

Description: Indicates communication status for the redundant CAN bus.

Circuit diagram: -

Contact: -

Function: 11.6.2 Redundant CAN bus

Signal value:

3	OK.
2	Segment check
0	Error.

PRESENT REDCAN STATUS, NUMBER OF UNITS

Description: Indicates the 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 are therefore not counted).

Circuit diagram: Circuit CAN BUS opt. frame KDU group 11.6, Circuit CAN BUS ATT group, 11.6

Contact: -

Function: 11.6.2 Redundant CAN bus

Signal value:

X	Number of nodes that should be in the machine. Number of nodes depends 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 if there is, where the first open circuit is. If there is open circuit, it is indicated with a number that corresponds to the defective segment on the redundant CAN bus.

Circuit diagram: Circuit CAN BUS opt. frame KDU group 11.6, Circuit CAN BUS ATT group, 11.6

Contact: -

Function: 11.6.2 Redundant CAN bus

Signal value:

0	No open circuits.
> 0	If X is separated from 0, the first segment is indicated as missing contact. A 1 means that the first segment is defective, that is, that contact between first and second control unit is cut off. To see which control units are installed on the machine along with their order, use diagnostic menu <i>CAN/POWER</i>, menu 2, see <i>PRESENT REDCAN STATUS</i>, <i>RED.CON.CITIES</i>, page 8:14.

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: Circuit CAN BUS opt. frame KDU group 11.6, Circuit CAN BUS ATT group, 11.6

Contact:

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, D791-1: 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, 11.5.3.5 Control unit, attachment, 11.5.3.6, 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: Not connected.

Position 3: Not connected.

Position 4: Not connected.

Position R: Control unit, frame rear (D797-R)

Position O: Not connected.

Position F: Control unit, frame front (D797-F)

Position D: Control unit KID (D795)

DIAG CAN/POWER 2(20)	
PRESENT REDCAN STATUS	
RED.CON.CITIES	
XYXYXYXY	
1234ROFD	

000087

DIAG CAN/POWER 3 (20)	
PRESENT DRIVE-TRAIN	
CAN BUS STATUS	
ENGINE	X
TRANSMISSION	X

000088

8.4.1.3 CAN/POWER, menu 3

PRESENT DRIVE-TRAIN CAN BUS STATUS, ENGINE

Description: Indicates status for engine in the drive-train's CAN bus.

Circuit diagram: Circuit CAN BUS frame, cab group 11.6, Circuit engine Cummins group 1.0, Drive-train CAMRY

Contact:

Yuchai YC6M360-30: CAN J1939 from D790-1/K13:1 and K13:2 to D794/1:34 and 1:35

Cummins QSM11 (+): CAN J1939 from D790-1/K13:1 and K13:2 to D794/46 and 37

Function: 11.6.3 CAN bus drive-train

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 drive-train is common to the engine and transmission from the cab electronic box to the frame electronic box. The cable branches in the frame electronic box. If communication with both the engine and transmission is cut off, start troubleshooting at the cable harness between the cab electronic box and the frame electronic box. If there is communication (either engine or transmission), this rules out a fault in the cable harness between the cab electronic box and the frame electronic box.

PRESENT DRIVE-TRAIN CAN BUS STATUS, TRANSMISSION

Description: Indicates status for transmission in the drive-train's CAN bus.

Circuit diagram: Circuit diagram drive-train CAMRY

Connection: CAN J1939 from D790-1/K13:1 and K13:2 to D793/22 and 23.

Function: 11.6.3 CAN bus drive-train

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 drive-train is common to the engine and transmission from the cab electronic box to the frame electronic box. The cable branches in the frame electronic box. If communication with both the engine and transmission is cut off, start troubleshooting at the cable harness between the cab electronic box and the frame electronic box. If there is communication (either engine or transmission), this rules out a fault in the cable harness between the cab electronic box and the frame electronic box.

DIAG CAN/POWER 3 (20)	
PRESENT DRIVE-TRAIN	
CAN BUS STATUS	
ENGINE	X
TRANSMISSION	X

000088

DIAG	CAN/POWER	4 (X)
IGNITION		
KEY IN		X
RELAY K315-1		XY
RELAY K315-2		XY

006859

DIAG	CAN/POWER	4 (X)
IGNITION		
KEY IN		X
RELAY K315-1		XY
RELAY K315-2		XY

006859

DIAG	CAN/POWER	4 (X)
IGNITION		
KEY IN		X
RELAY K315-1		XY
RELAY K315-2		XY

006859

8.4.1.4 CAN/POWER, menu 4

IGNITION, KEY IN

Description: Indicates if ignition is switched on (key in ignition key lock).

Circuit diagram: Circuit Power group 11.5

Connection: signal from S150/15 to D790-1/K11:1

Function: 11.5.1.3 Ignition voltage

Signal value:

1	Input signal active.
0	No signal.

IGNITION, RELAY K315-1

Description: Control current to Relay, ignition voltage (K315-1), 15-voltage.

Circuit diagram: Circuit 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 and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

IGNITION, RELAY K315-2

Description: Control current to Relay, ignition voltage (K315-2) (15-voltage).

Circuit diagram: Circuit Power group 11.5

Connection: signal from D790-1/K10:16 to K315-2/86

Function: 11.5.1.3 Ignition voltage (15)

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

8.4.1.5 CAN/POWER, menu 5

EMERGENCY STOP, SW

Description: Indicates if switch, emergency stop switch, is activated.

Circuit diagram: Circuit Power group 11.5

Connection: signal from S250/12 to D790-1/K8:4

Function: 11.5.1.4 Emergency stop switch voltage (15E)

Signal value:

1	Input signal active.
0	No signal.

EMERGENCY STOP, RELAY K3009-1

Description: Status for control current to Relay K2, for emergency stop switch voltage (K3009-1), 15E voltage.

Circuit diagram: Circuit Power group 11.5

Connection: signal from D790-1/K10:11 to K3009-1/86

Function: 11.5.1.4 Emergency stop switch voltage (15E)

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

EMERGENCY STOP, FEEDBACK

Description: Feedback signal from emergency stop switch voltage relay (K3009-1), indicates that relay is working normally.

Circuit diagram: Circuit 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 Emergency stop 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

DIAG	CAN/POWER	5 (X)
EMERGENCY STOP, SW	X	
RELAY K3009-1	XY	
FEEDBACK	X	
RELAY K3009-2	XY	

006860

DIAG	CAN/POWER	5 (X)
EMERGENCY STOP, SW	X	
RELAY K3009-1	XY	
FEEDBACK	X	
RELAY K3009-2	XY	

006860

DIAG	CAN/POWER	5 (X)
EMERGENCY STOP, SW		X
RELAY K3009-1		XY
FEEDBACK		X
RELAY K3009-2		XY

008860

EMERGENCY STOP, RELAY K3009-2

Description: Status of control current to emergency stop switch voltage relay (K3009-2), 15E-voltage.

Circuit diagram: Circuit Power group 11.5

Connection: signal from D790-1/K10:12 to K3009-2/86

Function: 11.5.1.4 Emergency stop switch voltage (15E)

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

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 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), Circuit Drive-train group 1.1 (contact 3), Circuit Joystick group 7.1 (contact 4)

Contact:

1. signal from digital out D790-1/K4:5 to Y672/10 and Y673/10
2. signal from digital out D790-1/K5:11 to S118/1, S139/1 and S117/1
3. signal from digital out D790-1/K5:13 to B690/1
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

160000

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 Wiper group 9.5
2. Circuit Extra equipment group 9.1, Circuit Drive-train group 2.1, Circuit Cab driver's seat group 9.3, Circuit Lighting group 9.6, Circuit Working lights group 9.6 and Circuit Extra Sensor Instr. group 9.1
3. Circuit Joystick group 7.1
4. Circuit Power group 11.5, Circuit Brake group 4.0, Circuit Bypass group 8.2, Circuit Twistlocks group 7.9, Circuit Spreading Sensor group 7.5
5. Not used.
6. -
7. Not used.
8. Circuit Alarm, audible signals group 9.7
9. Circuit Wiper group 9.5
10. Circuit Wiper group 9.5

Contact:

1. Signal from digital out D790-1/K4:14 to M650-1/53a
2. Signal from digital out D790-1/K5:1 to 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 to S250/11, S107/5, S1005/5, S1003/3, S1003/4, S199-2/5
5. Not used.
6. Signal from digital out D790-1/K9:7 not connected
7. Not used.
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 Seat, 9.6 Lighting
3. 7.1.1 Control lever
4. 11.5.1.4 Emergency stop switch voltage, 4.5 Parking brake system, 8.2.2 Bypass, 7.9.1 Twistlocks
5. Not used.
6. -
7. Not used.
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	Normal mode function off. No output signal. It can also be a short circuit in the circuit as errors can only be detected when the output signal is active.
10	Output signal active, short circuit. It can also be an open circuit as this cannot be detected.
11	Normal mode function on. Output signal active, circuit OK or open circuit. Open circuit cannot be detected.

DIAG	CAN/POWER	7 (20)
790-1	CAB	
24V	SENSOR SUPPLY	XY
24V	SUPPLY, RPM>500	XY

003178

790-1 CAB, 24V SUPPLY, RPM>500

Description: Voltage feed when engine speed is higher than 500 rpm.

Circuit diagram: Circuit Sensor 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 and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

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 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).

DIAG	CAN/POWER	8 (20)
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: Circuit CAN BUS opt. frame KDU group 11.6

Contact:

Le: redundant feed 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.

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, EME STOP POWER

Description: Emergency stop switch voltage to Control unit, frame front (D797-F).

Circuit diagram: Circuit 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 Emergency stop switch voltage (15E)

Signal value:

1	Feed active.
0	No feed.

DIAG CAN/POWER	9 (20)
797-F FRAME	
24V SENSOR SUPPLY	XY
5V REF	X.XXV

000094

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 switches).

Circuit diagram: Circuit Brake system group 4.0, Circuit Drive-train 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 (closing switch) declutch, 4.3.7 Make-contact (closing switch) brake pressure, 4.3.8 Make-contact (closing switch) brake lights 4.5.5 Make-contact (closing switch) parking brake

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

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 Power group 11.5

Connection: 15-voltage from K315-1/87 via F54/4 and F58-2/3 to 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).

797-R FRAME, RED. POWER

Description: Redundant voltage to Control unit, frame rear (D797-R).

Circuit diagram: Circuit CAN BUS opt. frame KDU group 11.6

Contact:

Le: redundant feed 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 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

8.4.1.11 CAN/POWER, menu 11

797-R FRAME, 24V SENSOR SUPPLY

Description: Voltage feed 24 V to sensors connected to Control unit, frame rear (D797-R).

Circuit diagram: not used.

Connection: not used.

Function: not used.

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG CAN/POWER 11 (20)
797-R FRAME
24V SENSOR SUPPLY XY
5V REF X.XXV

000096

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

NOT USED

This menu is not used.

XXXXXXXX X (X)
NOT USED

008793

8.4.1.13 CAN/POWER, menu 13

NOT USED

This menu is not used.

XXXXXXXX X (X)
NOT USED

008793

DIAG CAN/POWER 14(20)		
795 DISPLAY		
RED.POWER	Le	X Ri X

000099

8.4.1.14 CAN/POWER, menu 14

795 DISPLAY, RED. POWER

Description: Redundant voltage to Control unit KID (D795).

Circuit diagram: Circuit CAN BUS opt. frame KDU group 11.6

Contact:

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 Power group 11.5, Circuit diagram Drive-train Camry

Connection: 30-voltage from F54/2 via F58-1/5 to D793/45

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).

793 TRANSMISSION, IGNITION POWER

Description: Ignition voltage (15) to Control unit, transmission (D793).

Circuit diagram: Circuit Power group 11.5, Circuit diagram Drive-train Camry

Connection: 15-voltage from K315/87 via F54/4 and F58-2/5 to D793/20, 21, 60

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 diagram Drive-train Camry

Connection: 5V analogue Ref from D793/15 to B765/C

Function: 2.9 Control system, transmission

Signal value: XX.XXV = voltage on the connection. The signal value should be 5 V, stable (not varying).

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 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

8.4.1.16 CAN/POWER, menu 16

791-1 ATTACHMENT, POWER

Description: Battery voltage to Control unit, attachment (D791-1).

Circuit diagram: Circuit 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 Emergency stop 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: Circuit CAN BUS opt. frame KDU group 11.6, Circuit CAN BUS ATT group, 11.6

Contact:

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.

8.4.1.1 CAN/POWER, menu 17

NOT USED

This menu is not used.

XXXXXXXX X(X)	
NOT USED	

008793

8.4.1.18 CAN/POWER, menu 18

NOT USED

This menu is not used.

XXXXXXXX X(X)	
NOT USED	

008793

8.4.1.19 CAN/POWER, menu 19

NOT USED

This menu is not used.

XXXXXXXX	X (X)
NOT USED	

008793

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: Circuit Spreading Valves group 7.5

Connection: digital out from D791/K1:10 to B769, B7202L, B7202R, B7203L, B7203R, B7204L, B7204R, B7205L and B7205R

Function: 7.5.10 Position sensor spreading, 7.9.1.8 Sensor, alignment, 7.9.1.9 Sensor twistlocks

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

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 791-2

This menu row is not used.

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

This menu row is not used.

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 791-4

This menu row is not used.

DIAG CAN/POWER 21(X)			
REDCAN STATUS CHECK			
PRESS ENTER			
SEGMENT ERROR		X	

006861

8.4.1.21 CAN/POWER, menu 21

REDCAN STATUS CHECK

Description: Control function from the redundant CAN bus. Control unit, attachment (D791-1) creates a virtual fault in the redundant CAN bus in order to determine whether all control units have contact and are connected in the right order. The control system indicates the fault by numbering the cables between the control units (segments) from 1 onwards. 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). The segments in between vary depending on machine configuration.

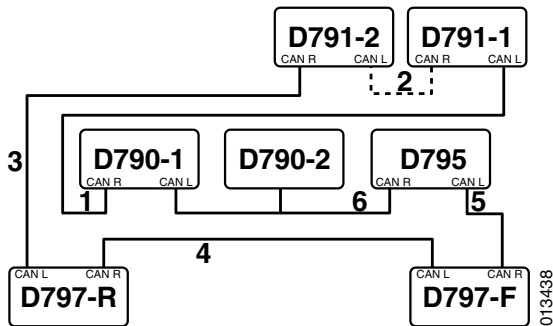
Circuit diagram: Circuit CAN BUS opt. frame KDU group 11.6

Contact:

Function: 11.6.2 Redundant CAN bus

Signal value:

0	No errors.
> 0	X > 0, the number indicates defective segment. Use the circuit diagram to find the defective segment.



013438

Segment numbering with maximum number of control units. Control units marked with dashes are optional.

DIAGNOSIS			
CAN/POWER	LIGHTS	CAB	
CLIMATE	HYD	ENGINE	
TRANSM	BOOM	ATTACH	
OP	EXTRA	RMI	

012083

8.4.2 LIGHTS

LIGHTS, description

This group covers lighting.

Confirm selections with function key for Enter.

DIAG LIGHTS 1(13)			
WORKING LIGHT CAB			
SWITCH			X
OUTPUT	LE	XY	RI XY

000107

8.4.2.1 LIGHTS, menu 1

WORKING LIGHT CAB, SWITCH

Description: Signal from switch, working lights cab roof.

Circuit diagram: Circuit Working 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

WORKING LIGHT CAB, OUTPUT

Description: Voltage feed to working lights cab roof.

Circuit diagram: Circuit Working lights group 9.6

Contact:

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 Working lights cab

Signal value:

01	Normal mode function off. No output signal. It can also be a fault in the circuit as errors can only be detected when the output signal is active.
10	Output signal active, short circuit or open circuit.
11	Normal mode function on. Output signal active, circuit OK.

8.4.2.2 LIGHTS, menu 2

WORKING LIGHT ATTACH, SWITCH

Description: Signal from switch, working lights attachment.

Circuit diagram: Circuit Working 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
OPT OUTPUT (2X)		XY

012084

DIAG LIGHTS		2 (13)
WORKING LIGHT ATTACH		
SWITCH		X
OUTPUT	LE XY RI	XY
OPT OUTPUT (2X)		XY

012084

WORKING LIGHT ATTACH, OUTPUT

Description: Voltage feed to working lights, attachment, feed.

Circuit diagram: Circuit Working lights group 9.6

Contact:

LE: digital out from D791/K1:15 to E404-2L

RI: digital out from D791/K1:1 to E404-2R

Function: 9.6.11 Working lights attachment

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG LIGHTS		2 (13)
WORKING LIGHT ATTACH		
SWITCH		X
OUTPUT	LE XY RI	XY
OPT OUTPUT (2X)		XY

012084

WORKING LIGHT ATTACH, OPT OUTPUT (2X)



Description: Voltage feed to the extra working lights on the attachment.

Circuit diagram: Circuit Extra Wor.li. Att group 9.6

Connection: digital out from D791/K1:42 to E404-4R and E404-4L

Function: 9.6.11 Working lights attachment

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

8.4.2.3 LIGHTS, menu 3

WORKING LIGHT BOOM, SWITCH

Description: Signal from switch, working lights boom.

Circuit diagram: Circuit Working 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.

DIAG LIGHTS		3 (13)
WORKING LIGHT BOOM		
SWITCH		X
OUTPUT	LE XY RI	XY
OPTIONAL OUTPUT		XX

000109

DIAG LIGHTS		3 (13)
WORKING LIGHT BOOM		
SWITCH		X
OUTPUT	LE XY RI	XY
OPTIONAL OUTPUT		XX

000109

WORKING LIGHT BOOM, OUTPUT

Description: Voltage feed to working lights boom.

Circuit diagram: Circuit Working lights group 9.6

Contact:

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 Working light boom

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

WORKING LIGHT BOOM, OPTIONAL OUTPUT



Description: Voltage feed to extra working lights on the boom.

Circuit diagram: Circuit Extra Wor.li. 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 Working light boom

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG LIGHTS		3 (13)
WORKING LIGHT BOOM		
SWITCH		X
OUTPUT	LE XY RI	XY
OPTIONAL OUTPUT		XX

000109

DIAG LIGHTS	4 (13)
MAIN LIGHT SWITCH	X

000110

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:

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

8.4.2.5 LIGHTS, menu 5

PRESENT OUTPUT SIGNAL, SIDE-F

Description: Voltage feed to side lights front.

Circuit diagram: Circuit Lighting group 9.6

Contact:

LE: digital out from D797-F/K1:25 to H416-1

RI: digital out from D797-F/K1:29 to H417-1

Function: 9.6.2 Running lights

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

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

PRESENT OUTPUT SIGNAL, SIDE-R

Description: Voltage feed to side lights rear.

Circuit diagram: Circuit Lighting group 9.6

Contact:

LE: digital out from D797-R/K1:7 to H416-2

RI: digital out from D797-R/K1:9 to H417-2

Function: 9.6.2 Running lights

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

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

PRESENT OUTPUT SIGNAL, REAR

Description: Voltage feed to tail lights.

Circuit diagram: Circuit Lighting group 9.6

Contact:

LE: digital out from D797-R/K1:10 to H412L

RI: digital out from D797-R/K1:25 to H412R

Function: 9.6.3 Tail lights

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG LIGHTS				6 (13)
HEAD LIGHTS				
SWITCH				X
HEAD	LE	XY	RI	XY
DIMMED				XY

000112

DIAG LIGHTS				6 (13)
HEAD LIGHTS				
SWITCH				X
HEAD	LE	XY	RI	XY
DIMMED				XY

000112

8.4.2.6 LIGHTS, menu 6

HEAD LIGHTS, 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.

HEAD LIGHTS, HEAD

Description: Voltage feed to headlights, high beam. If the machine is equipped with extra working lights front then they are connected in parallel with the high beams.

Circuit diagram: Circuit Lighting group 9.6 and Circuit Extra Wor.Li.
Frame group 9.6

Contact:

LE: digital out from D797-F/K1:1 to E402L

RI: digital out from D797-F/K1:15 to E402R

Function: 9.6.1 Headlights

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG LIGHTS		6 (13)
HEAD LIGHTS		
SWITCH		X
HEAD	LE XY RI	XY
DIMMED		XY

000112

HEAD LIGHTS, DIMMED

Description: Voltage feed to headlights, low beam.

Circuit diagram: Circuit Lighting group 9.6

Connection: digital out from D797-F/K1:42 to E400L and E400R

Function: 9.6.1 Headlights

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

8.4.2.7 LIGHTS, menu 7

PRESENT INPUT SIGNAL, HAZARD SWITCH

Description: Signal from switch, flashing hazard lights (Hazard).

Circuit diagram: Circuit Direction indicators, Hazard flashers, group 9.7

Connection: from S109/1 to digital in D790-1/K5:6

Function: 9.7 Signalling system

Signal value:

1	Input signal active.
0	No signal.

PRESENT INPUT SIGNAL, FLASH.SW.

Description: Signal from switch, direction indicators.

Circuit diagram: Circuit Direction indicators, Hazard flashers, group 9.7

Contact:

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.

DIAG LIGHTS		7 (13)
PRESENT INPUT SIGNAL		
HAZARD SWITCH		X
FLASH.SW.	LE X RI	X

000113

DIAG LIGHTS		7 (13)
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	000114
REAR	LE XY RI XY	

8.4.2.8 LIGHTS, menu 8

PRESENT OUTPUT SIGNAL HAZARD/FLASHER, FRONT

Description: Voltage feed to direction indicators front.

Circuit diagram: Circuit Direction indicators, Hazard flashers, group 9.7

Contact:

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 and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

PRESENT OUTPUT SIGNAL HAZARD/FLASHER, REAR

Description: Voltage feed to direction indicators rear.

Circuit diagram: Circuit Direction indicators, Hazard flashers, group 9.7

Contact:

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 and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG LIGHTS		8 (13)
PRESENT OUTPUT SIGNAL		
HAZARD/FLASHER		
FRONT	LE XY RI XY	000114
REAR	LE XY RI XY	

DIAG LIGHTS 9 (13)	
ROTATION BEACON	
SWITCH	X
OUTPUT	XY

000115

DIAG LIGHTS 9 (13)	
ROTATION BEACON	
SWITCH	X
OUTPUT	XY

000115

DIAG LIGHTS 10 (13)	
PRESENT INPUT SIGNAL	
BRAKE LIGHT SWITCH	X
REVERSE LIGHT SIGNAL	X

013260

8.4.2.9 LIGHTS, menu 9

ROTATION BEACON, SWITCH

Description: Signal from switch, revolving 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.

ROTATION BEACON, OUTPUT

Description: Voltage feed to revolving beacon.

Circuit diagram: Circuit Lighting group 9.6

Connection: digital out D790-1/K2:5 to H428

Function: 9.6.8 Revolving beacon

Signal value:

01	Normal mode function off. No output signal. It can also be a fault in the circuit as errors can only be detected when the output signal is active.
10	Output signal active, short circuit or open circuit.
11	Normal mode function on. Output signal active, circuit OK.

8.4.2.10 LIGHTS, menu 10

PRESENT INPUT SIGNAL, BRAKE LIGHT SWITCH

Description: Signal from make-contact (closing switch) 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 (closing switch) brake lights

Signal value:

1	Input signal active.
0	No signal.

DIAG LIGHTS 10 (13)	
PRESENT INPUT SIGNAL	
BRAKE LIGHT SWITCH	X
REVERSE LIGHT SIGNAL	X

013260

PRESENT INPUT SIGNAL, REVERSE LIGHT SIGNAL

Description: Signal from Control unit, transmission (D793) when reverse gear is activated.

Circuit diagram: Circuit Lighting group 9.6

Contact: -

Function: 9.6.5 Back-up lights

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

Contact:

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:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG LIGHTS 11 (13)	
PRESENT OUTPUT SIGNAL	
BRAKE LIGHT LEXY RIXY	
REVERSE LGT LEXY RIXY	
REVERSE ALARM	XY

000117

DIAG LIGHTS	11(13)
PRESENT OUTPUT SIGNAL	
BRAKE LIGHT LEXY RIXY	
REVERSE LGT LEXY RIXY	
REVERSE ALARM XY	

000117

PRESENT OUTPUT SIGNAL, REVERSE LGT

Description: Voltage feed to brake lights.

Circuit diagram: Circuit Lighting group 9.6

Contact:

LE: digital out from D797-R/K1:28 to E405L

RI: digital out from D797-R/K1:42 to E405R

Function: 9.6.5 Back-up lights

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

PRESENT OUTPUT SIGNAL, REVERSE ALARM

Description: Voltage feed to reverse alarm.

Circuit diagram: Circuit Reverse alarm group 9.7

Connection: digital out from D797-R/K1:30 to H965

Function: 9.7.5 Reverse alarm

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

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.

DIAG LIGHTS	11(13)
PRESENT OUTPUT SIGNAL	
BRAKE LIGHT LEXY RIXY	
REVERSE LGT LEXY RIXY	
REVERSE ALARM XY	

000117

DIAG LIGHTS	12(13)
CAB LIGHT	
MANUAL SWITCH X	
DOOR SWITCH X	
OUTPUT XXX	

000118

DIAG LIGHTS 12 (13)	
CAB LIGHT	
MANUAL SWITCH	X
DOOR SWITCH	X
OUTPUT	XXX

000118

CAB LIGHT, DOOR SWITCH

Description: Signal from break contact (opening switch) door.

Circuit diagram: Circuit Lighting group 9.6

Connection: from S266LE/2 or S266RE/2 (connected in parallel) to digital in D790-1/K11:3

Function: 9.10.2 Doors

Signal value:

1	Input signal active.
0	No signal.

CAB LIGHT, OUTPUT

Description: Voltage feed to interior lighting cab.

Circuit diagram: Circuit Sensor Instr. group 9.1

Connection: from D790-1/K11:6 to E434

Function: 9.6.12 Interior lighting cab

Signal value: XXX = 0-255 = 0-24 V (255 means 24 V which corresponds to battery voltage).

DIAG LIGHTS 12 (13)	
CAB LIGHT	
MANUAL SWITCH	X
DOOR SWITCH	X
OUTPUT	XXX

000118

8.4.2.13 LIGHTS, menu 13

SWITCH LIGHTS, OUTPUT

Description: Voltage feed to background lighting in switches, panels and keys.

Circuit diagram: -

Contact: -

Function: 9.6.12 Interior lighting cab

Signal value:

50	Means 4-5 V.
170	Means 15-16 V.

DIAG LIGHTS 13 (13)	
SWITCH LIGHTS	
OUTPUT	XXX

000119

DIAGNOSIS
CAN/POWER LIGHTS CAB
CLIMATE HYD ENGINE
TRANSM BOOM ATTACH
OP EXTRA RMI

012086

DIAG CAB	1 (X)
WASHER	
SWITCH	X
OUTPUT FRONT	XY
OUTPUT REAR/ROOF	XY

012087

DIAG CAB	1 (X)
WASHER	
SWITCH	X
OUTPUT FRONT	XY
OUTPUT REAR/ROOF	XY

012087

8.4.3 CAB

CAB, description

This group covers functions in the cab.

Confirm selections with function key for Enter.

8.4.3.1 CAB, menu 1

WASHER, SWITCH

Description: Signal from gear and multi-function lever switch washer.

Circuit diagram: Circuit Wiper 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, windscreen washing.

Circuit diagram: Circuit Wiper 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:

01	Normal mode function off. No output signal. It can also be a fault in the circuit as errors can only be detected when the output signal is active.
10	Output signal active, short circuit or open circuit.
11	Normal mode function on. Output signal active, circuit OK.

DIAG CAB	1 (X)
WASHER	
SWITCH	X
OUTPUT FRONT	XY
OUTPUT REAR/ROOF	XY

012087

WASHER, OUTPUT REAR/ROOF

Description: Grounding of motor washer roof and rear window.
The motor is supplied with voltage parallel with Motor windscreen washing, activation is controlled by controlling grounding of the motor.
The motor is grounded at windscreen washing if the wiper motor roof or rear window is activated.

Circuit diagram: Circuit Wiper group 9.5

Connection: PWM out D790-1/K5:4 to M651-2

Function: 9.5.4 Washer motor and reservoir

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

8.4.3.2 CAB, menu 2

FRONT WIPER, SWITCH (1-3)

Description: Signal from multi-function lever, switch wiper function.

Circuit diagram: Circuit Wiper group 9.5

Contact:

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.

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

FRONT WIPER, OUTPUT

Description: Voltage feed to wiper front.

Circuit diagram: Circuit Wiper group 9.5

Connection: digital out D790-1/K2:1 to M650-1/53

Function: 9.5.5 Wiper motor front

Signal value:

01	Normal mode function off. No output signal. It can also be a fault in the circuit as errors can only be detected when the output signal is active.
10	Output signal active, short circuit or open circuit.
11	Normal mode function on. Output signal active, circuit OK.

DIAG CAB 2 (10)	
FRONT WIPER	
SWITCH (1-3)	X
OUTPUT	XY
FEEDBACK	X

000122

FRONT WIPER, FEEDBACK

Description: Signal from motor wiper front, indicates when the wiper sweep is completed.

Circuit diagram: Circuit Wiper 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 (home position).

8.4.3.3 CAB, menu 3

REAR WIPER, SWITCH

Description: Status of rear window wiper switch on Control unit KIT (D790-2).

Circuit diagram: -

Contact: -

Function: 9.5 Wiping and cleaning of windows

Signal value:

1	Input signal active. Key for continuous/interval pressed down.
0	No signal.

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

REAR WIPER, OUTPUT

Description: Voltage feed to direction windscreen wiper rear.

Circuit diagram: Circuit Wiper 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	Normal mode function off. No output signal. It can also be a fault in the circuit as errors can only be detected when the output signal is active.
10	Output signal active, short circuit or open circuit.
11	Normal mode function on. Output signal active, circuit OK.

DIAG CAB	3 (10)
REAR WIPER	
SWITCH	X
OUTPUT	XY
FEEDBACK	X

000123

REAR WIPER, FEEDBACK

Description: Signal from motor windscreen wiper rear, indicates when the wiper sweep is completed.

Circuit diagram: Circuit Wiper group 9.5

Connection: 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 (home position).

8.4.3.4 CAB, menu 4

ROOF WIPER, SWITCH

Description: Signal from switch, wiper roof.

Circuit diagram: -

Contact: -

Function: 9.5 Wiping and cleaning of windows

Signal value:

1	Input signal active. Key for continuous/interval pressed down.
0	No signal.

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

ROOF WIPER, OUTPUT

Description: Voltage feed to wiper roof.

Circuit diagram: Circuit Wiper 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 and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG CAB	4 (10)
ROOF WIPER	
SWITCH	X
OUTPUT	XY
FEEDBACK	X

000124

ROOF WIPER, FEEDBACK

Description: Signal from motor wiper roof, indicates when the wiper sweep is completed.

Circuit diagram: Circuit Wiper group 9.5

Connection: 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 (home position).

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 Signalling system

Signal value:

1	Input signal active.
0	No signal.

DIAG CAB	5 (10)
HORN	
SWITCH	X
OUTPUT	XY
SWITCH JOYSTICK	X

013382

DIAG CAB	5 (10)
HORN	
SWITCH	X
OUTPUT	XY
SWITCH JOYSTICK	X

013382

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

Function: 9.7.1 Horn

Signal value:

01	Normal mode function off. No output signal. It can also be a fault in the circuit as errors can only be detected when the output signal is active.
10	Output signal active, short circuit or open circuit.
11	Normal mode function on. Output signal active, circuit OK.

DIAG CAB	5 (10)
HORN	
SWITCH	X
OUTPUT	XY
SWITCH JOYSTICK	X

013382

SWITCH JOYSTICK

Description: Signal from switch, open twistlocks on the control lever. The signal is used to activate the horn when there is no alignment.

Circuit diagram: Circuit Joystick group 7.1

Connection: signal from S815/20 to digital in D790-1/K7:15

Function: 9.7 Signalling system

Signal value:

1	Input signal active.
0	No signal.

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 D790-2/K8:4 to H853/1

Function: 9.3 Seat, 1 Engine, 8.2.1 Overload system

Signal value:

DIAG CAB	6 (10)
BUZZER	XY
SWITCH SEAT	X
ALARM	X
OP	X

000126

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG CAB 6 (10)	
BUZZER	XY
SWITCH SEAT	X
ALARM	X
OP	X

000126

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 system.

Circuit diagram: -

Contact: -

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.

DIAG CAB 6 (10)	
BUZZER	XY
SWITCH SEAT	X
ALARM	X
OP	X

000126

OP

Description: Status for overload warning from the control system.

Circuit diagram: Circuit OP + Scale group 8.2

Contact: -

Function: 8.2.1 Overload system

Signal value:

1	Conditions for activation of buzzer fulfilled, that is, overload system is indicating.
0	Conditions for activation of buzzer are not fulfilled.

DIAG CAB 6 (10)	
BUZZER	XY
SWITCH SEAT	X
ALARM	X
OP	X

000126

8.4.3.7 CAB, menu 7

FUEL, SENSOR VALUE

Description: Signal from sensor fuel level.

Circuit diagram: Circuit Sensor 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 7 (10)	
FUEL	
SENSOR VALUE	XXXOHM
PROC	XXX

000127

FUEL, PROC

Description: The control system's interpretation of the signal from sensor, fuel tank.

Circuit diagram: Circuit Sensor Instr. group 9.1

Contact: -

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 heating.

Circuit diagram: Circuit Cab driver's seat group 9.3

Connection: signal from S143/1 to digital in D790-1/K6:6

Function: 9.3 Seat

Signal value:

1	Input signal active.
0	No signal.

DIAG CAB 8 (10)	
SEAT HEATER	
SWITCH	X
OUTPUT	XY

000128

SEAT HEATER, OUTPUT



Description: Control voltage to seat heating relay.

Circuit diagram: Circuit Cab driver'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 and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG CAB 8 (10)	
SEAT HEATER	
SWITCH	X
OUTPUT	XY

000128

8.4.3.9 CAB, menu 9

NOT USED

This menu is not used.

XXXXXXXX X (X)	
NOT USED	

008793

8.4.3.10 CAB, menu 10

NOT USED

This menu is not used.

XXXXXXX	X (X)
NOT USED	

008793

8.4.4 CLIMATE

CLIMATE, description

This group covers the cab's air conditioning.

Confirm selections with function key for Enter.

DIAGNOSIS
CAN/POWER LIGHTS CAB
CLIMATE HYD ENGINE
TRANSM BOOM ATTACH
OP EXTRA RMI

012088

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 = Preset temperature shown in tenths of degrees and adjusted in increments of half degrees (200 = 20 °C). Test by increasing or decreasing temperature with the temperature switch on the panel.

DIAG CLIMATE	1 (8)
PRESENT INPUT SIGNAL	
REQUIRED TEMP	XXX
PRESENT TEMP	XXX
WATER VALVE FEEDB.	XXX

000132

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).

DIAG CLIMATE	1 (8)
PRESENT INPUT SIGNAL	
REQUIRED TEMP	XXX
PRESENT TEMP	XXX
WATER VALVE FEEDB.	XXX

000132

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.

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

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

8.4.4.2 CLIMATE, menu 2

TEMP COIL

Description: Temperature of the air out from the fan. The sensor is fitted 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 drive-train.

Circuit diagram: Circuit Climate system group 9.4

Connection: from engine via CAN bus, see *PRESENT INPUT SIGNAL*, *COOLANT TEMP*, page 8:62.

Function: 1.7.9 Sensor coolant temperature

Signal value: XXX = Engine temperature in tenths of degrees (200 = 20 °C).

TEMP AMBIENT

Description: Outdoor temperature. Heat radiation from engine and sun may affect the value since the sensor is fitted 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).

DIAG CLIMATE 3 (X)	
PRESENT INPUT SIGNAL	
PRESSURE SWITCH	X
OPT DOOR SWITCH	X

006865

DIAG CLIMATE 3 (X)	
PRESENT INPUT SIGNAL	
PRESSURE SWITCH	X
OPT DOOR SWITCH	X

006865

DIAG CLIMATE 4 (8)	
PRESENT INPUT SIGNAL	
WATER VALVE	XX.XXV
DRAUGHT VALVE	XX.XXV

000135

DIAG CLIMATE 4 (8)	
PRESENT INPUT SIGNAL	
WATER VALVE	XX.XXV
DRAUGHT VALVE	XX.XXV

000135

8.4.4.3 CLIMATE, menu 3

PRESENT INPUT SIGNAL, PRESSURE SWITCH

Description: Signal from refrigerant pressure switch.

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 switch

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 of automatic shutdown of AC with open door this signal is used to control the shutdown.

Circuit diagram: Circuit Lighting group 9.6

Connection: signal 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.

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. The voltage is a measure of the damper'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

DIAG CLIMATE	5 (8)
PRESENT INPUT SIGNAL	
REQUIRED TEMP	XX.XXV
REQ. DRAUGHT	XX.XXV
REQ. FAN SPEED	XX.XXV

000136

DIAG CLIMATE	5 (8)
PRESENT INPUT SIGNAL	
REQUIRED TEMP	XX.XXV
REQ. DRAUGHT	XX.XXV
REQ. FAN SPEED	XX.XXV

000136

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
RECIRKULATION	XY
COMPRESSOR	XY

000137

8.4.4.5 CLIMATE, menu 5

PRESENT INPUT SIGNAL, REQUIRED TEMP

Description: Signal from switch, temperature. Voltage when the switch is pressed in the 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 windscreen (up) or floor (down). The damper's position changes in steps between windscreen - 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 adjustable steplessly. 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 air conditioning

Signal value: XX.XXV ~ 2.4 / 0 / 5.0 V = Increase / - / decrease.

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).

DIAG CLIMATE 6 (8)	
PRESENT OUTPUT SIGNAL	
FAN SPEED	XXX
RECIRKULATION	XY
COMPRESSOR	XY

000137

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	Normal mode function off. No output signal. It can also be a fault in the circuit as errors can only be detected when the output signal is active.
10	Output signal active, short circuit or open circuit.
11	Normal mode function on. Output signal active, circuit OK.

PRESENT OUTPUT SIGNAL, COMPRESSOR

Description: Voltage feed of AC compressor's electromagnetic clutch. Controls cut-in and cut-out of the compressor. Two outputs are connected in parallel to handle the current intensity.

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 and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG CLIMATE 6 (8)	
PRESENT OUTPUT SIGNAL	
FAN SPEED	XXX
RECIRKULATION	XY
COMPRESSOR	XY

000137

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 air conditioning's software depending on desired temperature, outside temp. cab temperature and coolant temperature, so it may be difficult to determine whether the valve is working as it should.

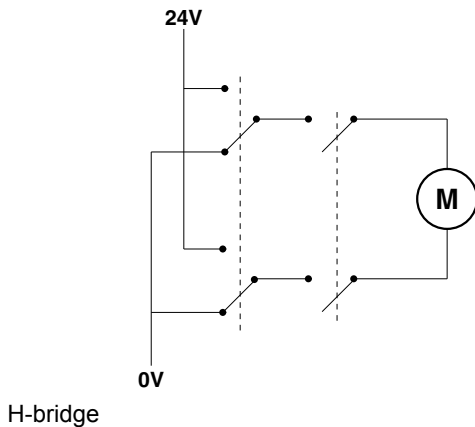
Circuit diagram: Circuit Climate system group 9.4

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

DIAG CLIMATE	7 (8)
OUTPUT WATER VALVE	
CLOCKWISE	XY XY
ANTI-CLOCKWISE	XY XY



00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

OUTPUT WATER VALVE, ANTI-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 air conditioning's software depending on desired temperature, outside temp. cab temperature and coolant temperature, so it may be difficult to determine whether the valve is working as it should.

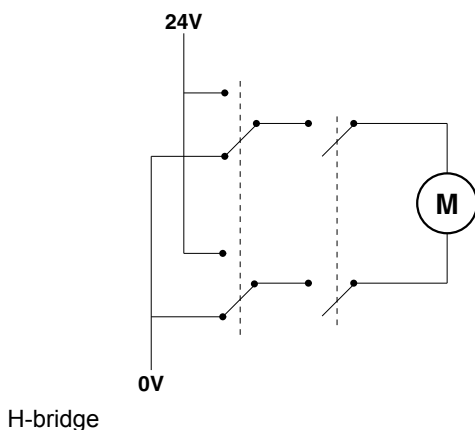
Circuit diagram: Circuit Climate system group 9.4

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

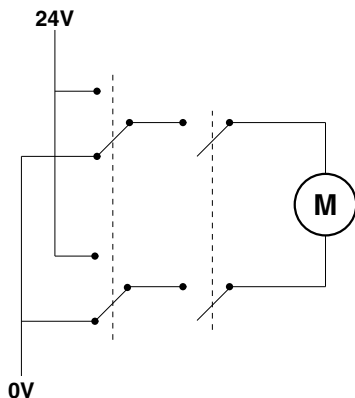
Signal value: motor runs anticlockwise row 1: 00 11, row 2: 11 11

DIAG CLIMATE	7 (8)
OUTPUT WATER VALVE	
CLOCKWISE	XY XY
ANTI-CLOCKWISE	XY XY



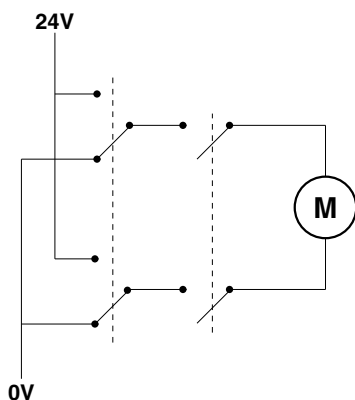
00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

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

DIAGNOSIS
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009272

8.4.4.8 CLIMATE, menu 8

OUTPUT DRAUGHT VALVE, CLOCKWISE

Description: Voltage feed to the motor for the air distributor, rotation clockwise. Is connected to an H-bridge. The 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 and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

OUTPUT DRAUGHT VALVE, ANTI-CLOCKWISE

Description: Voltage feed to the motor for the air distributor, rotation anticlockwise. The motor is connected to an H-bridge. The 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 anticlockwise row 1: 00 11, row 2: 11 11

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

8.4.5 HYD

HYD, description

This group covers the hydraulic functions.

Confirm selections with function key for Enter.

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

DIAG HYD	2 (6)
BRAKE COOLANT OIL	
TEMP	XXX
FAN	XY

000142

8.4.5.1 HYD, menu 1

HYDRAULIC OIL, TEMP

Description: Signal from sensor hydraulic oil temperature.

Circuit diagram: Circuit Hydraulics group 10.0

Connection: signal from B776/1 for 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: Circuit Hydraulics group 10.0

Connection: digital out from D797-R/K1:14 to M668/1

Function: 10.6.4 Cooling fan

Signal value:

01	Normal mode function off. No output signal. It can also be a fault in the circuit as errors can only be detected when the output signal is active.
10	Output signal active, short circuit or open circuit.
11	Normal mode function on. Output signal active, circuit OK.

8.4.5.2 HYD, menu 2

BRAKE COOLANT OIL, TEMP

Description: Signal from sensor for oil temperature, brake system.

Circuit diagram: Circuit Brake system group 4.0

Connection: signal from B762/1 for input D797-F/K2:13

Function: 4.8.10 Sensor oil temperature, brake system

Signal value: XXX = Temperature in tenths of degrees (200 = 20 °C).

BRAKE COOLANT OIL, FAN

Description: Voltage feed to cooling fan for brake system 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	Normal mode function off. No output signal. It can also be a fault in the circuit as errors can only be detected when the output signal is active.
10	Output signal active, short circuit or open circuit.
11	Normal mode function on. 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 8:91.

Circuit diagram: Circuit OP + Scale group 8.2

Contact: See *PRESENT INPUT SIGNAL LIFT CYL LE RI, C-*, page 8:92

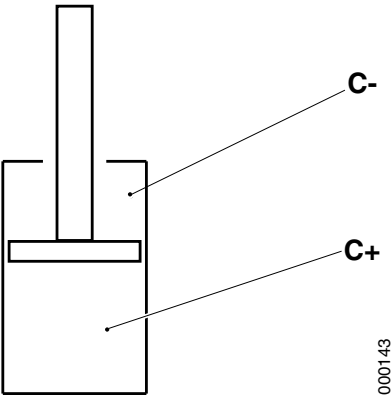
Function: 8.2.1 Overload system

Signal value: XXX = 0-250 = Hydraulic pressure 0 - 25 MPa. (255 = incorrect signal.)

NOTE

The sensors can be quickly tested by lifting max. and running the lifting function against end-position (overflow). All 4 sensors (C+ and C-) will then show the same pressure ±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 the lift cylinders' piston side (C+). For voltage value, see *OP, description*, page 8:91. The sensor on the right-hand lift cylinder is optional

Circuit diagram: Circuit OP + Scale group 8.2

Contact: See *PRESENT INPUT SIGNAL LIFT CYL LE RI, C+*, page 8:92

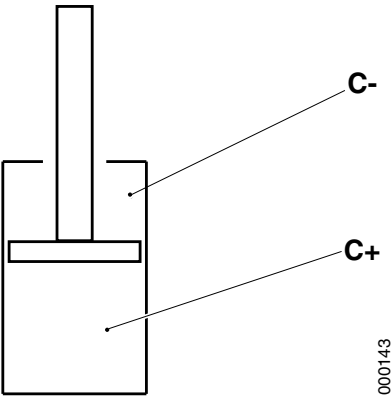
Function: 8.2.1 Overload system

Signal value: XXX = 0-250 = Hydraulic pressure 0 - 25 MPa. (255 = incorrect signal.)

NOTE

The sensors can be quickly tested by lifting max. and running the lifting function against end-position (overflow). All 4 sensors (C+ and C-) will then show the same pressure ±0.1 MPa.

DIAG HYD			3 (6)
PRESSURE LIFTING CYL			
	Le	Ri	
C-	XXX	XXX	
C+	XXX	XXX	



000143

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

012403

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

012403

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

012403

DIAG HYDRAULIC	5 (X)
P-BRAKE	
SWITCH	X/Y
FEEDBACK SWITCH	X
VALVE	XY

012404

8.4.5.4 HYD, menu 4

PRESSURE SWITCHES, BRAKE PRESSURE

Description: Signal from break contact (opening switch) for oil pressure, brake system.

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 (opening switch) oil pressure, brake system

Signal value:

1	Input signal active.
0	No signal.

PRESSURE SWITCHES, BRAKE LIGHT PRESS.

Description: Signal from make-contact (closing switch) brake lights.

Circuit diagram: Circuit Lighting group 9.6

Connection: from S216/2 to analogue in D797-F/K1:13

Function: 4.3.8 Make-contact (closing switch) brake lights

Signal value:

1	Input signal active.
0	No signal.

PRESSURE SWITCHES, DECLUTCH PRESSURE

Description: Signal from make-contact (closing switch) declutch.

Circuit diagram: Circuit Drive-train group 2.1

Connection: from S220-2/2 to analogue in D797-F/K1:41

Function: 2.8.2 Make-contact (closing switch), 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.

DIAG HYDRAULIC		5 (X)
P-BRAKE		
SWITCH	X/Y	
FEEDBACK SWITCH	X	
VALVE	XY	

012404

DIAG HYDRAULIC		5 (X)
P-BRAKE		
SWITCH	X/Y	
FEEDBACK SWITCH	X	
VALVE	XY	

012404

DIAG HYD		6 (6)
PRESENT OUTPUT SIGNAL		
PRESSURE TO ATTACHM.		
VALVE	XY	

000146

P-BRAKE, FEEDBACK SWITCH

Description: Signal from break contact (opening switch) parking brake.

Circuit diagram: Circuit Brake system group 4.0

Connection: signal from S200/2 analogue in D797-F/K1:27

Function: 4.5.5 Break contact (opening switch), parking brake

Signal value:

1	Input signal active.
0	No signal.

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 and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

8.4.5.6 HYD, menu 6

PRESENT OUTPUT SIGNAL, PRESSURE TO ATTACHM. VALVE

Description: Voltage feed to Solenoid valve, engagement of hydraulics for top lift.

Circuit diagram: Circuit Rotation, group 7.6

Connection: digital out D797-R/K1:31 to Y6003/1

Function: 7.4 Side shift, 7.5 Spreading, 7.6 Rotation, 7.7 Tilt, 7.8 Levelling 7.9.1 Twistlock, 7.9.2 Lifting jacks, 10.5.7 Valve block servo pressure

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

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012093

DIAG ENGINE	1 (X)
PRESENT INPUT SIGNAL	
ACCELERATOR	X.XXV
REQUIRED SPD PROC	XXX
REQUIRED SPD RPM	XXXX

006866

DIAG ENGINE	1 (X)
PRESENT INPUT SIGNAL	
ACCELERATOR	X.XXV
REQUIRED SPD PROC	XXX
REQUIRED SPD RPM	XXXX

006866

DIAG ENGINE	1 (X)
PRESENT INPUT SIGNAL	
ACCELERATOR	X.XXV
REQUIRED SPD PROC	XXX
REQUIRED SPD RPM	XXXX

006866

DIAG ENGINE	2 (X)
PRESENT INPUT SIGNAL	
ENGINE SPEED EDC	XXXX

014149

8.4.6 ENGINE

ENGINE, description

This group covers engine functions.

Confirm selections with function key for Enter.

8.4.6.1 ENGINE, menu 1

PRESENT INPUT SIGNAL, ACCELERATOR

Description: Signal from accelerator pedal.

Circuit diagram: Circuit Drive-train 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 percent) which is sent from Control unit, cab (D790-1) to Control unit, engine (D794) via CAN bus drive-train.

Circuit diagram: -

Contact: -

Function: 1.9 Control system, engine

Signal value: XXXX = 0-100%

PRESENT INPUT SIGNAL, REQUIRED SPD TCU

Description: Required engine speed in rpm which is sent from Control unit, transmission (D793) to Control unit, engine (D794) via CAN bus drive-train.

Circuit diagram: -

Contact: -

Function: 1.9 Control 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 drive-train. Actual value for engine speed.

Circuit diagram: -

Contact: -

Function: 1.9.2 Sensor engine rpm

Signal value: XXXX = Active speed in rpm.

DIAG ENGINE	3 (X)
PRESENT INPUT SIGNAL	
PRESENT TORQUE	XXX

014150

8.4.6.3 ENGINE, menu 3

PRESENT INPUT SIGNAL, PRESENT TORQUE

Description: Actual torque from Control unit, engine (D794).
 Percentage torque use of engine's capacity.

Circuit diagram: -

Contact: -

Function: 1.9 Control system, engine

Signal value: XXX = 0-100%

8.4.6.4 ENGINE, menu 4

PRESENT INPUT SIGNAL, PREHEAT SWITCH

This menu row is not used

DIAG ENGINE	4 (X)
PRESENT INPUT SIGNAL	
PREHEAT SWITCH	X
CRANK ENGINE SWITCH	X
D+	X

009282

DIAG ENGINE	4 (X)
PRESENT INPUT SIGNAL	
PREHEAT SWITCH	X
CRANK ENGINE SWITCH	X
D+	X

009282

PRESENT INPUT SIGNAL, CRANK ENGINE SWITCH

Description: Signal from ignition key lock, start position.

Circuit diagram: Circuit 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.

PRESENT INPUT SIGNAL, D+

Description: Signal from alternator, indicates if alternator supplies current.

Circuit diagram: Circuit 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.

DIAG ENGINE	4 (X)
PRESENT INPUT SIGNAL	
PREHEAT SWITCH	X
CRANK ENGINE SWITCH	X
D+	X

009282

DIAG ENGINE	5 (X)
PRESENT OUTPUT SIGNAL	
PREHEAT	X
CRANK ENGINE	X

009283

DIAG ENGINE	5 (X)
PRESENT OUTPUT SIGNAL	
PREHEAT	X
CRANK ENGINE	X

009283

DIAG ENGINE	5 (X)
PRESENT OUTPUT SIGNAL	
PREHEAT	X
CRANK ENGINE	X

009283

8.4.6.5 ENGINE, menu 5

PRESENT OUTPUT SIGNAL, PREHEAT

Description: Status for preheating of induction air. Only used on machines with engine alternative Yuchai YC6M360-30.

Circuit diagram: -

Connection: controlled by engine's control system

Function: 1.10.1 Preheating

Signal value:

1	Output signal active.
0	No output signal.

PRESENT OUTPUT SIGNAL, CRANK ENGINE

Description: Status for Voltage feed starter motor. Only used on machines with engine alternative Yuchai YC6M360-30.

Circuit diagram: Circuit Power group 11.5

Connection: digital out D797-R/K1:36 to K360/86

Function: 1.11 Start and stop

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

PRESENT OUTPUT SIGNAL, CRANK ENGINE WIRE



Description: Control current to relay starter motor (K360). Only used on machines with engine alternative Cummins QSM11.

Circuit diagram: Circuit engine Cummins group 1.0, Circuit Drive-train group 2.1

Connection: digital out D797-R/K1:12 to K360/86

Function: 1.11 Start and stop

Signal value:

01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit or open circuit.
11	Normal mode function on. Output signal active, circuit OK.

DIAG ENGINE	6 (10)
PRESENT INPUT SIGNAL	
OIL PRESSURE	XXX
BOOST PRESSURE	XXX

000153

DIAG ENGINE	6 (10)
PRESENT INPUT SIGNAL	
OIL PRESSURE	XXX
BOOST PRESSURE	XXX

000153

DIAG ENGINE	7 (X)
PRESENT INPUT SIGNAL	
OIL TEMP	XXX
COOLANT TEMP	XXX
INTAKE MAIN.TEMP	XXX

009284

DIAG ENGINE	7 (X)
PRESENT INPUT SIGNAL	
OIL TEMP	XXX
COOLANT TEMP	XXX
INTAKE MAIN.TEMP	XXX

009284

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*

Contact:

Cummins QSM11 (+): signal from "Oil pressure/temperature sensor" to Control unit, engine (D794) "Sensor connector" sleeve 44

Yuchai YC6M360-30: -

Function: 1.8 Lubrication system

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). Only used on machines with engine alternative Cummins QSM11.

Circuit diagram: see *supplier documentation, engine*

Connection: signal from "Intake manifold (Boost) pressure sensor" to Control unit, engine (D794) "Sensor connector" sleeve 39

Function: 1.6 Air intake and exhaust outlet

Signal value: XXX = 10 corresponds to 100 kPa.

8.4.6.7 ENGINE, menu 7

PRESENT INPUT SIGNAL, OIL TEMP

Description: Engine oil temperature. CAN bus message from Control unit, engine (D794) to Control unit, cab (D790-1).

Circuit diagram: see *supplier documentation, engine*

Contact:

Cummins QSM11 (+): signal from "Oil pressure/temperature sensor" sleeve 4 to Control unit, engine (D794) "Sensor connector" sleeve 42

Yuchai YC6M360-30: -

Function: 1.8 Lubrication system

Signal value: XXX = 200 corresponds to 20 °C.

PRESENT INPUT SIGNAL, COOLANT TEMP

Description: Coolant temperature. CAN bus message from Control unit, engine (D794) to Control unit, cab (D790-1).

Circuit diagram: see *supplier documentation, engine*

Contact:

Cummins QSM11 (+): signal from "Coolant temperature sensor" to Control unit, engine (D794) "Sensor connector" sleeve 02

Yuchai YC6M360-30: -

Function: 1.7 Cooling system

Signal value: XXX = 200 corresponds to 20 °C.

DIAG ENGINE	7 (X)
PRESENT INPUT SIGNAL	
OIL TEMP	XXX
COOLANT TEMP	XXX
INTAKE MAIN.TEMP	XXX

009284

PRESENT INPUT SIGNAL, INTAKE MAIN.TEMP

Description: Charge air temperature. CAN bus message from Control unit, engine (D794) to Control unit, cab (D790-1).

Circuit diagram: see *supplier documentation, engine*

Contact:

Cummins QSM11 (+): signal from "Intake manifold /(Boost) temperature sensor" to Control unit, engine (D794) "Sensor connector" sleeve 38

Yuchai YC6M360-30: -

Function: 1.6 Air intake and exhaust outlet

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: -

Contact: -

Function: 1.9 Control system

Signal value: XX = number of active error codes.

DIAG ENGINE	8 (X)
PRESENT EDC ERROR	
NR OF ACT ERROR	XX
SPN	XXXX
FMI	XX

009279

PRESENT EDC ERROR, SPN

Description: SPN number for the first error code from Control unit, engine (D794). SPN indicates the malfunction area, i.e. what component or signal is defective. Error codes are shown with SPN/FMI in the error code menus.

Circuit diagram: -

Contact: -

Function: 8.3 Error codes

Signal value: XXXX = error code number. Use the error code list; see section *D Error codes*.

DIAG ENGINE	8 (X)
PRESENT EDC ERROR	
NR OF ACT ERROR	XX
SPN	XXXX
FMI	XX

009279

PRESENT EDC ERROR, FMI

Description: FMI number for the first error code from the Control unit, engine (D794). FMI indicates error type, e.g. short circuit or low value. Error codes are shown with SPN/FMI in the error code menus.

Circuit diagram: -

Contact: -

Function: 8.3 Error codes

Signal value: XX = fault type number. Use the error code list; see section *D Error codes*.

DIAG ENGINE	8 (X)
PRESENT EDC ERROR	
NR OF ACT ERROR	XX
SPN	XXXX
FMI	XX

009279

DIAG ENGINE	9 (X)
FUEL CONSUMPTION MOMENTARILY l/h	XXX

009280

DIAG ENGINE	10 (X)
PRESENT INPUT SIGNAL	
PRE-HEAT FEEDBACK	X
WATER IN FUEL SW.	X
COOLANT LEVEL SW.	X

013919

DIAG ENGINE	10 (X)
PRESENT INPUT SIGNAL	
PRE-HEAT FEEDBACK	X
WATER IN FUEL SW.	X
COOLANT LEVEL SW.	X

013919

DIAG ENGINE	10 (X)
PRESENT INPUT SIGNAL	
PRE-HEAT FEEDBACK	X
WATER IN FUEL SW.	X
COOLANT LEVEL SW.	X

013919

8.4.6.9 ENGINE, menu 9**FUEL CONSUMPTION, MOMENTARILY l/h**

Description: Current fuel consumption in litres/hour.

Circuit diagram: -

Contact: -

Function: 1.2 Fuel system

Signal value: XXX = fuel consumption in l/h.

8.4.6.10 ENGINE, menu 10**PRESENT INPUT SIGNAL, PRE-HEAT FEEDBACK**

Description: Signal from Control unit, engine (D794) which indicates that preheating is active. Only used on machines with engine alternative Yuchai YC6M360-30.

Circuit diagram: Circuit diagram Drive-train Camry

Connection: signal from D794/1:38 to D797-F/K1:26

Function: 1.6 Air intake and exhaust outlet

Signal value:

1	No signal
0	Input signal active. (Indication that preheating is activated by Control unit, engine (D794) is active.)

PRESENT INPUT SIGNAL, WATER IN FUEL SW.

Description: Signal from Control unit, engine (D794) which indicates that there is too much water in the fuel filter. Only used on machines with engine alternative Yuchai YC6M360-30.

Circuit diagram: Circuit diagram Drive-train Camry

Connection: signal from D794/1:39 to D797-F/K1:40

Function: 1.2 Fuel system

Signal value:

1	No signal
0	Input signal active. (Indication that preheating is activated by Control unit, engine (D794) is active.)

PRESENT INPUT SIGNAL, COOLANT LEVEL SW.

Description: Signal from Control unit, engine (D794) which indicates that the coolant level is low. Only used on machines with engine alternative Yuchai YC6M360-30.

Circuit diagram: Circuit diagram Drive-train Camry

Connection: signal from B759/2 to D797-F/K1:11

Function: 1.7 Cooling system

Signal value:

1	No signal
0	Input signal active. (Indication that preheating is activated by Control unit, engine (D794) is active.)

DIAGNOSIS
CAN/POWER LIGHTS CAB
CLIMATE HYD ENGINE
TRANSM BOOM ATTACH
OP EXTRA RMI

009274

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

DIAG TRANSM.	1 (15)
PRESENT INPUT SIGNAL	
BRAKE PEDAL	X.XXV
DECLUTCH SWITCH	X
DECLUTCH PRESS SW.	X

000159

8.4.7 TRANSM

TRANSM, description

This group covers the transmission function.

Confirm selections with function key for Enter.

8.4.7.1 TRANSM, menu 1

PRESENT INPUT SIGNAL, BRAKE PEDAL

Description: Not used.

Circuit diagram: Circuit Drive-train group 2.1

Connection: signal from B697/3 to analogue in on D790-1/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 Drive-train 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 depressed.
0	No signal.

PRESENT INPUT SIGNAL, DECLUTCH PRESS SW.

Description: Signal from make-contact (closing switch) declutch (pressure switch).

Circuit diagram: Circuit Drive-train group 2.1

Connection: signal from S220-2/2 to digital in D797-F/K1:41

Function: 2.8.2 Make-contact (closing switch), declutch

Signal value:

1	Input signal active.
0	No signal.

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

000161

8.4.7.2 TRANSM, menu 2

SWITCHES, FORWARD

Description: Signal from gear and multi-function lever (forward).

Circuit diagram: Circuit Drive-train 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 Drive-train group 2.1

Connection: 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). The switches are integrated in Control unit KIT (D790-2).

Circuit diagram: -

Contact: -

Function: 2 Transmission

Signal value:

1	Shifting program 1 selected.
2	Shifting program 2 selected.
4	Automatic shifting selected.

8.4.7.3 TRANSM, menu 3

PRESENT VALUE, FORWARD

Description: Status for forward direction of travel from Control unit, transmission (D793). Indicates if forward drive is activated in the transmission.

Circuit diagram: -

Contact: -

Function: 2.8 Control system, transmission

Signal value:

1	Output signal for travel direction forward active.
0	No output signal.

DIAG TRANSM.	3 (15)
PRESENT VALUE	
FORWARD	X
REVERSE	X
GEAR	X

000161

PRESENT VALUE, REVERSE

Description: Status for rearward direction of travel from Control unit, transmission (D793). Indicates if rearward drive is activated in the transmission.

Circuit diagram: -

Contact: -

Function: 2.8 Control system, transmission

Signal value:

1	Output signal for travel direction reverse active.
0	No output signal.

DIAG TRANSM.	3 (15)
PRESENT VALUE	
FORWARD	X
REVERSE	X
GEAR	X

000161

PRESENT VALUE, GEAR

Description: Current gear, status from Control unit, transmission (D793). Shows which gear is activated in the transmission.

Circuit diagram: -

Function: 2.8 Control system, transmission

Contact: -

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: -

Contact: -

Function: 2.8 Control system, transmission

Signal value:

1	Automatic.
0	Manual.

DIAG TRANSM.	4 (15)
OPERATING STATE	
AUT/MAN MODE	X
WARNING	X
OPERATING MODE	X

000162

OPERATING STATE, WARNING

Description: Warning for serious malfunction in transmission from Control unit, transmission (D793).

Circuit diagram: -

Contact: -

Function: 2.8 Control system, transmission

Signal value:

1	Active error.
0	No errors.

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

OPERATING STATE, OPERATING MODE

Description: Operating mode status for Control unit, transmission (D793), also shown in control unit display.

Circuit diagram: -

Contact: -

Function: 2.8 Control 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: -

Contact: -

Function: 2.8 Control 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

OPERATING STATE, FAULT

Description: Status for transmission's function during operation, active error codes present.

Circuit diagram: -

Contact: -

Function: 2.8 Control system, transmission

Signal value:

1	Active error code.
0	No error codes.

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, OLD FAULT

Description: Status for transmission's function during operation, there are inactive error codes that have not been acknowledged.

Circuit diagram: -

Contact: -

Function: 2.8 Control 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

NOT USED

This menu is not used.

XXXXXXXX X (X)	
NOT USED	

008793

8.4.7.7 TRANSM, menu 7

NOT USED

This menu is not used.

XXXXXXXX X (X)	
NOT USED	

008793

8.4.7.8 TRANSM, menu 8

NOT USED

This menu is not used.

XXXXXXXX X (X)	
NOT USED	

008793

8.4.7.9 TRANSM, menu 9

NOT USED

This menu is not used.

XXXXXXXX X (X)	
NOT USED	

008793

8.4.7.10 TRANSM, menu 10**NOT USED**

This menu is not used.

XXXXXXXX	X (X)
NOT USED	

008793

8.4.7.11 TRANSM, menu 11**NOT USED**

This menu is not used.

XXXXXXXX	X (X)
NOT USED	

008793

8.4.7.12 TRANSM, menu 12**NOT USED**

This menu is not used.

DIAG TRANSM.	12 (X)
NOT USED	

006872

8.4.7.13 TRANSM, menu 13**ACT ERROR AREA**

Description: Indicates malfunction area active error, first part of the error code. In the event of several error codes, the most serious error code is shown.

Circuit diagram: -

Contact: -

Function: 2.8 Control system, transmission

Signal value: XXX = First part of error code; see section *D Error codes*.

TYPE

Description: Indicates type of active error.

Circuit diagram: -

Contact: -

Function: 2.8 Control 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.	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)
MANUAL GEAR SHIFT	
GEAR (+/-)	X

014102

NUMBER OF OCCU.

Description: Number of times active errors have occurred.

Circuit diagram: -

Contact: -

Function: 2.8 Control system, transmission

Signal value: XXXXX = Number of times active errors have occurred.

TIME AGO

Description: When latest active error occurred.

Circuit diagram: -

Contact: -

Function: 2.8 Control system, transmission

Signal value: XXXXX = Operating time in hours since latest error.

8.4.7.14 TRANSM, menu 14

MANUAL GEAR SHIFT, GEAR

Description: Manual control of the transmission with the plus and minus keys. The menu can be used to rule out mechanical malfunctions in the transmission's gear control.

Circuit diagram: -

Contact: -

Function: 2.8 Control system, transmission

Signal value: X = Selected gear.

DIAGNOSIS
CAN/POWER LIGHTS CAB
CLIMATE HYD ENGINE
TRANSM BOOM ATTACH
OP EXTRA RMI

009275

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 XY	
RELIEVE PRESS. IN XY	

012097

8.4.8 BOOM

BOOM, description

This group covers the boom functions.

Confirm selections 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, lower.

Circuit diagram: Circuit Boom up/down group 7.2

Contact:

LE: digital out from D797-F/K1:30 to H6002/1

RI: digital out from D797-F/K1:31 to H6001/1

Function: 7.2.7 Valve block lift cylinder

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG BOOM	2 (8)
BLOCK VALVES	
UP/DOWN LE XY RI XY	
IN XY	
RELIEVE PRESS. IN XY	

012097

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 B6050/1

Function: 7.3.7 Valve block extension cylinder

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

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 B6062/1

Function: 7.3.9 Valve block pump unloading.

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG BOOM	2 (8)
BLOCK VALVES	
UP/DOWN LE XY RI XY	
IN XY	
RELIEVE PRESS. IN XY	

012097

DIAG BOOM		3 (8)
BOOM HIGH SPEED		
UP	LE XY RI	XY
OUT		XY

000177

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

Contact:

LE: digital out from D797-F/K1:33 to H6052/1

RI: digital out from D797-F/K1:32 to H6051/1

Function: 7.2.7 Valve block lift cylinder

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG BOOM		3 (8)
BOOM HIGH SPEED		
UP	LE XY RI	XY
OUT		XY

000177

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 B6046/1

Function: 7.3.7 Valve block extension cylinder

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG BOOM	4 (8)
OUTPUT BOOM UP	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000178

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:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG BOOM	4 (8)
OUTPUT BOOM UP	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000178

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 controlling solenoid valve.

DIAG BOOM	4 (8)
OUTPUT BOOM UP	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000178

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.

DIAG BOOM	5 (8)
OUTPUT BOOM DOWN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000179

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:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

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 controlling solenoid valve.

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 actual 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.

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

DIAG BOOM	6 (8)
OUTPUT BOOM IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000180

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:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG BOOM	6 (8)
OUTPUT BOOM IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000180

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 controlling solenoid valve.

DIAG BOOM	6 (8)
OUTPUT BOOM IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000180

OUTPUT BOOM IN, FEEDBACK

Description: Present 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 actual 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

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:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

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 controlling 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 actual 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.

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

DIAG BOOM	8 (8)
PRESENT INPUT SIGNAL	
BOOM LOW SPEED	
UP/DOWN	X
IN/OUT	X/X

000182

DIAGNOSIS
CAN/POWER LIGHTS CAB
CLIMATE HYD ENGINE
TRANSM BOOM ATTACH
OP EXTRA RMI

009276

DIAG ATTACHMENT	1 (21)
PRESENT INPUT SIGNALS	
ROT CW/CCW	XX.XXV
TILT IN/OUT	XX.XXV

000184

8.4.8.8 BOOM, menu 8

PRESENT INPUT SIGNAL BOOM LOW SPEED, UP/DOWN

Description: Status signal from sensor boom angle, which indicates when the signal matches values to activate damping during lifting/lowering.

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.

PRESENT INPUT SIGNAL BOOM LOW SPEED, IN/OUT

Description: Status signal from sensor boom length, which indicates when the signal matches values to activate damping during extension.

Circuit diagram: Circuit Boom in/out group 7.3 (Mechanical overload system)

Contact: Analogue signal in from B777/3 to analogue in D797-R/K1:22

Function: 7.3.11 Sensor, boom length

Signal value:

1	Input signal active.
0	No signal.

8.4.9 ATTACH

ATTACH, description

This group covers attachment functions.

Confirm selections with function key for Enter.

8.4.9.1 ATTACH, menu 1

PRESENT INPUT SIGNALS, ROT CW/CCW

Description: Signals from control lever for rotating the 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

PRESENT INPUT SIGNALS, TILT IN/OUT

This menu row is not used.

8.4.9.2 ATTACH, menu 2

PRESENT INPUT SIGNALS, SIDE SHIFT

Description: Signals from control lever for side shift of attachment. If the pistol trigger is depressed at the same time as side shift then spreading is activated. Text in brackets describes spreading.

Circuit diagram: Circuit Joystick group 7.1

Contact:

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 Side shift

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

000185

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 Synchronised 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

000185

PRESENT INPUT SIGNALS, 30/35 STOP

This menu row is not used.

DIAG ATTACHMENT 2(21)	
PRESENT INPUT SIGNALS	
SIDE SHIFT LE X RI X	
PISTOL	X
30/35 STOP	X

000185

DIAG ATTACHMENT 3 (21)	
PRESENT INPUT SIGNALS	
LOCK TW	X
UNLOCK TW	X
BY-PASS HEIGHT	X

000186

8.4.9.3 ATTACH, menu 3

PRESENT INPUT SIGNALS, LOCK TW

Description: Signal from switch, lock twistlock.

Circuit diagram: Circuit Twistlock group 7.9

Connection: from S1003/7 and S1007/2 to digital in D790-1/K8:12

Function: 7.9.1 Twistlocks

Signal value:

1	Input signal active.
0	No signal.

PRESENT INPUT SIGNALS, UNLOCK TW

Description: Signal from control lever to unlock twistlock.

Circuit diagram: Circuit Joystick group 7.1

Contact: from 815/20 to digital input 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

PRESENT INPUT SIGNALS, BY-PASS HEIGHT

This menu row is not used

DIAG ATTACHMENT 3 (21)	
PRESENT INPUT SIGNALS	
LOCK TW	X
UNLOCK TW	X
BY-PASS HEIGHT	X

000186

8.4.9.4 ATTACH, menu 4

NOT USED

This menu is not used.

XXXXXXXX X (X)	
NOT USED	

008793

DIAG ATTACHMENT 5 (X)		
PRESENT INPUT SIGNALS		
LOW SPEED 20/40		X
30/35 STOP		X

012122

DIAG ATTACHMENT 5 (X)		
PRESENT INPUT SIGNALS		
LOW SPEED 20/40		X
30/35 STOP		X

012122

DIAG ATTACHMENT 6 (21)			
PRESENT INPUT SIGNALS			
ALIGNMENT	LE	RI	
FRONT	X	X	
REAR	X	X	

000202

DIAG ATTACHMENT 6 (21)			
PRESENT INPUT SIGNALS			
ALIGNMENT	LE	RI	
FRONT	X	X	
REAR	X	X	

000202

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: Circuit Spreading Sensor 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.

PRESENT INPUT SIGNALS, 30/35 STOP

This menu row is not used.

8.4.9.6 ATTACH, menu 6

PRESENT INPUT SIGNALS ALIGNMENT, FRONT

Description: Signals from sensors, alignment, right front and left front.

Circuit diagram: Circuit Twistlock group 7.9

Contact:

LE: signal from B7202L/C to analogue in (used as digital)
D791-1/K1:13

RI: signal from B7202R/C to digital input D791-1/K1:40

Function: 7.9.1.8 Sensor, alignment

Signal value:

1	Input signal active.
0	No signal.

PRESENT INPUT SIGNALS ALIGNMENT, REAR

Description: Signals from sensors, alignment, right rear and left rear.

Circuit diagram: Circuit Twistlock group 7.9

Contact:

LE: signal from B7203L/C to analogue in (used as digital)
D791-1/K1:27

RI: signal from B7203R/C to digital input D791-1/K1:26

Function: 7.9.1.8 Sensor, alignment

Signal value:

1	Input signal active.
0	No signal.

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: Circuit Twistlock group 7.9

Contact:

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 INPUT SIGNAL, UNLOCKED TW

Description: Signals from sensors open twistlock right and left.

Circuit diagram: Circuit Twistlock group 7.9

Contact:

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.

8.4.9.8 ATTACH, menu 8

NOT USED

This menu is not used.

XXXXXXXX X (X)	
NOT USED	

008793

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: Circuit Twistlock group 7.9

Contact: digital output from D791-1/K1:32 to Y6040/1

Function: 7.9.1.3 Control valve attachment

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

PRESENT OUTPUT SIGNAL, UNLOCK TW

Description: Voltage feed to control valve attachment, open twistlock.

Circuit diagram: Circuit Twistlock group 7.9

Contact: digital output from D791-1/K1:33 to Y6039/1

Function: 7.9.1.3 Control valve attachment

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG ATTACHMENT 9 (21)	
PRESENT OUTPUT SIGNAL	
LOCK TW	XY
UNLOCK TW	XY

000190

DIAG ATTACHMENT 10 (21)		
PRESENT OUTPUT SIGNAL		
IND. LOCKED TW	XY	000191
IND. UNLOCKED TW	XY	
IND. ALIGNMENT	XY	

8.4.9.10 ATTACH, menu 10

PRESENT OUTPUT SIGNAL, IND. LOCKED TW

Description: Voltage feed indicator light locked twistlock.

Circuit diagram: Circuit Twistlock group 7.9

Connection: digital output from D791-1/K1:39 to H563/1

Function: 7.9.1 Twistlocks

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG ATTACHMENT 10 (21)		
PRESENT OUTPUT SIGNAL		
IND. LOCKED TW	XY	000191
IND. UNLOCKED TW	XY	
IND. ALIGNMENT	XY	

PRESENT OUTPUT SIGNAL, IND. UNLOCKED TW

Description: Voltage feed indicator light open twistlock.

Circuit diagram: Circuit Twistlock group 7.9

Contact: digital output from D791-1/K1:25 to H562/1

Function: 7.9.1 Twistlocks

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG ATTACHMENT 10 (21)		
PRESENT OUTPUT SIGNAL		
IND. LOCKED TW		XY
IND. UNLOCKED TW		XY
IND. ALIGNMENT		XY

000191

PRESENT OUTPUT SIGNAL, ALIGNMENT

Description: Voltage feed indicator light alignment.

Circuit diagram: Circuit 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 and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

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: Circuit 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:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

OUTPUT ROTATION C.W., REQUIRED VALUE

Description: Reference value for control current to control valve attachment for rotation clockwise.

Circuit diagram: Circuit 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 controlling solenoid valve.

DIAG ATTACHMENT 11 (21)		
OUTPUT ROTATION C.W.		
REFERENCE		XY
RQUIRED VALUE		XXX
FEEDBACK		XXX

000192

DIAG ATTACHMENT 11 (21)		
OUTPUT ROTATION C.W.		
REFERENCE		XY
RQUIRED VALUE		XXX
FEEDBACK		XXX

000192

DIAG ATTACHMENT 11(21)	
OUTPUT ROTATION C.W.	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000192

DIAG ATTACHMENT 12(21)	
OUTPUT ROTATION C.C.W.	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000193

DIAG ATTACHMENT 12(21)	
OUTPUT ROTATION C.C.W.	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000193

DIAG ATTACHMENT 12(21)	
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: Circuit 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 anticlockwise.

Circuit diagram: Circuit 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:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

OUTPUT ROTATION C.C.W., REQUIRED VALUE

Description: Reference value for control current to control valve attachment for rotation anticlockwise.

Circuit diagram: Circuit 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 controlling solenoid valve.

OUTPUT ROTATION C.C.W., FEEDBACK

Description: Present control current to control valve attachment for rotation clockwise.

Circuit diagram: Circuit 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

8.4.9.13 ATTACH, menu 13

OUTPUT SPREADER OUT, REFERENCE

Description: Status control current to control valve attachment for spreading out.

Circuit diagram: Circuit Spreading Valves group 7.5

Contact: digital output from D791-1/K1:4 to Y6018/1

Function: 7.5.3 Control valve attachment

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

OUTPUT SPREADER OUT, REQUIRED VALUE

Description: Reference value for control current to control valve attachment for output signal, spreading out.

Circuit diagram: Circuit 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 controlling solenoid valve.

DIAG ATTACHMENT 13 (21)	
OUTPUT SPREADER OUT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000194

OUTPUT SPREADER OUT, FEEDBACK

Description: Present control current to control valve attachment for spreading out.

Circuit diagram: Circuit 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.

DIAG ATTACHMENT 13 (21)	
OUTPUT SPREADER OUT	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000194

DIAG ATTACHMENT 14 (21)	
OUTPUT SPREADER IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000195

8.4.9.14 ATTACH, menu 14

OUTPUT SPREADER IN, REFERENCE

Description: Status control current to control valve attachment for spreading in.

Circuit diagram: Circuit Spreading Valves group 7.5

Contact: digital output from D791-1/K1:5 to Y6019/1

Function: 7.5.3 Control valve attachment

Signal value:

00	No output signal and open circuit in the circuit.
01	Normal mode function off. No output signal, circuit OK. It can also be a short circuit as this is only detected when the output signal is active.
10	Output signal active, short circuit.
11	Normal mode function on. Output signal active, circuit OK. It can also be an open circuit as this can only be detected when the output signal is missing.

DIAG ATTACHMENT 14 (21)	
OUTPUT SPREADER IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000195

OUTPUT SPREADER IN, REQUIRED VALUE

Description: Reference value for control current to control valve attachment for spreading in.

Circuit diagram: Circuit 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 controlling solenoid valve.

DIAG ATTACHMENT 14 (21)	
OUTPUT SPREADER IN	
REFERENCE	XY
REQUIRED VALUE	XXX
FEEDBACK	XXX

000195

OUTPUT SPREADER IN, FEEDBACK

Description: Present control current to control valve attachment for spreading in.

Circuit diagram: Circuit 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

NOT USED

This menu is not used.

XXXXXXXX X (X)	
NOT USED	

008793

8.4.9.16 ATTACH, menu 16

NOT USED

This menu is not used.



8.4.9.1 ATTACH, menu 17

NOT USED

This menu is not used.



8.4.9.18 ATTACH, menu 18

NOT USED

This menu is not used.



8.4.9.19 ATTACH, menu 19

NOT USED

This menu is not used.



8.4.9.20 ATTACH, menu 20

NOT USED

This menu is not used.



8.4.9.21 ATTACH, menu 21

NOT USED

This menu is not used.

XXXXXXXX	X (X)
NOT USED	

008793

8.4.9.22 ATTACH, menu 22

NOT USED

This menu is not used.

XXXXXXXX	X (X)
NOT USED	

008793

8.4.10 OP

OP, description

This group covers the overload system functions.

Confirm selections with function key for Enter.

DIAGNOSIS	
CAN/POWER LIGHTS CAB	
CLIMATE HYD ENGINE	
TRANSM BOOM ATTACH	
OP	EXTRA RMI

009277

8.4.10.1 OP, menu 1

NOT USED

This menu is not used.

XXXXXXXX	X (X)
NOT USED	

008793

8.4.10.2 OP, menu 2

PRESENT INPUT SIGNAL, BY-PASS

Description: Signal from switch, bypass.

Circuit diagram: Circuit Bypass group 8.2

Connection: signal from S1005/1 to digital in D790-1/K8:3

Function: 7.1.3 Bypass switch

Signal value:

1	Input signal active. The signal is only active for max. 60 seconds.
0	No signal.

DIAG OP	2 (5)
PRESENT INPUT SIGNAL	
BY-PASS	X

000206

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 8:56 (for pressure information).

Circuit diagram: Circuit OP + Scale group 8.2

Contact:

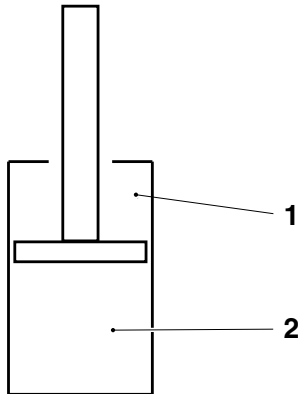
LE: signal from B768-L2/3 to analogue in D797-F/K1:22

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.

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+

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 8:56 for pressure.

Circuit diagram: Circuit OP + Scale group 8.2

Contact:

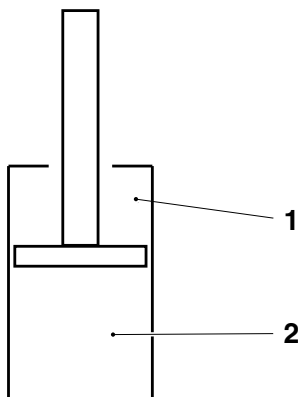
LE: signal from B768-L1 to analogue in D797-F/K1:21

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.

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+

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	XXXXXXkg
PRESENT LOAD	XXXXXXkg
LOAD STR.AXLE	XXXXXXkg
LOAD-CENTER	XX.XXm

006879

DIAG OP	5 (X)
ALLOWED LOAD	XXXXXXkg
PRESENT LOAD	XXXXXXkg
LOAD STR.AXLE	XXXXXXkg
LOAD-CENTER	XX.XXm

006879

DIAG OP	5 (X)
ALLOWED LOAD	XXXXXXkg
PRESENT LOAD	XXXXXXkg
LOAD STR.AXLE	XXXXXXkg
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: Permitted load at the current load centre.

Circuit diagram: -

Contact: -

Function: 8.2.1 Overload system

Signal value: XXXXXkg = Weight in kg.

PRESENT LOAD

Description: Calculated load.

Circuit diagram: -

Contact: -

Function: 8.2.1 Overload system

Signal value: XXXXXkg = Weight in kg.

LOAD STR.AXLE

Description: Estimated load on the steering axle.

Circuit diagram: -

Contact: -

Function: 8.2.1 Overload system

Signal value: XXXXXkg = Weight in kg.

DIAG OP	5 (X)
ALLOWED LOAD	XXXXXkg
PRESENT LOAD	XXXXXkg
LOAD STR.AXLE	XXXXXkg
LOAD-CENTER	XX.XXm

006879

DIAG OP	6 (X)
BOOM ANGLE	XXX
EXTENSION	XXX
BOOM HEIGHT	XXX
BOOM HEIGHT-NOSE	XXX

006880

DIAG OP	6 (X)
BOOM ANGLE	XXX
EXTENSION	XXX
BOOM HEIGHT	XXX
BOOM HEIGHT-NOSE	XXX

006880

DIAG OP	6 (X)
BOOM ANGLE	XXX
EXTENSION	XXX
BOOM HEIGHT	XXX
BOOM HEIGHT-NOSE	XXX

006880

DIAG OP	6 (X)
BOOM ANGLE	XXX
EXTENSION	XXX
BOOM HEIGHT	XXX
BOOM HEIGHT-NOSE	XXX

006880

LOAD-CENTRE

Description: Horizontal distance between centre drive axle and load centre.

Circuit diagram: -

Contact: -

Function: 8.2.1 Overload system, 8.2.3 Load centre limitation

Signal value: XX.XXm = distance in metres

8.4.10.6 OP, menu 6

BOOM ANGLE

Description: Current boom angle.

Circuit diagram: -

Contact: -

Function: 8.2.1 Overload system

Signal value: XXX = boom angle in °.

BOOM EXTENSION

Description: Current boom extension.

Circuit diagram: -

Contact: -

Function: 8.2.1 Overload system

Signal value: XXX = boom extension in cm.

BOOM HEIGHT

Description: Status for boom height at the top edge of the boom, the machine's total height.

Circuit diagram: -

Contact: -

Function: 8.2.4 Height limitation

Signal value: XXX = height above ground in cm.

BOOM HEIGHT-NOSE

Description: Status for current height of the attachment's fixing point in the boom, suspension. The height is used to calculate the load's centre of gravity as a part of the overload system.

Circuit diagram: -

Contact: -

Function: 8.2.1 Overload system

Signal value: XXX = height above ground in cm.

8.4.11 EXTRA

EXTRA, description

This menu is not used.

DIAGNOSIS	009278
CAN/POWER LIGHTS CAB	
CLIMATE HYD ENGINE	
TRANSM BOOM ATTACH	
OP EXTRA RMI	

8.4.13 RMI

RMI, description

This menu is not used.

DIAGNOSIS	007442
CAN/POWER LIGHTS CAB	
CLIMATE HYD ENGINE	
TRANSM BOOM ATTACH	
OP EXTRA RMI	

8.5 Setup

Setup, general

Settings are built-in functions to adapt the functions to the unique machine individual. Settings are performed via menus in the display. Settings are divided into initiation and calibration.

Initiation

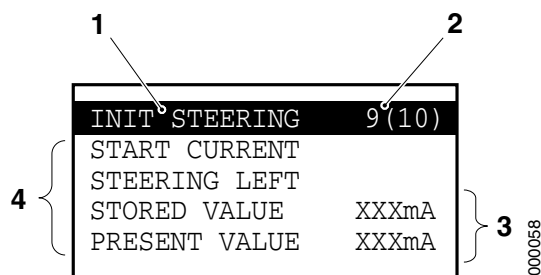
Initiation, which involves setting start and stop currents for the steering and hydraulic functions, is performed before the machine is used in work. This is carried out in order to compensate for mechanical and electrical tolerances (variations between different machines).

Calibration

Calibration is performed after the machine has started to be used for work, after replacement of control units, and in certain cases, service or replacement of components. Calibration is performed so that certain functions shall function properly and show 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. Actual variable



DANGER

The settings influence the functions. Adjustments may impair the function.

If uncertain, contact Cargotec 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 consists of several menus grouped according to functions. Each individual menu sets a specific variable. The menus are similar in structure and use a common terminology explained here:

PRESENT

Displays the stored value when the menu is opened. Adjust the value with the plus and minus keys. Store 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, it controls how slowly a function can be operated. On functions with analogue control/activation (controllable), e.g. lift, this is the current which 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 directly when 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 actuated. 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 which is triggered 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 	INIT DRIVE-TRAIN, menu 9, page 8:109
1 Engine, speed warning 	INIT DRIVE-TRAIN, menu 13, page 8:110
1 Engine, automatic shut-down on idling 	INIT DRIVE-TRAIN, menu 11, page 8:109
2 Transmission, starting gear	INIT DRIVE-TRAIN, menu 1, page 8:107
2 Transmission, speed limit shifting forward - reverse	INIT DRIVE-TRAIN, menu 2, page 8:108
2 Transmission, engine speed limit shifting forward - reverse	INIT DRIVE-TRAIN, menu 3, page 8:108
2 Transmission, engine speed limit shifting neutral - gear	INIT DRIVE-TRAIN, menu 4, page 8:108
2 Transmission, engine speed limit selection of same gear	INIT DRIVE-TRAIN, menu 5, page 8:108
2 Transmission, speed limit selection of same gear	INIT DRIVE-TRAIN, menu 6, page 8:108
2 Transmission, speed limitation (gear lock-out) 	INIT DRIVE-TRAIN, menu 10, page 8:109
2 Transmission, automatic engine speed reduction for shift forward - reverse 	INIT DRIVE-TRAIN, menu 12, page 8:110
7.2 Lifting/lowering, boom up	INIT BOOM, menu 1, page 8:99 INIT BOOM, menu 2, page 8:99
7.2 Lifting/lowering, boom down Comment: The current value is for unladen machines. When loaded, the current value is controlled by the limited lowering speed.	INIT BOOM, menu 3, page 8:100 INIT BOOM, menu 4, page 8:100
7.2 Lifting/lowering, lift speed during operation	INIT BOOM, menu 9, page 8:102
7.3 Extension, boom out	INIT BOOM, menu 5, page 8:100 INIT BOOM, menu 6, page 8:101
7.3 Extension, boom in Comment: The current value is for unladen machines. When loaded, the current value is controlled by the limited lowering speed.	INIT BOOM, menu 7, page 8:101 INIT BOOM, menu 8, page 8:101
7.5 Spreading, out	INIT ATTACH, menu 9, page 8:104 INIT ATTACH, menu 10, page 8:105 INIT ATTACH, menu 11, page 8:105

Function	Menu
7.5 Spreading, in	INIT ATTACH, menu 12, page 8:105 INIT ATTACH, menu 13, page 8:106 INIT ATTACH, menu 14, page 8:106
7.6 Rotation, clockwise	INIT ATTACH, menu 1, page 8:103 INIT ATTACH, menu 2, page 8:103
7.6 Rotation, anticlockwise	INIT ATTACH, menu 3, page 8:103 INIT ATTACH, menu 4, page 8:103

Initiate hydraulic function, work instruction

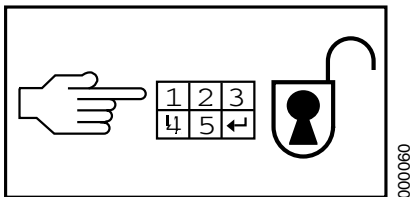
To select a hydraulic function to initiate, proceed as follows:

All hydraulic functions are initiated in the same way.

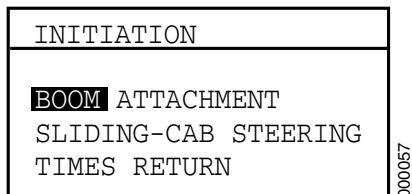
- 1 Navigate to the service menu.
- 2 Press Enter.



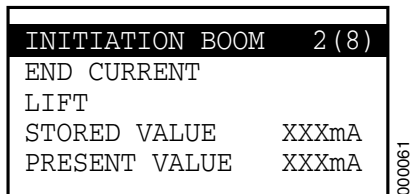
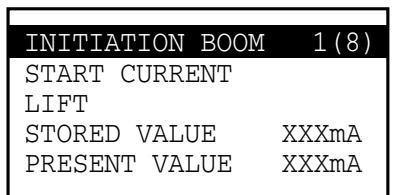
000056



000060



000057



000061

- 3 Enter the code for initiation.

Code is obtained from Cargotec Support.

NOTE

The code determines which service menu is activated (Service, Diagnostic test, Initiation or Calibration).

- 4 Select group by scrolling with the arrow keys (1 and 2) and confirm with Enter.

Each initiation consists of a sequence of a number of menus. The first menu for the selected initiation opens in 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

Current values can only be adjusted within specific limits.

- 6 Use the function key for Enter to store the desired current value setting, "STORED".

INITIATION	
BOOM ATTACHMENT	000651
SLIDING-CAB STEERING	
DRIVE-TRAIN	

8.5.1.1 BOOM

INIT BOOM

This function menu group handles initiation of the boom functions lift, lower and extension.



DANGER

The settings influence the functions. Adjustments may impair the function.

If uncertain, contact Cargotec Service.

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 the current value for the start current. Adjust the value with the plus and minus keys. Store 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 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 1 (11)	
START CURRENT	005042
LIFT	
STORED VALUE	
PRESENT VALUE	

INIT BOOM, menu 2

END CURRENT, LIFT

Description: Control current at full lever actuation for the activation of Solenoid valve, lift (Y6005).

PRESENT VALUE: indicates the current value for max. current. Adjust the value with the plus and minus keys. Store 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: 7.2.5 Control valve lift, lower and extension

Component: Solenoid valve, lift (Y6005)

Signal value: XXXmA = 0 - 999 mA

INIT BOOM 2 (11)	
END CURRENT	005043
LIFT	
STORED VALUE	
PRESENT VALUE	

INIT BOOM	3 (11)
START CURRENT LOWER	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005044

INIT BOOM, menu 3

START CURRENT, LOWER

Description: Start current for activation of Solenoid valve, lower (Y6004).

PRESENT VALUE: indicates the current value for the start current. Adjust the value with the plus and minus keys. Store 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 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	4 (11)
END CURRENT LOWER	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005045

INIT BOOM, menu 4

END CURRENT, LOWER

Description: Control current at full lever actuation for the activation of Solenoid valve, lower (Y6004).

PRESENT VALUE: indicates the current value for max. current. Adjust the value with the plus and minus keys. Store 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: 7.2.5 Control valve lift, lower and extension

Component: Solenoid valve, lower (Y6004)

Signal value: XXXmA = 0 - 999 mA

INIT BOOM	5 (11)
START CURRENT BOOM OUT	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005046

INIT BOOM, menu 5

START CURRENT, BOOM OUT

Description: Start current for activation of Solenoid valve, boom out (Y6006).

PRESENT VALUE: indicates the current value for the start current. Adjust the value with the plus and minus keys. Store 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 start 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 6 (11)	
END CURRENT	
BOOM OUT	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005047

INIT BOOM, menu 6

END CURRENT, BOOM OUT

Description: Control current at full lever actuation for the activation of Solenoid valve, boom out (Y6006).

PRESENT VALUE: indicates the current value for max. current. Adjust the value with the plus and minus keys. Store 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: 7.2.5 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 the current value for the start current. Adjust the value with the plus and minus keys. Store 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 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 7 (11)	
START CURRENT	
BOOM IN	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005048

INIT BOOM, menu 8

END CURRENT, BOOM IN

Description: Control current at full lever actuation for the activation of Solenoid valve, boom in (Y6007).

PRESENT VALUE: indicates the current value for max. current. Adjust the value with the plus and minus keys. Store 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: 7.2.5 Control valve lift, lower and extension

Component: Solenoid valve, boom in (Y6007)

Signal value: XXXmA = 0 - 999 mA

INIT BOOM 8 (11)	
END CURRENT	
BOOM IN	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005049

INIT BOOM	9 (11)
OUTPUT LIFT AT F/R (PROC)	
STORED VALUE	XXX
PRESENT VALUE	XXX

004930

INIT BOOM, menu 9

OUTPUT LIFT AT F/R

Description: Lift speed with gear engaged, as a percentage of max. lift speed.

PRESENT VALUE: indicates the current value for the lift speed. Adjust the value with the plus and minus keys. Store 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 as a percentage of max. value.

XXXXXXXX	X (X)
NOT USED	

008793

INIT BOOM, menu 10

NOT USED

This menu is not used.

XXXXXXXX	X (X)
NOT USED	

008793

INIT BOOM, menu 11

NOT USED

This menu is not used.

INITIATION
BOOM ATTACHMEN
SLIDING-CAB STEERING
DRIVE-TRAIN

001157

8.5.1.2 ATTACHMENT

INIT ATTACH

This function handles initiation of the attachment functions rotation, controllable tilt and controllable levelling.



DANGER

The settings influence the functions. Adjustments may impair the function.

If uncertain, contact Cargotec Service.

NOTE

Initiation does not need to be performed in one process but each step can be performed separately, independently of other steps.

INIT ATTACH 1 (14)	
START CURRENT	
ROTATION CW	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005091

INIT ATTACH, menu 1

START CURRENT, ROTATION CW

Description: tart current for activation of Solenoid valve, rotation clockwise (Y6008).

PRESENT VALUE: indicates the current value for the start current. Adjust the value with the plus and minus keys. Store 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 start current.

Function: 7.6.3 Control valve attachment

Component: Solenoid valve rotation clockwise (Y6008)

Signal value: XXXmA = 0 - 999 mA

INIT ATTACH 2 (14)	
END CURRENT	
ROTATION CW	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005092

INIT ATTACH, menu 2

END CURRENT, ROTATION CW

Description: Control current at full lever actuation for the activation of Solenoid valve, rotation anticlockwise (Y6009).

PRESENT VALUE: indicates the current value for max. current. Adjust the value with the plus and minus keys. Store 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: 7.6.3 Control valve attachment

Component: Solenoid valve, anticlockwise (Y6009)

Signal value: XXXmA = 0 - 999 mA

INIT ATTACH 3 (14)	
START CURRENT	
ROTATION CCW	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA

005093

INIT ATTACH, menu 3

START CURRENT, ROTATION CCW

Description: tart current for activation of Solenoid valve, rotation anticlockwise (Y6009).

PRESENT VALUE: indicates the current value for the start current. Adjust the value with the plus and minus keys. Store 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 start current.

Function: 7.6.3 Control valve attachment

Component: Solenoid valve rotation anticlockwise (Y6009)

Signal value: XXXmA = 0 - 999 mA

XXXXXXXX X (X)	
NOT USED	

008793

INIT ATTACH, menu 4

NOT USED

This menu is not used.

INIT ATTACH, menu 5

NOT USED

This menu is not used.



INIT ATTACH, menu 6

NOT USED

This menu is not used.



INIT ATTACH, menu 7

NOT USED

This menu is not used.



INIT ATTACH, menu 8

NOT USED

This menu is not used.



INIT ATTACH, menu 9

START CURRENT, SPREADER OUT 20'-40'

Description: Start current for activation of Solenoid valve, spreading out (Y6018).

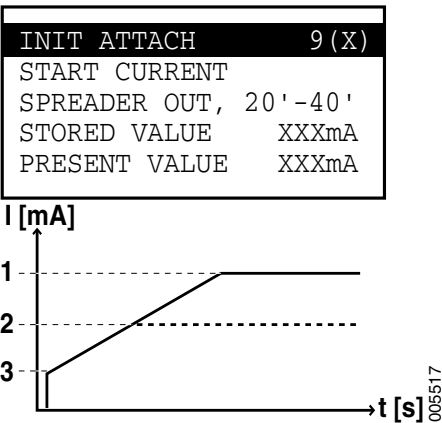
PRESENT VALUE: indicates the current value for max. current. Adjust the value with the plus and minus keys. Store the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

STORED VALUE: indicates stored value for max. current.

Function: 7.5.3 Control valve attachment

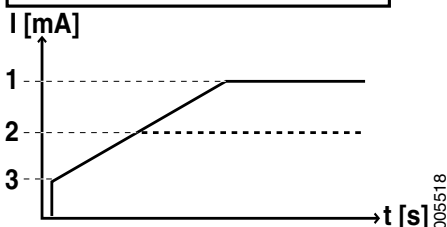
Component: Solenoid valve spreading out (6018)

Signal value: XXXmA = 0 - 999 mA.



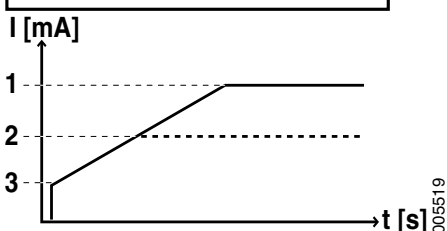
- 1. Max. current (END CURRENT)
- 2. Damping (PROC DAMPING)
- 3. Start current (START CURRENT)

INIT ATTACH	10 (X)
END CURRENT	
SPREADER OUT, 20'-40'	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA



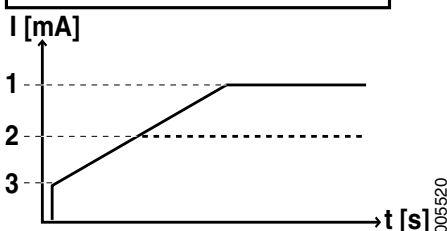
1. Max. current (END CURRENT)
2. Damping (PROC DAMPING)
3. Start current (START CURRENT)

INIT ATTACH	11 (X)
DAMP (PROC)	
SPREADER OUT, 20'-40'	
STORED VALUE	XX
PRESENT VALUE	XX



1. Max. current (END CURRENT)
2. Damping (PROC DAMPING)
3. Start current (START CURRENT)

INIT ATTACH	12 (X)
START CURRENT	
SPREADER IN, 40"-20"	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA



1. Max. current (END CURRENT)
2. Damping (PROC DAMPING)
3. Start current (START CURRENT)

INIT ATTACH, menu 10

END CURRENT, SPREADER OUT 20'-40'

Description: Control current at full lever actuation for the activation of Solenoid valve, spreading out (6018).

PRESENT VALUE: indicates the current value for max. current. Adjust the value with the plus and minus keys. Store 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 (PROC), SPREADING, OUT 20'-40'

Description: Control current to Solenoid valve, spreading out (Y6018) during damping, when damping is approaching 40'.

PRESENT VALUE: indicates the current value for max. current. Adjust the value with the plus and minus keys. Store 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 in percent.

Function: 7.8.3 Control valve attachment

Component: Solenoid valve, spreading out (Y6018)

Signal value: XXX = 0 - 100%. 100% means no damping i.e. max. current. 0% means full damping i.e. start current.

INIT ATTACH, menu 12

START CURRENT, SPREADER IN 40"-20"

Description: Start current for activation of Solenoid valve, spreading in (Y6019).

PRESENT VALUE: indicates the current value for max. current. Adjust the value with the plus and minus keys. Store the set value with the Enter key. Go to the next menu with the arrow keys. Exit initiation with the R-key.

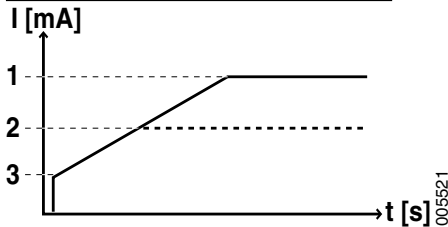
STORED VALUE: indicates stored value for max. current.

Function: 7.5.3 Control valve attachment

Component: Solenoid valve spreading in (6019)

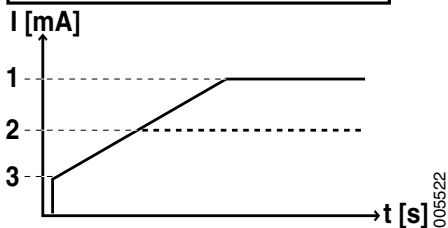
Signal value: XXXmA = 0 - 999 mA.

INIT ATTACH	13 (X)
END CURRENT	
SPREADER IN, 40'-20'	
STORED VALUE	XXXmA
PRESENT VALUE	XXXmA



1. Max. current (END CURRENT)
2. Damping (PROC DAMPING)
3. Start current (START CURRENT)

INIT ATTACH	14 (X)
DAMP (PROC)	
SPREADER IN, 40'-20'	
STORED VALUE	XX
PRESENT VALUE	XX



1. Max. current (END CURRENT)
2. Damping (PROC DAMPING)
3. Start current (START CURRENT)

XXXXXXXX	X (X)
NOT USED	

XXXXXXXX	X (X)
NOT USED	

INIT ATTACH, menu 13

END CURRENT, SPREADER IN 40"-20"

Description: Control current at full lever actuation for the activation of Solenoid valve, spreading in (6019).

PRESENT VALUE: indicates the current value for max. current. Adjust the value with the plus and minus keys. Store 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

INIT ATTACH, menu 14

DAMP (PROC), SPREADING, IN 40"-20"

Description: Control current to Solenoid valve, spreading in (Y6019) during damping, when damping is approaching 20'.

PRESENT VALUE: indicates the current value for max. current. Adjust the value with the plus and minus keys. Store 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 in percent.

Function: 7.8.3 Control valve attachment

Component: Solenoid valve, spreading in (Y6019)

Signal value: XXX = 0 - 100%. 100% means no damping i.e. max. current. 0% means full damping i.e. start current.

INIT ATTACH, menu 15

NOT USED

This menu is not used.

INIT ATTACH, menu 16

NOT USED

This menu is not used.

INITIATION	
BOOM ATTACHMENT	
SLIDING-CAB	STEERING
DRIVE-TRAIN	

001645

8.5.1.3 SLIDING-CAB

INIT SLIDING-CAB

This menu is not used.

INITIATION	
BOOM ATTACHMENT	
SLIDING-CAB	STEERING
DRIVE-TRAIN	

002954

8.5.1.4 STEERING

INIT STEERING

This menu is not used.

INITIATION	
BOOM ATTACHMENT	
SLIDING-CAB	STEERING
DRIVE-TRAIN	

003140

8.5.1.5 DRIVE-TRAIN

INIT DRIVE-TRAIN

This function handles initialisation of the transmission.

NOTE

Initiation does not need to be performed in one process but each step can be performed separately, independently of other steps.

NOTE

The machine must be stationary with parking brake applied in order to enable access to the menus.

After changes have been made, the ignition must be switched off and then on for the changes to be saved and start to apply.

INIT DRIVE-TRAIN, menu 1

START IN 1:ST

Description: Setting to get transmission to always start in 1st gear.

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-TRN	1 (X)
START IN 1:ST	
1=YES 0=NO	
STORED VALUE	XXX
PRESENT VALUE	XXX

013915

**INIT DRIVE-TRAIN, menu 2****NOT USED**

This menu is not used.

**INIT DRIVE-TRAIN, menu 3****NOT USED**

This menu is not used.

**INIT DRIVE-TRAIN, menu 4****NOT USED**

This menu is not used.

**INIT DRIVE-TRAIN, menu 5****NOT USED**

This menu is not used.

**INIT DRIVE-TRAIN, menu 6****NOT USED**

This menu is not used.

**INIT DRIVE-TRAIN, menu 7****NOT USED**

This menu is not used.

XXXXXXX	X (X)
NOT USED	

008793

INIT DRIVE-TRAIN, menu 8

NOT USED

This menu is not used.

INIT DRIVE-TRN	9 (12)
OPTION SPEED LIMIT	
(KM/H)	
STORED VALUE	XXX
PRESENT VALUE	XXX

004935

INIT DRIVE-TRAIN, menu 9

OPTION SPEED LIMIT



Description: Setting of speed limitation.

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-TRAIN, menu 10

OPTION HIGHEST GEAR AT SPEED LIMIT



Description: Setting of highest permissible gear (speed limitation through blocked gears).

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 = gear

INIT DRIVE-TRN	10 (12)
OPTION HIGHEST GEAR	
AT SPEED LIMIT	
STORED VALUE	XXX
PRESENT VALUE	XXX

004936

INIT DRIVE-TRAIN, menu 11

OPTION ENGINE SHUT DOWN



Description: Setting of idle time prior to automatic engine shutdown.

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: 1 Engine

Component: -

Signal value: XXX = time in seconds before engine shutdown.

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 12

F-R WITHOUT ENGINE SPEED REDUCTION



Description: Activation or deactivation of automatic engine speed reduction when changing direction of travel forward - reverse. This makes it possible to change direction of travel without releasing the accelerator pedal. Engine speed drops to that set in menu 3, see *INIT DRIVE-TRAIN, menu 3*, page 8:108. If no value is set in menu 3, engine speed is reduced to idle speed.

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

INIT DRIVE-TRAIN, menu 13

OPT SPEED WARNING



Description: Speed warning, a warning is shown in the display at a set speed.

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)

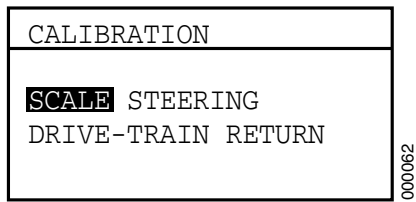
INIT DRIVE-TRN	13 (X)
OPT SPEED WARNING	
STORED VALUE	XXX
PRESENT VALUE	XXX

013918

8.5.2 Calibration

Calibration, description

Certain functions require calibration in order to operate correctly. The control system has integrated calibrations for these functions.



SCALE

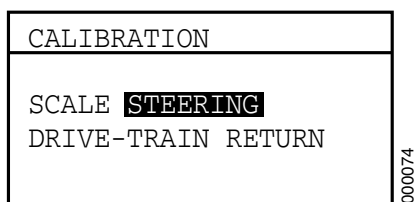
This menu handles calibration of sensors for weight indication.

Weight indicator, calibration, page 8:113

IMPORTANT

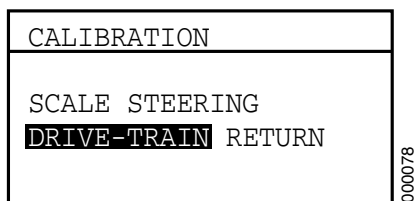
Calibrate the weight indicator after replacing components connected with lift, lower or extension.

If the weight indicator is not calibrated then the overload system intervenes at a lower weight than specified.



EL-STEERING

This menu is not used.



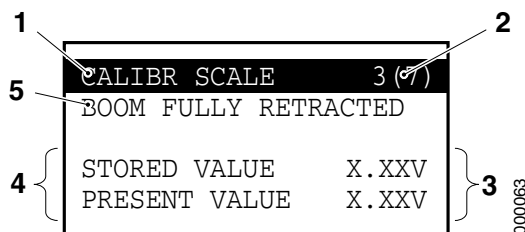
DRIVE-TRAIN

This function handles calibration for engine and transmission.

Accelerator pedal, calibration, page 8:115

NOTE

Calibration does not need to be performed in one process but each step can be performed separately, independently of other steps.



1. Menu group
2. Sequence number (the total number of sequences is indicated in brackets)
3. Signal value
4. STORED indicates stored value, PRESENT indicates the 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 calibrating the boom extension inner position. The table indicates what a description contains (which follows in the next section):

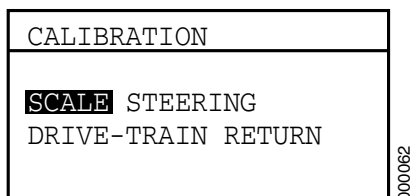
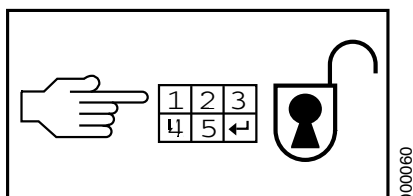
Designation: Example	Description
Variable (position 4): BOOM FULLY RETRACTED	Name of the input signal/control signal affected.
Description: Setting sensor boom length (R777) for boom extension in the innermost position. CALIBR VALUE: indicates stored signal value from boom length (R777) for boom extension in the innermost position. PRESENT VALUE: indicates the 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, the number of menus depends on the function. All menus are similar in structure and therefore the descriptions are similar.

To select a function to calibrate, proceed as follows:

- 1 Navigate to the service menu.
- 2 Press Enter.



- 3 Enter the code for calibration.

Code is obtained from Cargotec Support.

NOTE

The code determines which service menu is activated (Service, 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 opens in the display. Select the next menu with key 1 and 2 (arrow function).

8.5.2.1 Calibrate SCALE

Weight indicator, calibration



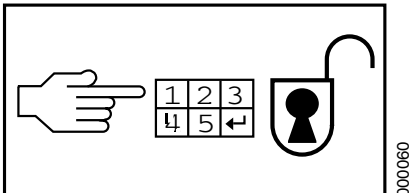
NOTE

It is very important for accuracy that all steps are performed in the given order.

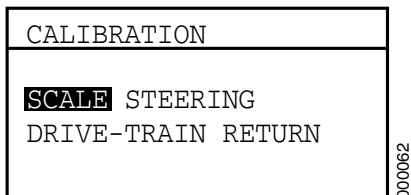
- 1 Operate and warm the hydraulic oil to operating temperature, min. 40 °C.
- 2 Park the machine on level ground without load and centre the attachment.
- 3 Navigate to the service menu and press ENTER.



000056



000060



000062

- 4 Enter the code for calibration.
Code is obtained from Cargotec Support.

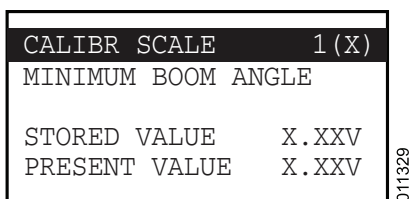
NOTE

The code determines which service menu is activated (Service, Diagnostic test, Initiation or Calibration).

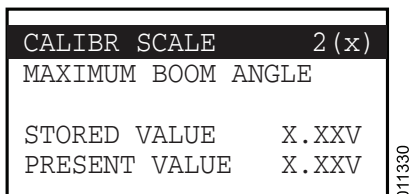
- 5 Scroll to SCALE with the arrow keys and press ENTER.
Every calibration consists of a sequence of menus. Scroll between the menus with the arrow keys.

NOTE

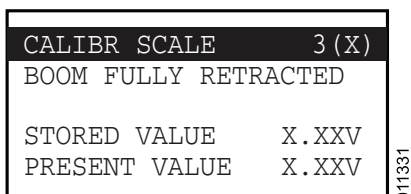
Some options, such as height limitation and load centre limitation, mean that bypass must be used to reach the boom's end positions.



011329



011330



011331

- 6 CALIBR SCALE, menu 1.
- 7 Lower the boom to the lowest position (0°).
- 8 Save the setting with ENTER.
- 9 Scroll to CALIBR SCALE, menu 2.
- 10 Raise the boom to its highest angle.
- 11 Save the setting with ENTER.
- 12 Scroll to CALIBR SCALE, menu 3.
- 13 Retract the boom completely.
- 14 Save the setting with ENTER.

CALIBR SCALE		4 (X)
BOOM FULLY EXTENDED		
STORED VALUE	X.XXV	
PRESENT VALUE	X.XXV	

011332

CALIBR SCALE		5 (X)
LOAD SENSOR BOOM		
RETRACTED	LE	RI
STORED	XXXX	XXXX
PRESENT	XXXX	XXXX

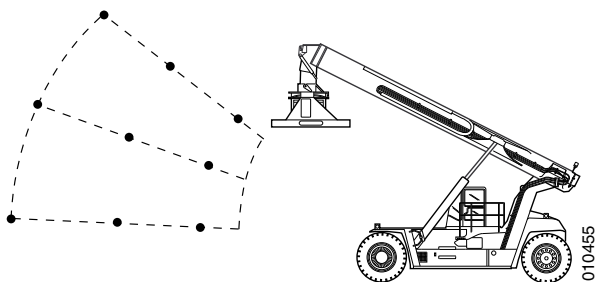
011333

CALIBR SCALE		6 (X)
LOAD SENSOR BOOM		
EXTENDED	LE	RI
CALIBR	XXXX	XXXX
PRESENT	XXXX	XXXX

010454

CALIBR SCALE		7 (X)
ALLOWED LOAD	XXXXXXKg	
PRESENT LOAD	XXXXXXKg	
LOAD STR.AXLE	XXXXXXKg	
LOAD-CENTER	XXX.XXm	

006804



010455

15 Scroll to CALIBR SCALE, menu 4.

16 Extend the boom completely.

17 Save the setting with ENTER.

18 Scroll to CALIBR SCALE, menu 5.

19 Retract the boom completely.

20 Lower the boom and inch towards the end until 2-4 cm remains on the lift cylinders.

21 Wait approximately five seconds to stabilise the pressure.

22 Save the setting with ENTER.

23 Scroll to CALIBR SCALE, menu 6.

24 Extend the boom completely.

25 Wait approximately five seconds to stabilise the pressure.

26 Check that "LOAD SENSOR BOOM" is set to 0 t. If not, adjust with the minus key to 0 t and save the setting with ENTER.

IMPORTANT

Check that the correct weight is shown in the menu before the setting is saved. Incorrectly input weight means that the scale indicates incorrectly.

Checking the calibration

27 Scroll to CALIBR SCALE, menu 7.

28 Lift a reference load and check that the control system calculates the correct weight of the load that the machine is lifting.

PRESENT LOAD = Reference load $\pm$ 450 kg. Weight is given in kg.

If the weight is not correct, repeat the calibration.

29 Operate the machine without a load, stop the machine and check that PRESENT LOAD = 00000 $\pm$ 450 kg.

Check in various ranges, as illustrated. The boom must not reach the end positions during checking.

NOTE

Check when stationary. (Operating generates dynamic forces.)

30 Back out of calibration with the R-key. When the code menu appears, press 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 8:112

ACCELERATOR, RELEASE THE PEDAL

Description: setting the accelerator's pedal zero position.

CALIBR VALUE: indicates current calibrated control value from Accelerator pedal (R690).

PRESENT VALUE: indicates the current signal value from Accelerator pedal (R690).

Function: 1.1.2 Accelerator 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 full-throttle position for Accelerator pedal (R690).

CALIBR VALUE: indicates current calibrated control value from Accelerator pedal (R690).

PRESENT VALUE: indicates the current signal value from Accelerator pedal (R690).

Function: 1.1.2 Accelerator pedal

Component: Accelerator pedal (R690).

- 6 Depress the accelerator pedal fully and keep it down until the position is stored.
- 7 Store the position with function key for Enter.

CALIBR DRIVE-TRN 1(4)		
ACCELERATOR, RELEASE THE PEDAL		
CALIBR VALUE	X.XXV	000079
PRESENT VALUE	X.XXV	

CALIBR DRIVE-TRN 2(4)		
ACCELERATOR, THE PEDAL TO FLOOR		
CALIBR VALUE	X.XXV	000080
PRESENT VALUE	X.XXV	

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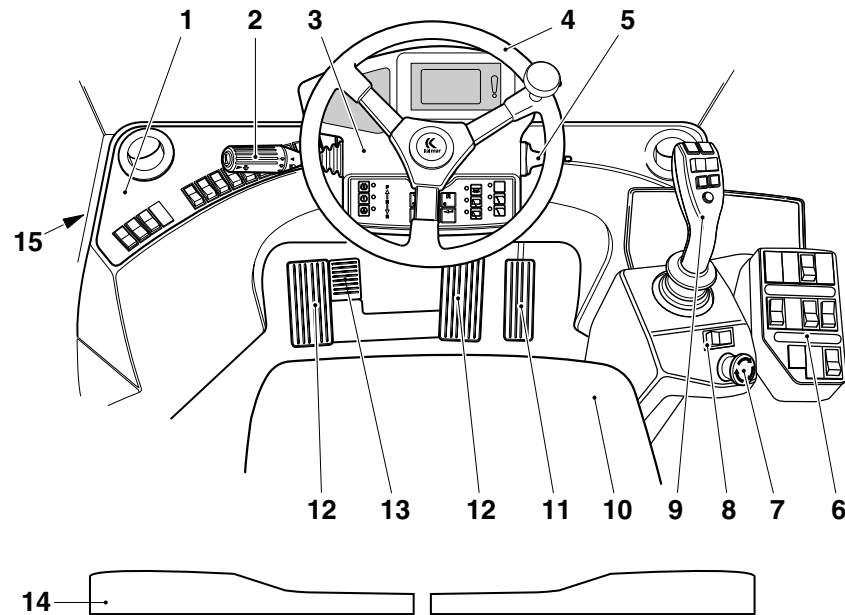
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9 Frame, body, cab and accessories

9.1 Controls and instruments

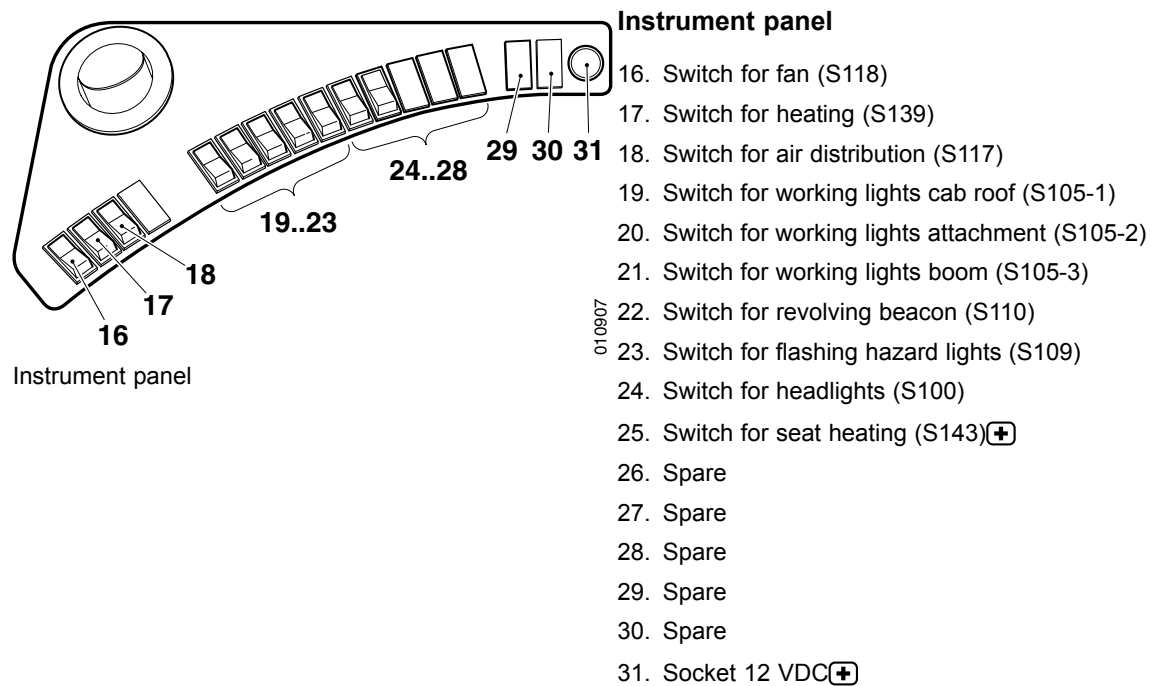
Controls and instruments, overview

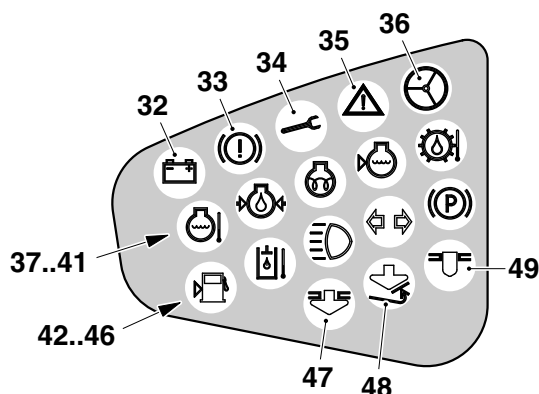
Overview



1. Left instrument panel
2. Gear selector and multi-function lever (S162)
3. Steering wheel panel
4. Steering wheel
5. Direction indicator (S161)
6. Panel for hydraulic functions
7. Emergency stop switch for hydraulics (S250)
8. Switch for parking brake (S107)
9. Control lever (S815)
10. Driver's seat
11. Accelerator pedal (B690)
12. Brake pedals
13. Declutch pedal (S220-1)
14. Electronic box with fuses and relays
15. Hour meter (P708)

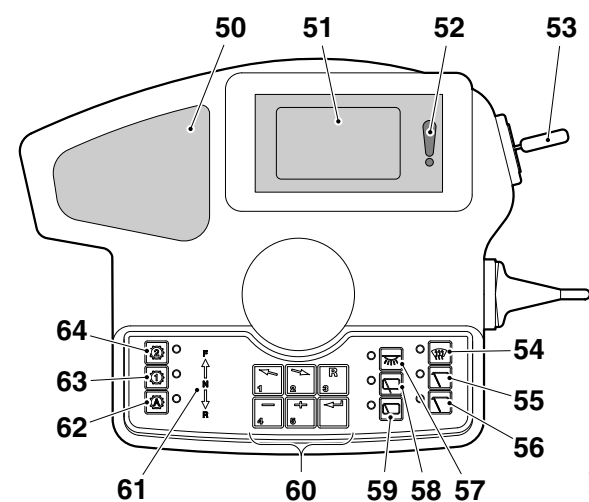
010906



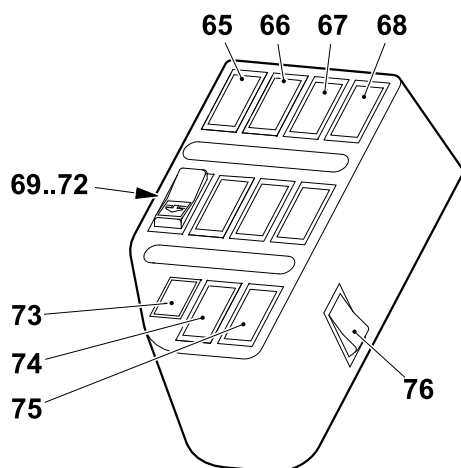


Steering wheel panel

- 32. Warning lamp, low battery charging
- 33. Warning lamp for low brake pressure
- 34. Indicator light for active error codes
- 35. Warning lamp, by-pass of hydraulic functions
- 36. Not used
- 37. Warning lamp, high coolant temperature
- 38. Warning lamp, low oil pressure in engine
- 39. Indicator light for preheating
- 40. Warning lamp for low coolant level engine
- 41. Warning lamp, high oil temperature in transmission
- 42. Warning lamp, low fuel level
- 43. Warning lamp, high temperature hydraulic oil
- 44. Indicator light, high beams
- 45. Indicator light for direction indicators
- 46. Indicator light, parking brake
- 47. Indicator light, locked twistlocks (secured load)
- 48. Indicator light, alignment (attachment / load)
- 49. Indicator light, unlocked twistlocks (load released)
- 50. Panel, warning and indicator lights
- 51. Control system display
- 52. Control system indicator
- 53. Ignition key lock (S150)
- 54. Switch for defroster
- 55. Switch, windscreen wiper roof, interval
- 56. Switch, windscreen wiper roof, continuous
- 57. Switch, interior lighting
- 58. Switch, windscreen wiper rear, interval
- 59. Switch, windscreen wiper rear, continuous
- 60. Control system function keys
- 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

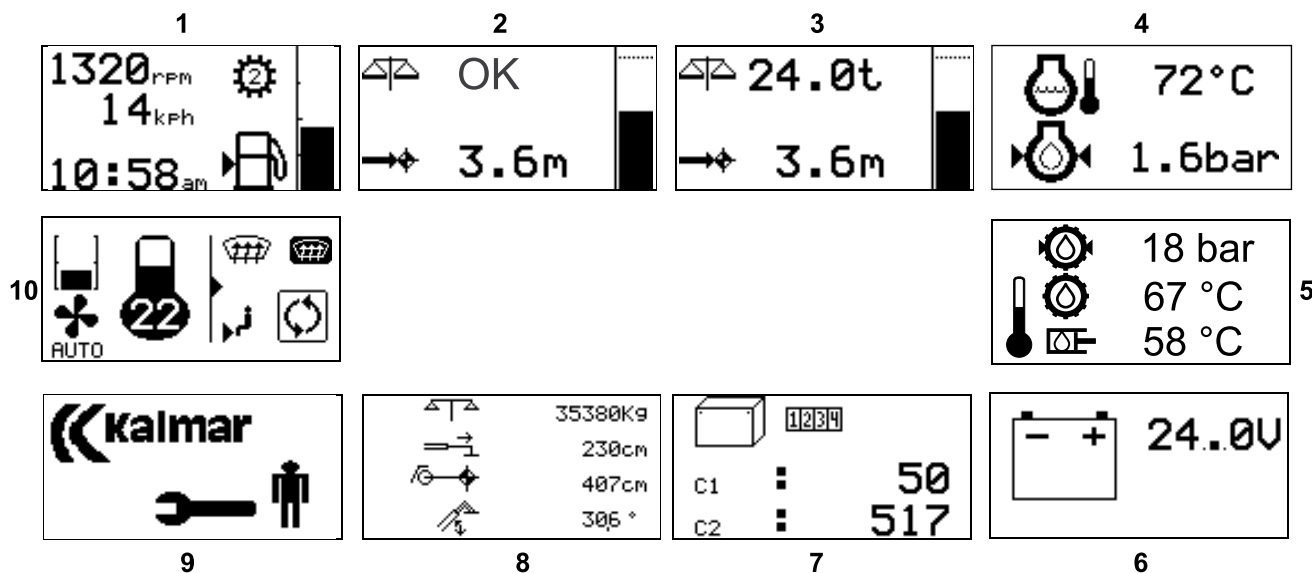


Panel for hydraulic functions

Panel for hydraulic functions

- 65. Spare
- 66. Spare
- 67. Spare
- 68. Spare
- 69. Switch for twistlocks, automatic/manual locking (S1003)
- 70. Spare
- 71. Spare
- 72. Spare
- 73. Spare
- 74. Spare
- 75. Spare
- 76. Switch for bypassing of hydraulic functions (S1005)

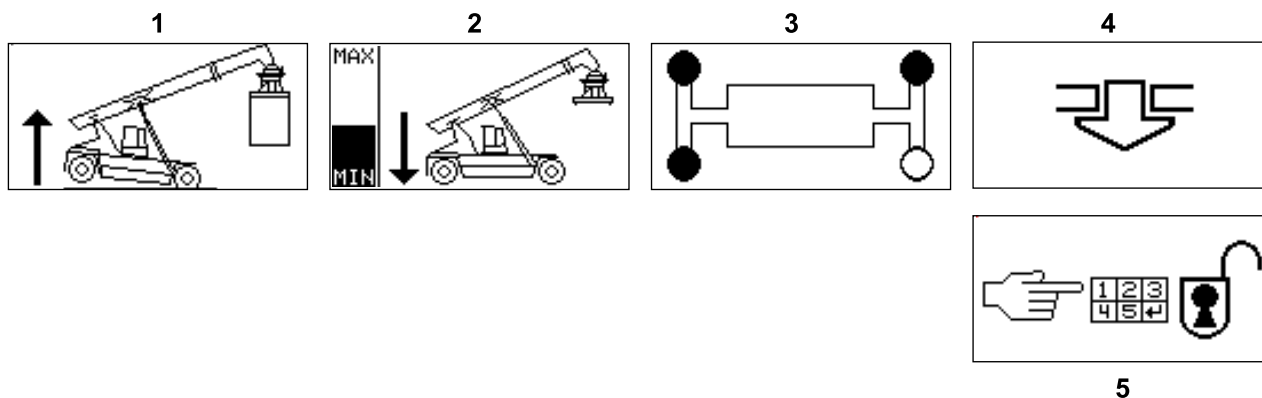
014162

Operating menus, overview

014142

- 1. Engine and transmission operating menu
- 2. Dynamic scale operating menu
- 3. Operating menu dynamic scale $\oplus$
- 4. Engine operating menu
- 5. Transmission and hydraulics operating menu
- 6. Operating menu electrical system
- 7. Operating menu, container counter $\oplus$
- 8. Operating menu control of dynamic scale $\oplus$
- 9. Service operating menu
- 10. Operating menu heating and air conditioning

Event menus overview



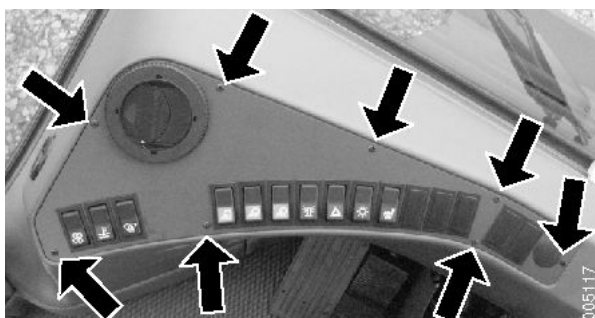
1. Event menu overload forward
2. Event menu overload on steering axle
3. Event menu alignment top lift
4. Event menu twistlocks
5. Event menu start interlock

Switch, replacement

NOTE

The instruction applies to switches in general.

- 1 Machine in service position, see section *B Safety*.
- 2 Remove the dashboard panel.

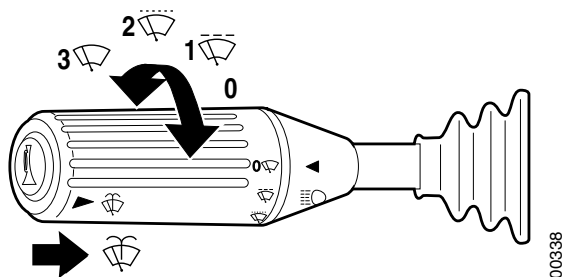


- 3 Detach the connector from the switch.
- 4 Remove the switch from the dashboard panel. Use a screwdriver to bend in the tabs.
- 5 Replace the switch.

9.1.1 Gear selector and multi-function lever

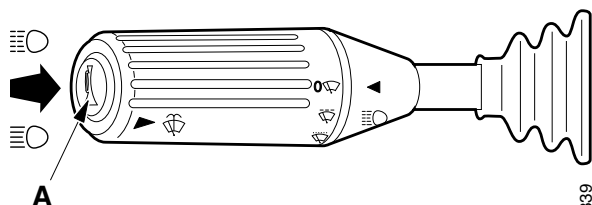
Gear selector and multi-function lever, description

The following functions are handled by the gear and multi-function lever (position 2).



000338

Move-ment	Function
For-ward/Re-verse	Travel direction (for selecting shifting program and travel direction, see section 2 <i>Transmission</i>).
Inward, handle	Washing of windscreen, roof window and rear window. The signal can be checked via the diagnostic menu. See section 8 <i>Control system</i> , group 8.4.3.1 <i>CAB</i> , menu 1.
Rotation	Windscreen wiper, front. 0 – No wiping of front window. If wiper rear or roof are active then these run at slow interval wiping. 1 – Slow interval wiping front window, controls slow interval wiping for roof window and rear window. 2 – Fast interval wiping front window, controls fast interval wiping for roof window and rear window. 3 - Continuous wiping of front window. If wiper rear or roof are active then these run at fast interval wiping. The signal can be checked via the diagnostic menu. See section 8 <i>Control system</i> , group 8.4.3.2 <i>CAB</i> , menu 2.



000339

Upward	Light signal
Down-ward	High beam (on/off) With headlights on: The gear selector multi-function lever are used for switching between high and low beam. With headlights off: The gear selector and multi-function lever are used to flash with the headlights. The signal can be checked via 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 via the diagnostic menu. See section 8 <i>Control system</i> , group 8.4.3.5 <i>CAB</i> , menu 5.

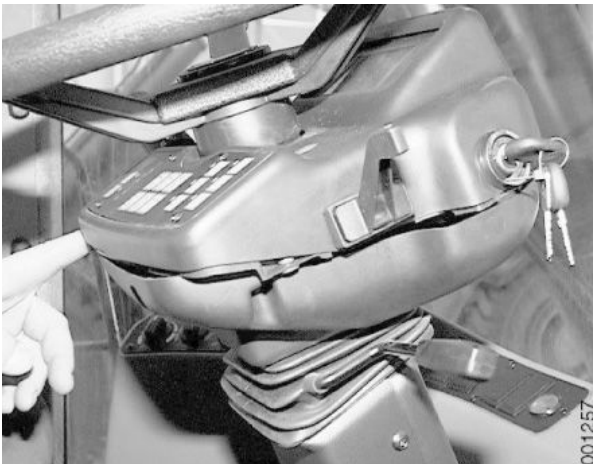
Gear selector and multi-function lever, replacement



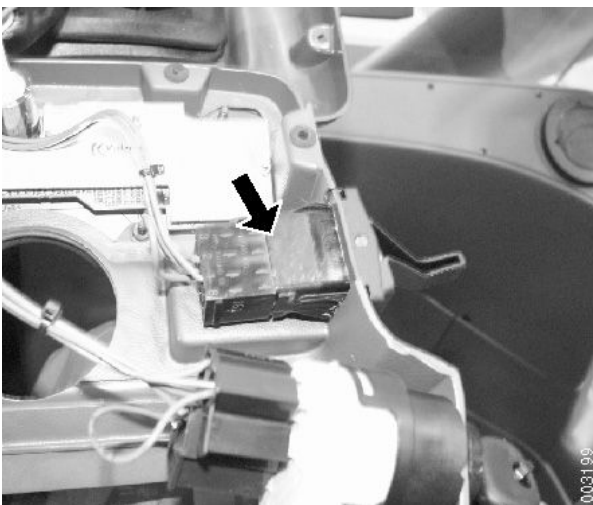
- 1 Separate the steering wheel panel.
6 attaching bolts and 2 bolts to the steering wheel shaft.
Remove the steering wheel, see *Steering wheel panel, replacement*, page 9:81.
- 2 Undo the attaching bolts (2 x hexagonal socket bolts).
- 3 Unplug the connector from Control unit KIT (D790-2).
- 4 Fit a new lever and refit the steering wheel panel.

9.1.22 Switch, direction indicators

Switch, direction indicators, replacement



- 1 Machine in service position, see section *B Safety*.
- 2 Remove the steering wheel and separate the steering wheel panel.



- 3 Detach the cable harness from the direction indicator.
- 4 Press together the clips on the direction indicator and detach it from the steering wheel panel.
- 5 Replace the direction indicator, fitting it in the reverse order.

9.2 Safety and emergency equipment

9.2.1 Control breaker

Emergency stop switch, description

See section 11 *Common electrics*, group 11.5.1.4 *Emergency stop switch voltage*.

9.2.2 Seat belt

Seat belt, description

The seat belt is a two or a three-point belt, depending on the type of seat fitted in the machine. The seat belt is mounted on the seat.

9.2.3 Fire extinguisher

Fire extinguisher, description



The fire extinguisher is located by the boarding step on the left-hand frame member. Usage instructions are on the fire extinguisher.

9.2.4 Buzzer

Seat buzzer, description

See *Sensor, operator-in-seat, description (product alternative Hao Bang)*, page 9:17.

9.3 Seat

Seat, general

There are three versions of driver's seat:

- *Seat, description (product alternative Hao Bang), page 9:11*
-  *Seat, description (product alternative BE-GE 9200), page 9:12*
-  *Seat, description (product alternative BE-GE 9200 air suspension), page 9:13*

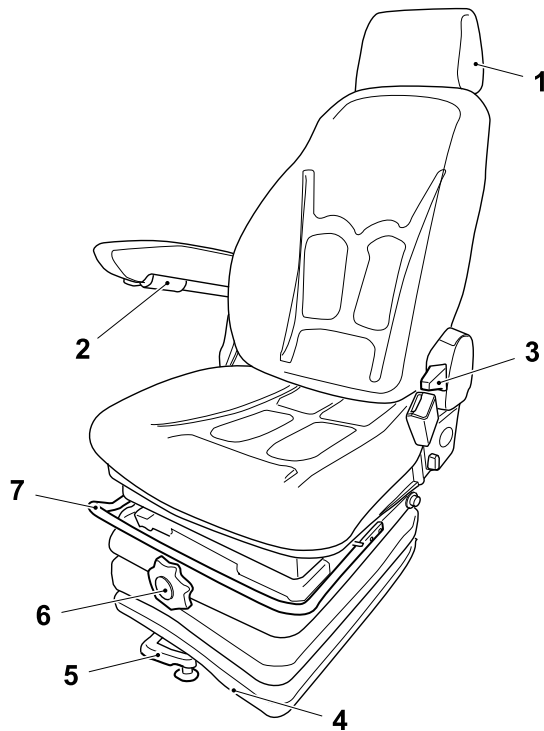
Seat, description (product alternative Hao Bang)

The seat's function is to provide the operator with a good sitting position and contribute to a good work environment. The cab's seat has several adjustment options and fulfils high comfort standards.

The seat has the following equipment:

- mechanical height adjustment
- seat cushion angling
- arm rest right
- two-point seat belt
- head rest

The seat is equipped with a sensor which detects if there is downward pressure on the seat cushion. This is used to activate the buzzer if the operator leaves the seat without applying the parking brake as well as without putting the transmission in neutral position if leaving the seat.



014151

1. Head rest
2. Adjusting arm rest, right
3. Back rest rake adjustment
4. Display of weight setting
5. Seat height adjustment
6. Seat cushion angle adjustment
7. Front/rear adjustment

Seat, description (product alternative BE-GE 9200)

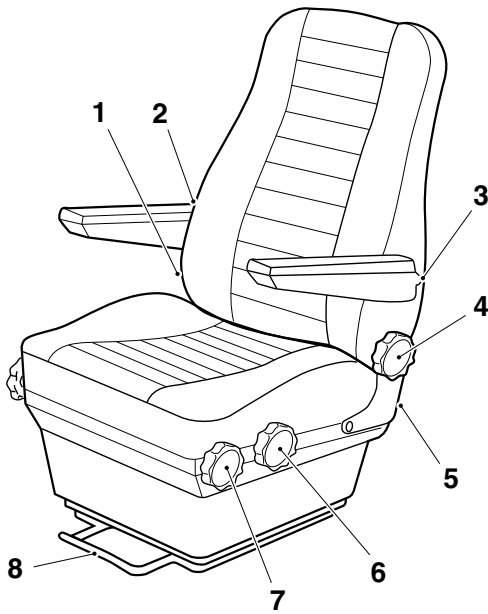


The seat's function is to provide the operator with a good sitting position and contribute to a good work environment. The cab's seat has several adjustment options and fulfils high comfort standards.

The seat has the following equipment:

- mechanical height adjustment
- arm rest right
- two-point seat belt
- seat heating
- head restraint
- left armrest

The seat is equipped with a sensor that senses the spring deflection of the seat. This is used to activate the buzzer if the operator leaves the seat without applying the parking brake as well as without putting the transmission in neutral position if leaving the seat.



006825

Controls

1. Adjusting lumbar support
2. Adjusting arm rest, right
3. Adjusting arm rest, left
4. Back rest rake adjustment
5. Adjusting suspension position
6. Seat cushion angle adjustment
7. Seat height adjustment
8. Front/rear adjustment

Seat, description (product alternative BE-GE 9200 air suspension)

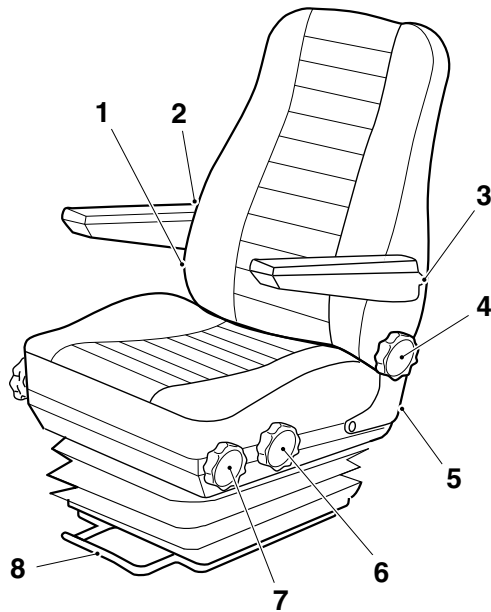


The seat's function is to provide the operator with a good sitting position and contribute to a good work environment. The cab's seat has several adjustment options and fulfils high comfort standards. The air suspension automatically adjusts seat height and suspension to the operator's weight. The air suspension is supplied by a special compressor installed on the underside of the cab.

The seat has the following equipment:

- air suspension (with external compressor)
- arm rest right
- three-point seat belt
- seat heating
- left armrest
- head restraint

The seat is equipped with a sensor that senses the spring deflection of the seat. This is used to activate the buzzer if the operator leaves the seat without applying the parking brake as well as without putting the transmission in neutral position if leaving the seat.



006826

Controls BE-GE 9200

1. Adjusting lumbar support
2. Adjusting arm rest, right
3. Adjusting arm rest, left
4. Back rest rake adjustment
5. Adjusting suspension position
6. Seat cushion angle adjustment
7. Seat height adjustment
8. Front/rear adjustment

Seat, replacement (product alternative BE-GE)

- 1 Machine in service position, see section *B Safety*.
- 2 Slide back the seat to its rear position, remove the front attaching bolts.



005987



- 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 to the operator. Under the seat cushion is the driver's seat frame and a circuit breaker for the buzzer. There may be a heating coil fitted (+).

For location, see *Seat, general*, page 9:11.

Seat cushion, replacement (product alternative BE-GE)

- 1 Machine in service position, see section *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).

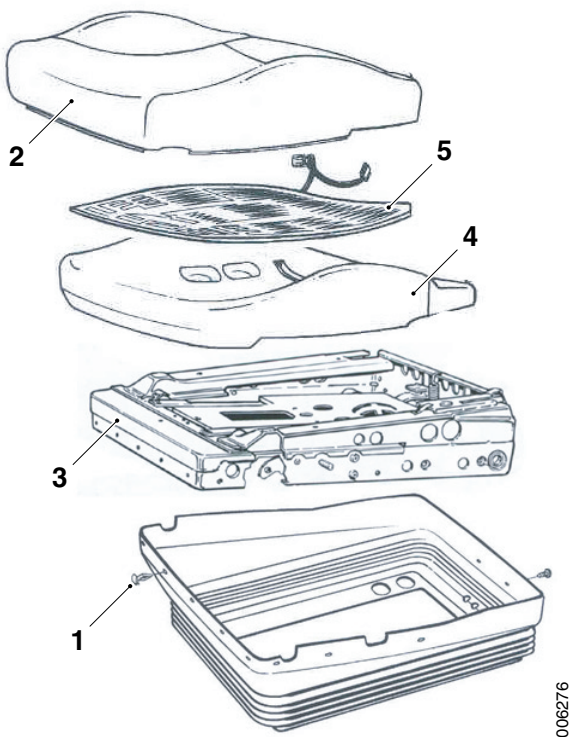
(+) If the seat is equipped with seat heater.

Unplug the connector for the heating coil before the padding is removed.

NOTE

The seat's heating coil is glued to the padding. Exercise caution if the padding is to be replaced but the heating coil is to be re-used, or if only the coil is to be replaced.

- 5 Assemble in reverse order.



1. Plastic clip, rubber bellows
2. Upholstery
3. Seat frame
4. Padding
5. Heating coil

9.3.2 Back rest cushion

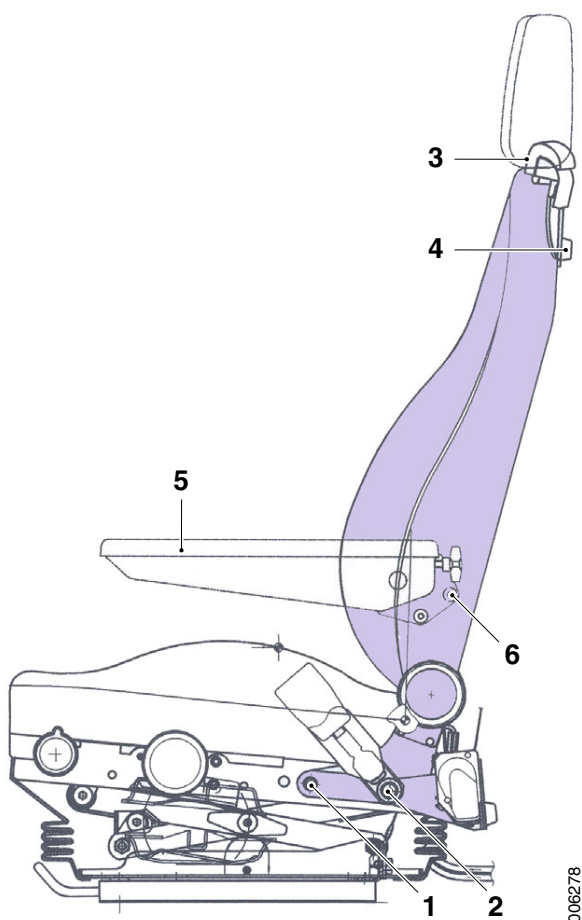
Back rest cushion, description

The function of the back rest cushion is to provide good comfort to the operator. Under the back rest cushion is the driver's seat frame. There may be a heating coil fitted (+).

For location, see *Seat, general*, page 9:11.

Back rest cushion, replacement (product alternative BE-GE)

- 1 Machine in service position, see section *B Safety*.
- 2 Detach the rubber bellows on the rear of the seat by removing the plastic clips and folding down the rubber bellows. See *Seat cushion, replacement (product alternative BE-GE)*, page 9:14.
- 3 Remove the back rest by first removing the attaching bolts (position 1) on the right and left-hand side of the seat and then remove the attaching bolts for the seat belt (position 2) on the right and left-hand 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 arm rest by removing the attaching bolts (position 6).
- 6 Position the back rest on the seat and fit the attaching bolts (position 1), do not tighten them. Then fit the attaching bolts for the seat belt (position 2).
- 7 (+) If the seat is equipped with 3-point seatbelt or armrest.
Tighten the attaching bolts for the seatbelt (position 2) with a torque of **42 Nm**, then tighten the attaching bolts (position 1) with a torque of **33 Nm**.
Cut holes in the upholstery for seat belt and arm rest on the new back rest before arm rest or seat belt is installed.
- 8 Fit in the reverse order.



1. Attaching bolt back rest
2. Attaching bolt, seat belt
3. Cover, belt guide
4. Attaching bolt, belt guide
5. Arm rest
6. Attaching bolt, arm rest

9.3.3 Heating coil

Heating coil, description



The function of the heating coil is to warm the back rest and seat cushions in the driver's seat. The heating coil is fitted under the upholstery on the seat.

The heating coil (E803) is supplied with voltage upon warm-up by Control unit, cab (D790-1) via Relay, seat heating (K383). The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.3.8 *CAB, menu 8*.

Heating coil, replacement (product alternative BE-GE)

See *Seat cushion, replacement (product alternative BE-GE)*, page 9:14.

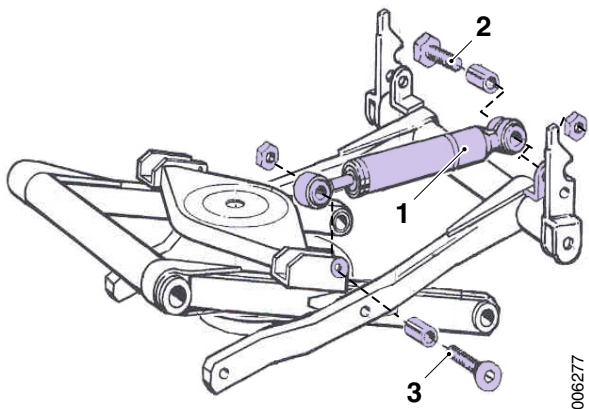
9.3.4 Bumper

Bumper, description

The bumpers are integrated in the suspension unit in the seat's frame and are self-adjusting, that is, they adjust automatically to the operator's weight.

Bumper, replacement (product alternative BE-GE)

- 1 Machine in service position, see section *B Safety*.
- 2 Remove the driver's seat from the frame and lift it out of the machine. See *Seat, replacement (product alternative BE-GE)*, page 9:13.
- 3 Remove the seat cushion, see *Seat cushion, replacement (product alternative BE-GE)*, page 9:14.
- 4 Remove the back rest cushion, see *Back rest cushion, replacement (product alternative BE-GE)*, page 9:15.
- 5 Remove the bumper's attaching bolts (position 2 and 3).
- 6 Replace the bumper (position 1).
- 7 Assemble in reverse order.



1. Bumper
2. Attaching bolt
3. Attaching bolt

9.3.5 Air suspension

Air suspension, description



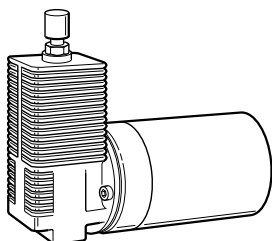
The air-suspension driver's seat consists of a seat with rubber bellows and compressor. The air suspension is self-adjusting, that is, it adjusts automatically to the operator's weight. The compressor provides air for the suspension unit.

9.3.5.1 Compressor, air suspension

Compressor air-suspension seat, description



The compressor is part of the air-suspension driver's seat and is fitted inside the seat's suspension unit.



Compressor air-suspension seat

9.3.6 Mechanical seat adjustment

Mechanical seat adjustment, description

Seat adjustment is all mechanical and is adapted by the operator with different controls in order to obtain a good sitting position.

See:

- *Seat, description (product alternative Hao Bang)*, page 9:11
- *Seat, description (product alternative BE-GE 9200)*, page 9:12
- *Seat, description (product alternative BE-GE 9200 air suspension)*, page 9:13

9.3.8 Arm rest

Armrests, description

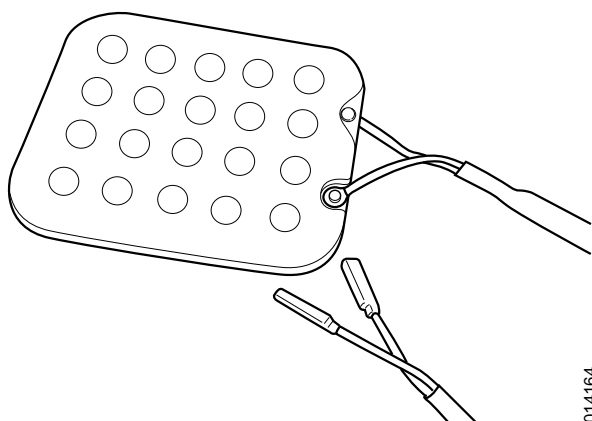
The armrest is affixed to the back rest and is individually adjustable vertically (around the attachment point). Depending on options there is also an arm rest for the left-hand side:

9.3.9 Sensor, operator-in-seat

Sensor, operator-in-seat, description (product alternative Hao Bang)

Sensor, operator-in-seat (S230) is fitted under the seat cushion's upholstery and it detects whether the driver's seat is depressed, which indicates to the control system that the driver's seat is occupied. This is used to allow the control system to indicate with Buzzer, operator-in-seat (H853) if the operator leaves the driver's seat without applying the parking brake.

The signal from Sensor, operator-in-seat (S230) is also used to set the transmission in neutral position if the operator leaves the seat. In an emergency situation the machine can be operated by bypassing the safety system. Activate the by-pass switch, select travel direction and drive the machine to the workshop. Speed is limited to 10 km/h.



Sensor, operator-in-seat (S230) (product alternative Hao Bang)

014164



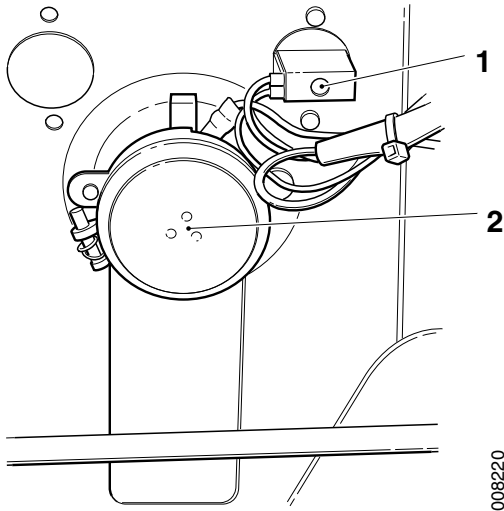
DANGER

Bypassing the safety systems results in a risk of tipping. Use at your own risk.

Extreme hazard to personal health and risk of property damage!

Only use the bypass of safety systems in emergency situations.

Sensor, operator-in-seat (S230) is supplied with voltage by and sends a voltage signal to Control unit, cab (D790-1). The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.3.6 *CAB, menu 6*.



Seat, view from below

1. Sensor, operator-in-seat, (S230) (product alternative BE-GE)
2. Buzzer (H853)

008220

Sensor, operator-in-seat, description (product alternative BE-GE)



Sensor, operator-in-seat (S230) is fitted under the seat cushion and it detects whether the driver's seat suspension is depressed, which indicates to the control system that the driver's seat is occupied. This is used to allow the control system to indicate with Buzzer, operator-in-seat (H853) if the operator leaves the driver's seat without applying the parking brake.

The signal from Sensor, operator-in-seat (S230) is also used to set the transmission in neutral position if the operator leaves the seat. In an emergency situation the machine can be operated by bypassing the safety system. Activate the by-pass switch, select travel direction and drive the machine to the workshop. Speed is limited to 10 km/h.



DANGER

Bypassing the safety systems results in a risk of tipping. Use at your own risk.

Extreme hazard to personal health and risk of property damage!

Only use the bypass of safety systems in emergency situations.

Sensor, operator-in-seat (S230) is supplied with voltage by and sends a voltage signal to Control unit, cab (D790-1). The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.3.6 *CAB, menu 6*.

9.4 Heating, ventilation and air conditioning

Heating, ventilation and air conditioning, description

The heating system controls heating and ventilation of the cab. The cab can also be equipped with air conditioning.

The temperature in the cab is thermostat-controlled by Control unit, cab (D790-1). The cab temperature is regulated to the set temperature. The temperature can be set between 16 and 28 °C. The unit is operated with controls on the dashboard panel.

Heating system (ECH)

The heating system (ECH) handles heating and ventilation. (The heating system cannot provide cooling.)

The heating system uses heat from the engine's cooling system via a heating coil to heat the ambient air. The fan forces the ambient air through the heating coil on through ducts in the cab interior. It is then directed to the windscreen (defroster) or the feet.

Air conditioning (ECC)

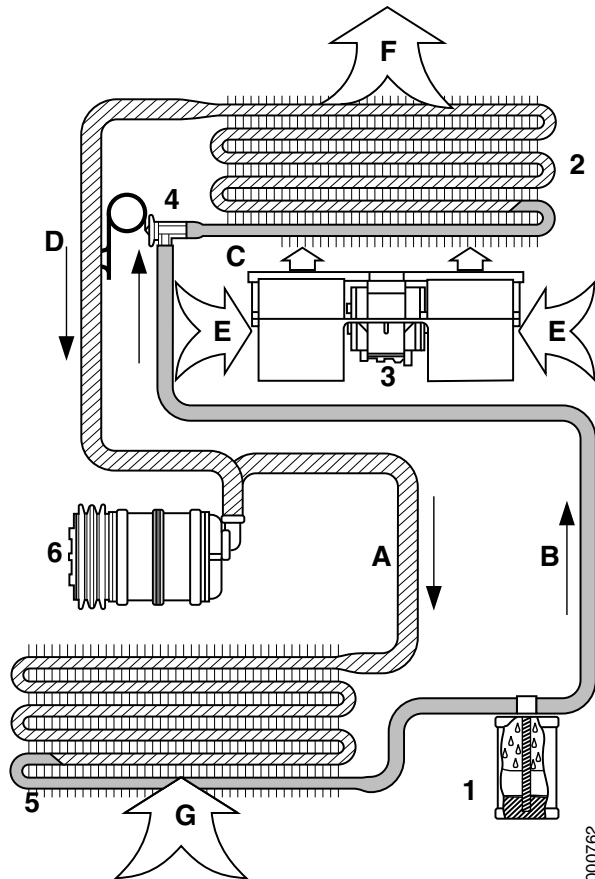


The climate control system (ECC) is responsible for heating, ventilation, cooling and dehumidifying. The air is heated in the same way as for the heating system (ECH).

During cooling, ambient air is forced through the evaporator, which cools the air. The air can then be directed in the same way as for the heating system.

The function of the air conditioning is to:

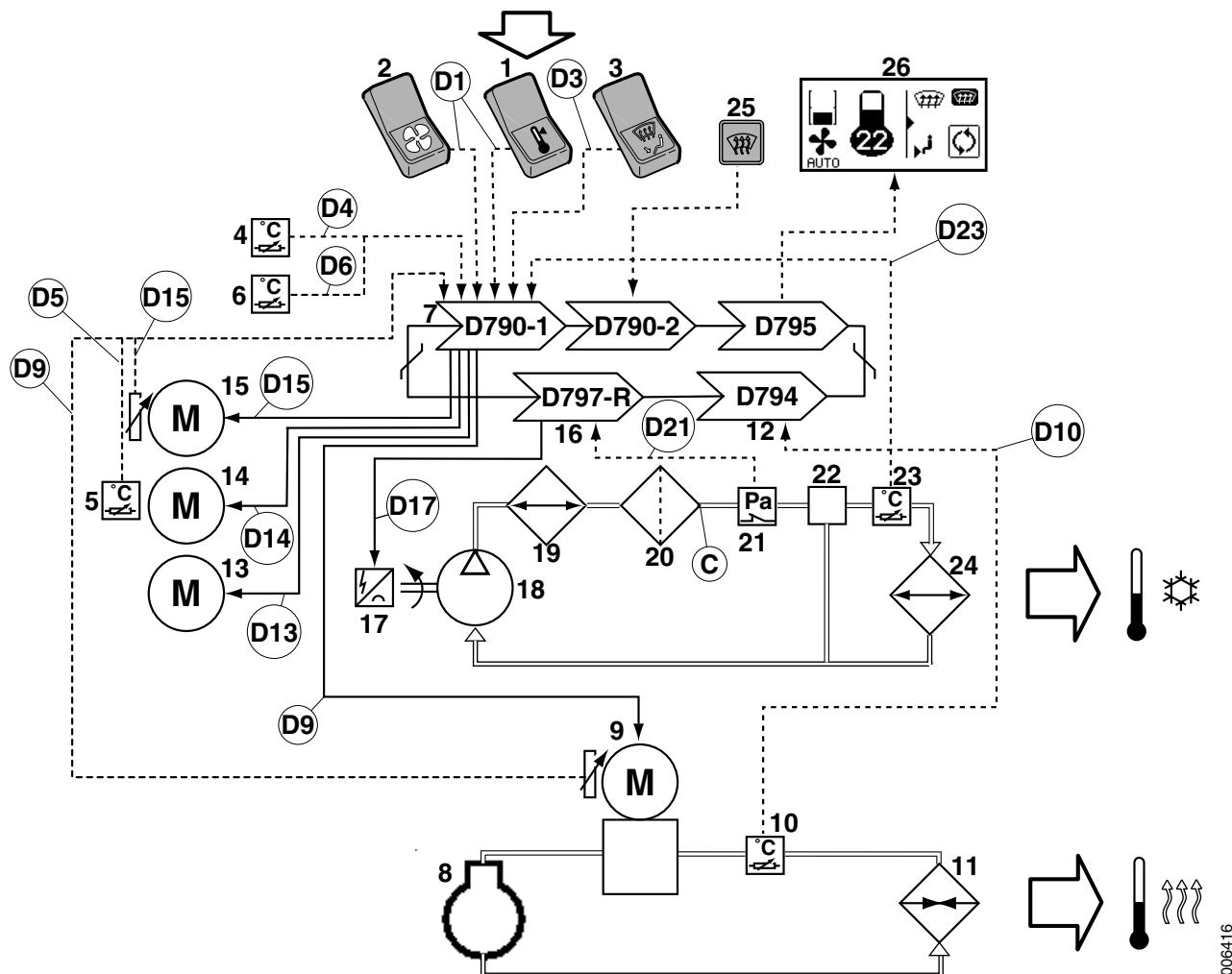
- heat the air when it is cold
- dehumidify the air when it is damp
- clean the air of impurities
- cool the air when it is hot
- defrost (defroster function)



Outline view, air conditioning

1. Fluid reservoir/filter dryer with integrated pressure switch
 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 cab ventilation
F Heated or cooled air to the cab
G Outdoor air for eliminating heat

Heating, ventilation and air conditioning, function description



Pos	Explanation	Signal description	Reference
1	Switch, temperature (S117) sends a voltage signal to Control unit, cab (D790-1).	Raise: U = 2.0–2.5 V Unaffected: U = 0-0.5 V Lower: U = 4.5-5.0 V	<i>Controls and instruments, overview</i> , page 9:3 D1: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.4.5, <i>CLIMATE menu 5</i>
2	Switch, fan (S118) sends a voltage signal to Control unit, cab (D790-1).	Raise: U = 2.0–2.5 V Unaffected: U = 0-0.5 V Lower: U = 4.5-5.0 V	<i>Controls and instruments, overview</i> , page 9:3 D2: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.4.5, <i>CLIMATE menu 5</i>
3	Switch, air distribution (S139) sends a voltage signal to Control unit, cab (D790-1).	Scroll up: U = 2.0–2.5 V Unaffected: U = 0 V Scroll down: U = 4.5-5.0 V	<i>Controls and instruments, overview</i> , page 9:3 D3: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.4.5, <i>CLIMATE menu 5</i>
4	Sensor, cab temperature (B775-1) sends a voltage signal proportional to the temperature to Control unit, cab (D790-1).	R = 10 kΩ at 25 °C	<i>Sensor, cab temperature, description</i> , page 9:51 D4: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.4.1, <i>CLIMATE menu 1</i>
5	Sensor, blower fan temperature (B775-2) sends a voltage signal proportional to the temperature to Control unit, cab (D790-1).	R = 10 kΩ at 25 °C	<i>Sensor, temperature outlet fan, description</i> , page 9:50 D5: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.4.2, <i>CLIMATE menu 2</i>

Pos	Explanation	Signal description	Reference
6	Sensor, ambient temperature (B774) sends a voltage signal proportional to the temperature to Control unit, cab (D790-1).	R = 10 kΩ at 25 °C	<i>Sensor, ambient temperature, description</i> , page 9:52 D6: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.4.2, <i>CLIMATE menu 2</i>
7	Control unit, cab (D790-1) regulates temperature and air distribution with signals from sensors and controls.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
8	The engine produces heat while 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), which routes hot water for heat exchanger heat. The water valve's opening (%) is fed back to the 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</i> , page 9:36 D9: Diagnostic menu, see section 8 <i>Control 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 a voltage signal proportional to the engine temperature to Control unit, engine (D794).	Checked by control system, error shown with error code.	Section 1 <i>Engine</i> D10: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.4.2, <i>CLIMATE menu 2</i>
11	Heat exchanger heat supplies heat to the cab air. The heat is transferred from the engine's cooling system to the cab air.	-	<i>Heat exchanger heat, description</i> , page 9:33
12	Control unit, engine (D794) transmits engine temperature in the cooling system on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.10 <i>Control unit, engine</i>
13	Control unit, cab (D790-1) controls Actuator motor, recirculation (M612) which sets the fresh air or recirculation damper in the required position.	Checked by control system, error shown with error code.	<i>Fresh air filter or recirculation damper, description</i> , page 9:27 D13: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.4.6, <i>CLIMATE menu 6</i>
14	Control unit, cab (D790-1) controls Fan motor (M657), which increases the airflow in the cab.	Checked by control system, error shown with error code.	<i>Cab fan, description</i> , page 9:30 D14: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.4.6, <i>CLIMATE menu 6</i>
15	Control unit, cab (D790-1) controls Damper motor (Y672), which sets the air distributor to the required position. The air distributor's position is fed 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</i> , page 9:48 D15: Diagnostic menu, see section 8 <i>Control 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 AC compressor engagement.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.3 <i>Control unit, frame rear</i>
17 +	Control unit, frame rear (D797-R) supplies voltage to Electromagnetic clutch (645) on the compressor.	U = 24 V	<i>Compressor, air conditioning, description (engine alternative Yuchai YC6M360-30)</i> , page 9:37 <i>Compressor, air conditioning, replacement (engine alternative Yuchai YC6M360-30)</i> , page 9:37 D17: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.4.6, <i>CLIMATE menu 6</i>

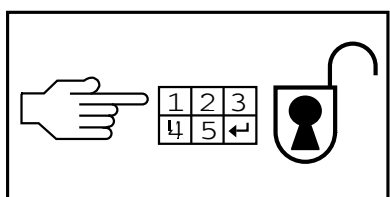
Pos	Explanation	Signal description	Reference
18 	The compressor draws gaseous refrigerant from the evaporator, compresses it, and forces it on to the condenser.	-	<i>Compressor, air conditioning, description (engine alternative Yuchai YC6M360-30), page 9:37</i> <i>Compressor, air conditioning, replacement (engine alternative Yuchai YC6M360-30), page 9:37</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 9:40</i>
20 	The moisture filter absorbs any moisture from the cooling circuit. The fluid reservoir stores the refrigerant.	-	<i>Receiver drier, description, page 9:42</i>
21 	Pressure switch (S246) sends a signal to Control unit, frame rear (D797-R) if the pressure in the system becomes abnormally high or low.	U = 24 V	<i>Pressure switch, description, page 9:42</i> D21: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.4.3, <i>CLIMATE menu 3</i>
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 expansion valve increases the flow of refrigerant so that heat dissipation in the evaporator increases.	-	<i>Expansion valve, description, page 9:44</i>
23 	Sensor, refrigerant circuit temperature, sends a voltage signal proportional to the temperature to Control unit, cab (D790-1).	R = 10 kΩ at 25 °C	<i>Sensor, temperature refrigerant, description, page 9:45</i> D23: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.4.2, <i>CLIMATE menu 2</i> .
24 	Heat exchanger, cooling, dissipates heat from the cab air. The heat is transferred from the air to the refrigerant and transforms the refrigerant to a gaseous state.	-	<i>Heat exchanger, cooling, description, page 9:47</i>
25	The defroster switch on Control unit KIT (D790-2) activates the defroster program for the air conditioning for six minutes.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.11 <i>Control unit, KIT</i>
26	Control unit KID (D795) shows the heating and ventilation settings in the display.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.12 <i>Control unit, KID</i>

Heating, ventilation and air conditioning, checking

- Machine in service position, see section *B Safety*.
- Navigate to the service menu and press Enter.



000056



000060

- Enter the code for diagnostics. Code is obtained from Cargotec Support.

NOTE

The code determines which service menu is activated (Service, Diagnostic test, Initiation or Calibration).

DIAGNOSIS	
CAN/POWER LIGHTS CAB	
CLIMATE	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 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

DIAG CLIMATE 4 (8)	
PRESENT INPUT SIGNAL	
WATER VALVE	XX.XXV
DRAUGHT VALVE	XX.XXV

000135

4 Select CLIMATE.

Menu 1

- 5 Checking the desired temperature, inside temperature sensor and water valve.

REQUIRED TEMP: should be 160 (16.0 °C) for max. cooling and 280 (28.0 °C) for max. heating. The setting is changed with the temperature switch.

PRESENT TEMP: shows the temperature inside the cab. This is measured by Sensor, cab temperature (located down to the left on the instrument panel, behind the rubber lead-through). 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), and 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 that is sent on the CAN bus.

TEMP AMBIENT: outdoor temperature that is measured by Sensor, outdoor temperature (B774).

TEMP DE-ICE: cooling circuit's temperature that is measured by Sensor, temperature refrigerant (B775-1). If the compressor is activated then 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 the refrigerant circuit is filled.

PRESSURE SWITCH: 0 = not filled, 1 = filled.

The sensor is located on the receiver drier which is fitted right rear in the frame.

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 the 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 window. 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.

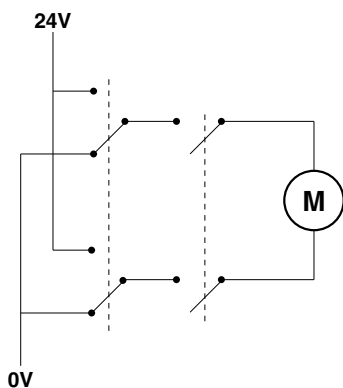
DIAG CLIMATE 5 (8)		
PRESENT INPUT	SIGNAL	
REQUIRED TEMP	XX.XXV	
REQ. DRAUGHT	XX.XXV	
REQ. FAN SPEED	XX.XXV	

000136

DIAG CLIMATE 6 (8)		
PRESENT OUTPUT	SIGNAL	
FAN SPEED	XXX	
RECIRKULATION	XY	
COMPRESSOR	XY	

000137

DIAG CLIMATE 7 (8)		
OUTPUT WATER VALVE		
CLOCKWISE	XY	XY
ANTI-CLOCKWISE	XY	XY



000138

Menu 5

- 9 Checks the switches for temperature, air distribution and fan speed.

REQUIRED TEMP: home position U = 0 V; raise U = 2-2.5 V; lower U = 4.5-5 V.

REQ. DRAUGHT: home position U = 0 V; against window U = 2-2.5 V; against floor U = 4.5-5 V.

REQ. FAN SPEED: home 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 Electromagnetic clutch, compressor (M645) .

FAN SPEED: increase and decrease fan speed, value should increase from 0 to 255 in steps.

RECIRCULATION: press in the Switch, bypass (S1005) (on the panel for load handling functions). When checking, the display should show "11". Check that the damper actually moves as it should by removing the fresh air filter at the front of the climate control system casing and feeling with your hand.

 (Only machines with ECC)

COMPRESSOR: lower the 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.

Menu 7

- 11 Checks the direction selector for Water valve (Y673).

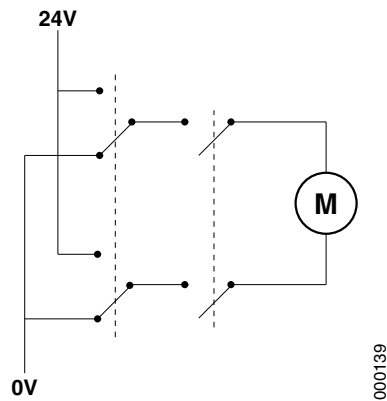
CLOCKWISE: when the temperature is increased and the water valve opens shows "CLOCKWISE 11 11" and "ANTI-CLOCKWISE 00 11".

ANTI-CLOCKWISE: when the temperature is decreased and the water valve closes shows "CLOCKWISE 00 11" and "ANTI-CLOCKWISE 11 11".

NOTE

The "ones" are only shown for a moment when the water valve changes position, "zeros" are shown when the valve does not change position. The water valve does not open if the engine temperature is low, or if the outdoor temperature is high.

DIAG CLIMATE		8 (8)
OUTPUT DRAUGHT VALVE		
CLOCKWISE	XY	XY
ANTI-CLOCKWISE	XY	XY



Menu 8

- 12 Checks the direction selector for the air distributor.

CLOCKWISE: when the air is directed against the windscreen and the air distributor changes position shows "CLOCKWISE 00 11" and "ANTI-CLOCKWISE 11 11".

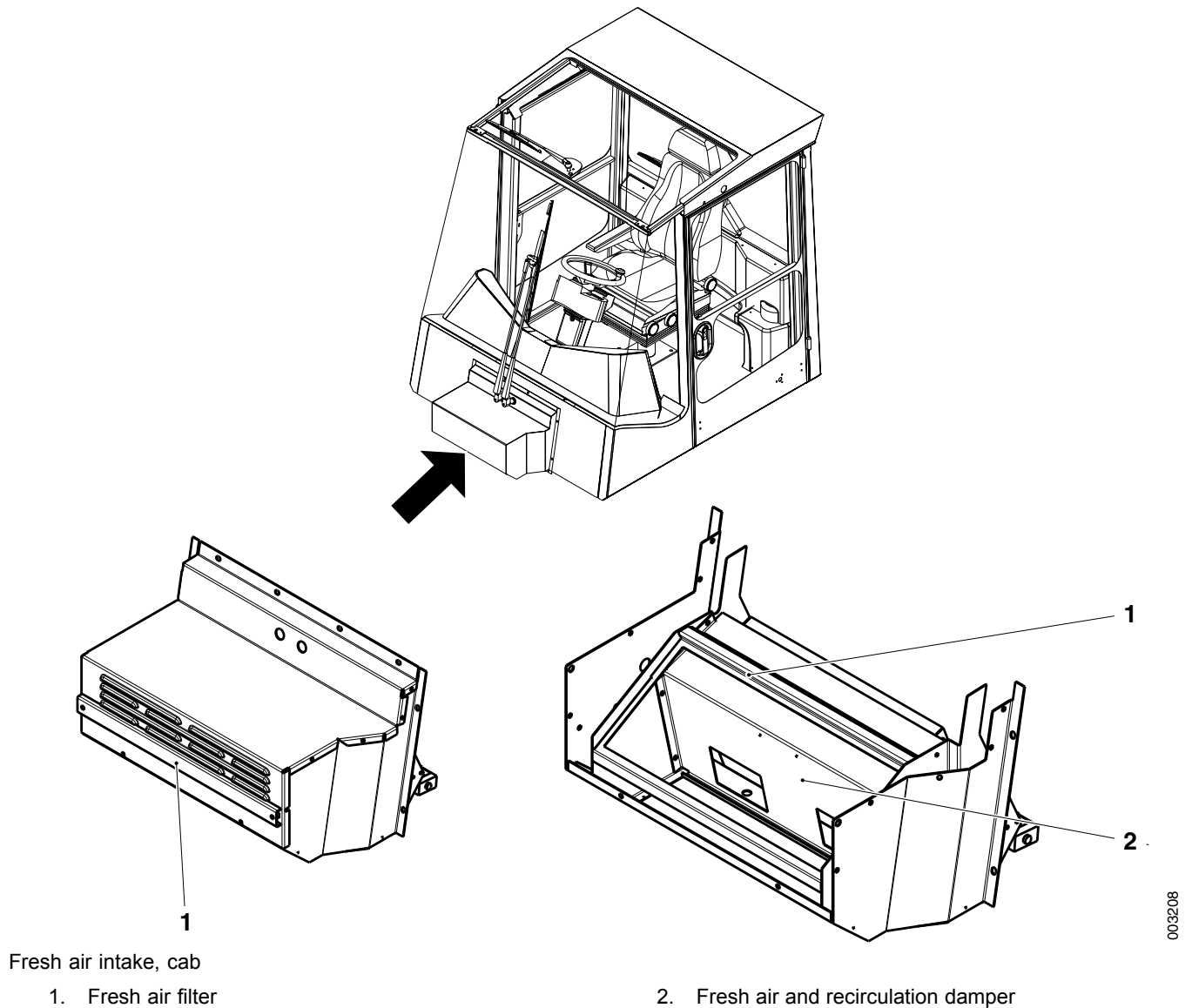
ANTI-CLOCKWISE: when the air is directed against the feet and the air distributor changes position shows "CLOCKWISE 11 11" and "ANTI-CLOCKWISE 00 11".

NOTE

The "ones" are only shown for a moment when the air distributor changes position, "zeros" are shown when the air distributor does not change position.

9.4.1 Fresh air filter

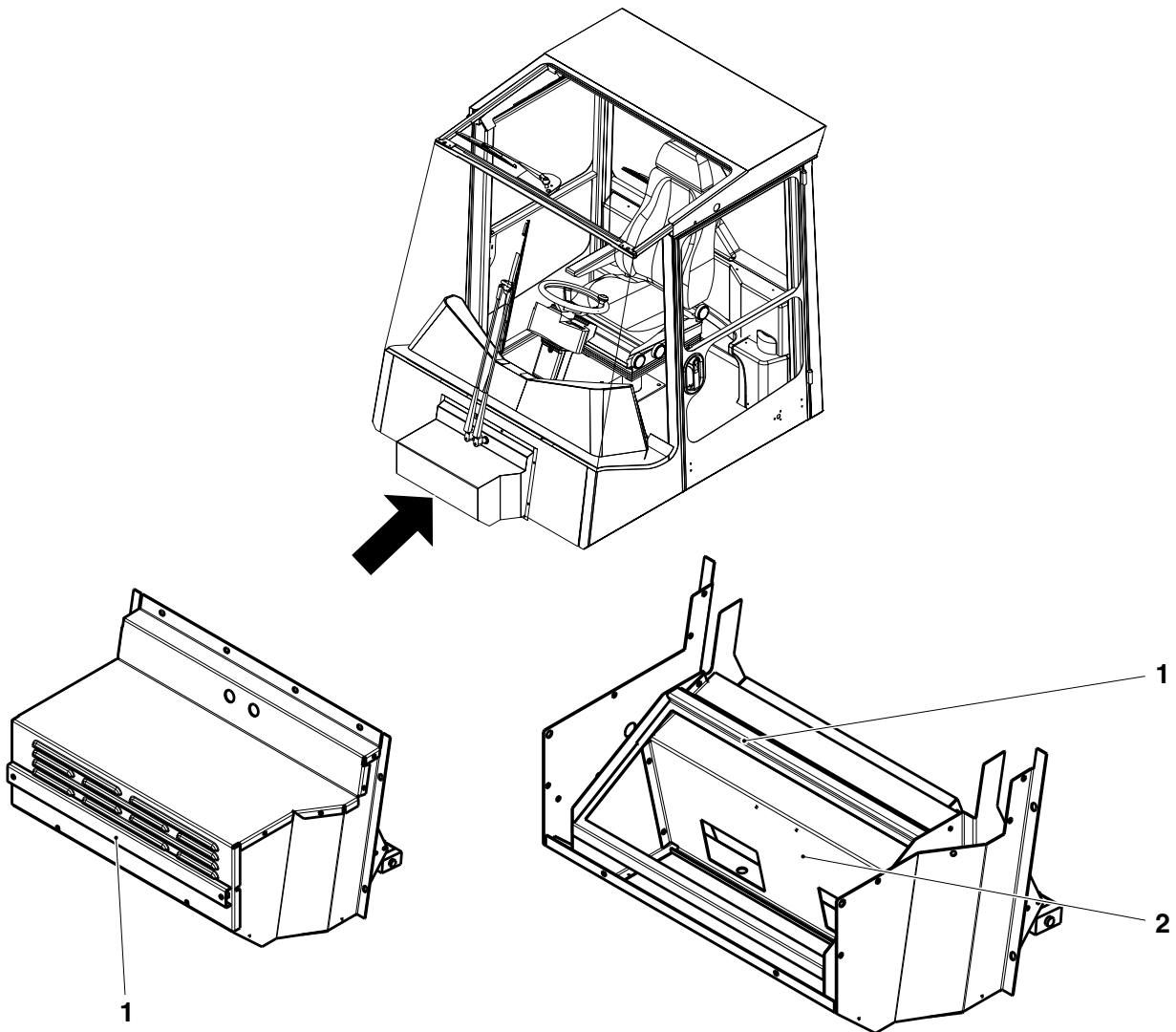
Fresh air filter, description



The fresh air filter is located under a cover in the external unit for fresh air intake into the cab, in front of the cab fan.

9.4.2 Fresh air and recirculation damper

Fresh air filter or recirculation damper, description



003208

Fresh air intake, cab

1. Fresh air filter

2. Fresh air and recirculation damper

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 intake into the cab.

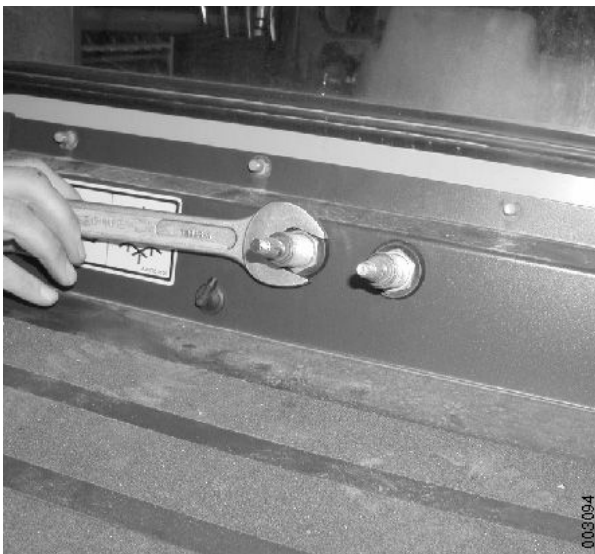
The signal can be checked via the diagnostic menu, section 8 *Control system*, group 8.4.4.6 *CLIMATE*, menu 6.

Motor, fresh air filter or recirculation damper, replacement

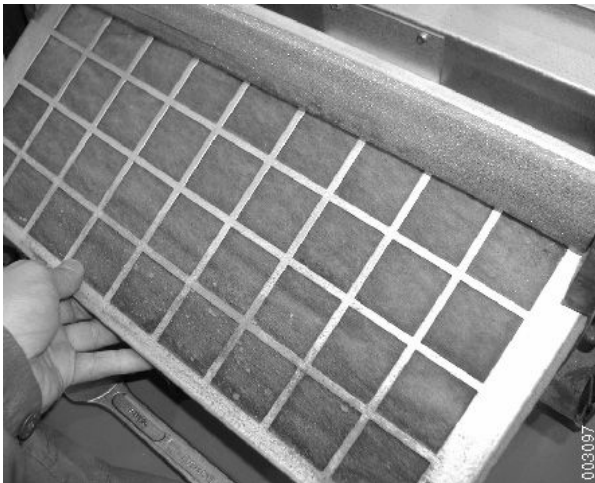
- 1 Machine in service position, see section *B Safety*.
- 2 Remove the wiper arms.

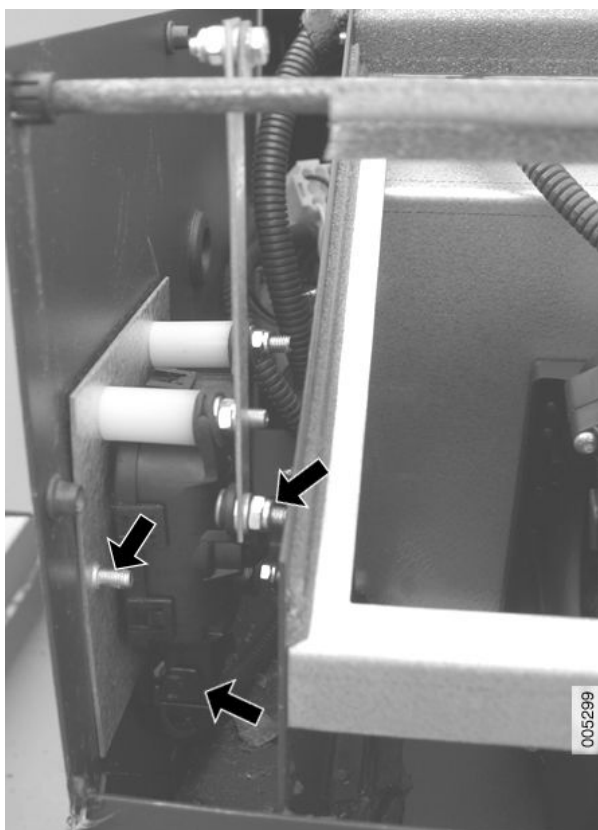


- 3 Remove the nuts which hold the wiper motor in the protective plate.
- 4 Remove the protective plate.



- 5 Remove the fresh air filter.





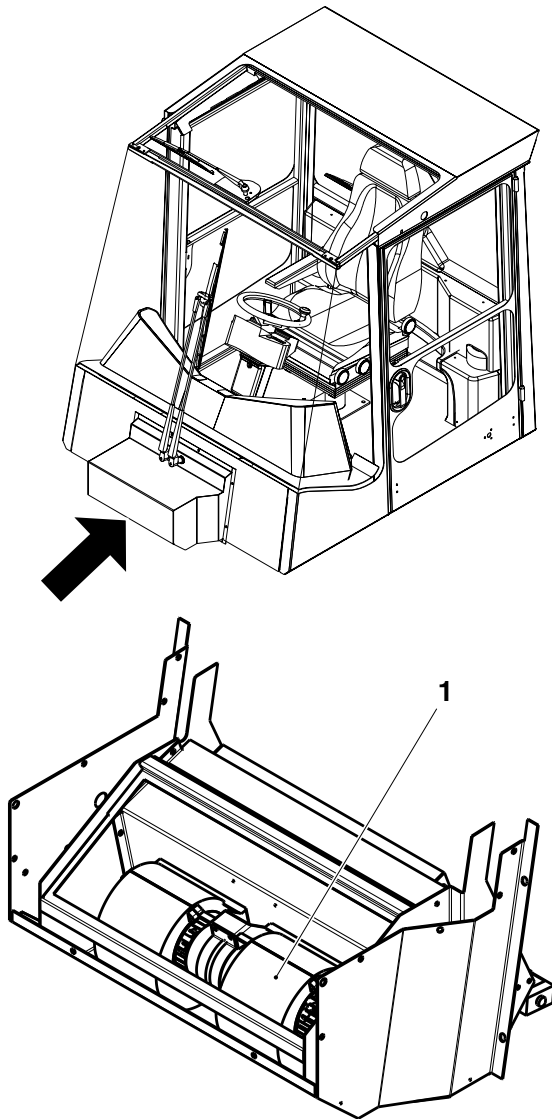
- 6 Remove the bolts which secure the arm and motor in the plate.
- 7 Detach the connector from the motor.
- 8 Replace the motor.
- 9 Fit in the reverse order. Tighten the wiper arm to 16-20 Nm.

9.4.3 Cabin fan

Cab fan, description

The cab fan is located in the external unit for fresh air intake into the cab. The fan consists of two single fans that are driven by a motor.

The signal can be checked via the diagnostic menu, section *8 Control system*, group *8.4.4.6 CLIMATE*, menu 6.



003209

Fresh air intake, cab

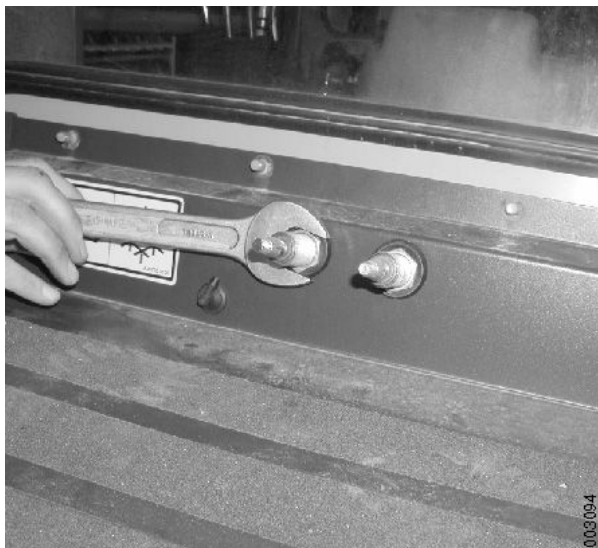
1. Cabin fan

Cab fan, replacement

- 1 Machine in service position, see section *B Safety*.
- 2 Remove the wiper arms.



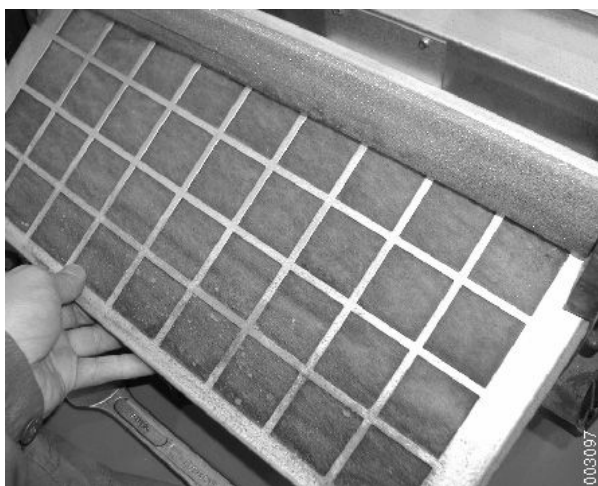
003079



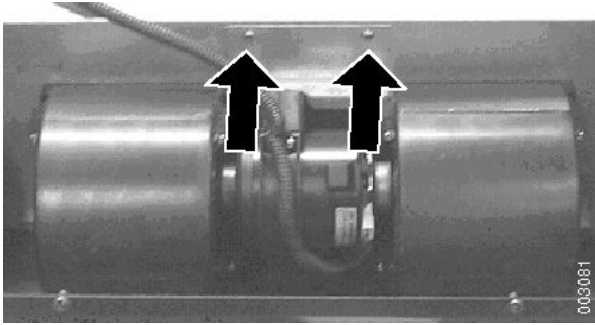
- 3 Remove the bolts which hold the wiper motor in the protective plate.
- 4 Remove the protective plate.



- 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.

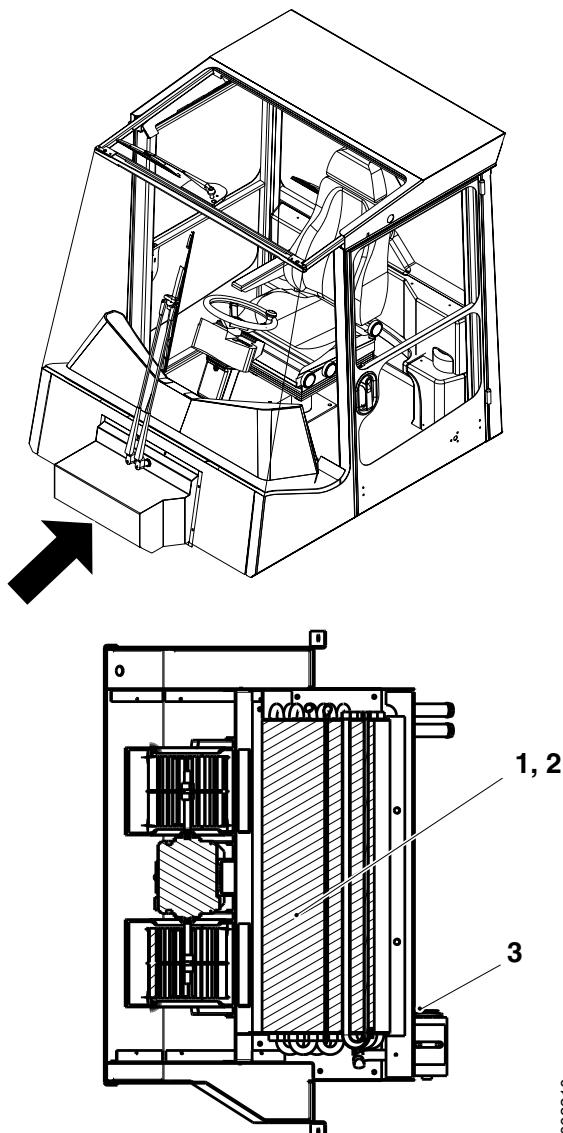


- 8 Detach the connector from the cab fan.
9 Remove the cab fan.
10 Replace the cab fan.
11 Fit in the reverse order. Tighten the wiper arm to 16-20 Nm.

9.4.4 Heat exchanger heat

Heat exchanger heat, description

The heat from the engine's coolant is transferred to the cab via the heat exchanger. The heat exchanger is located behind the fan in the external unit for fresh air intake into the cab.



Fresh air intake, cab

1. Heat exchanger heat
2. Heat exchanger, cooling
3. Expansion valve and sensor for refrigerant temperature

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 section *B Safety*.

- 2 Drain the AC system of R134a refrigerant.

IMPORTANT

Working on the air conditioning requires special authorisation.

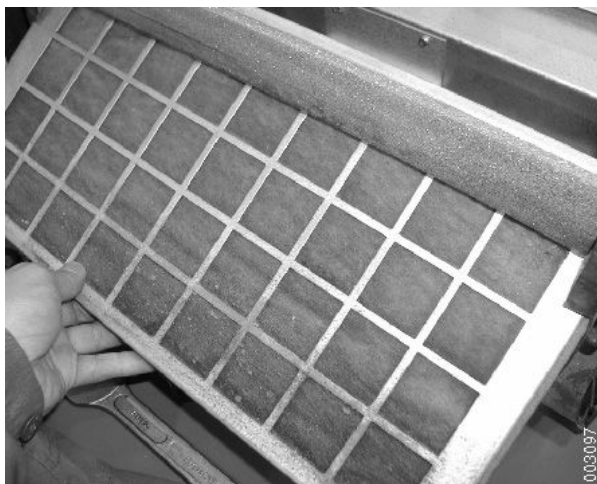
- 3 Detach the AC system hoses and the coolant hoses.
4 Remove the wiper arms.
5 Remove the nuts which hold the wiper motor in the protective plate.
6 Remove the protective plate.

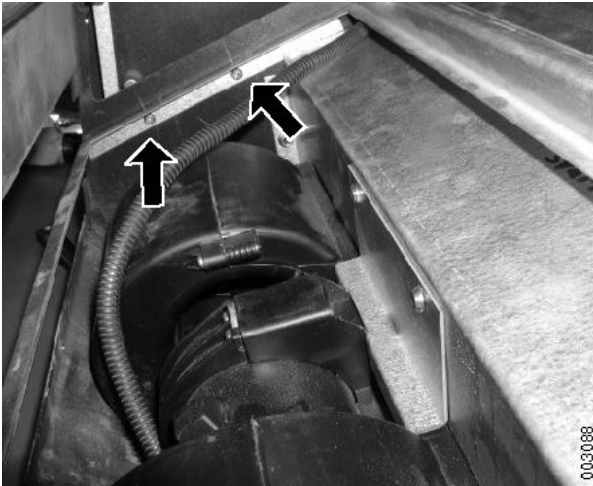


- 7 Detach the washer hose from the protective plate.

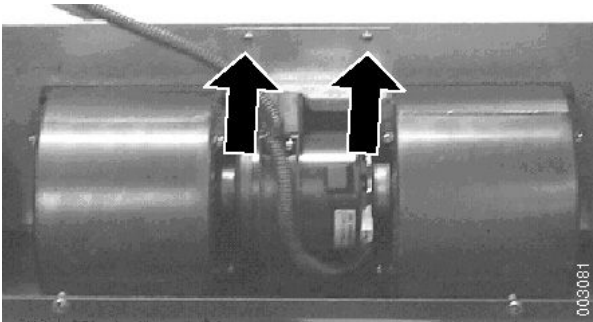


- 8 Remove the fresh air filter.





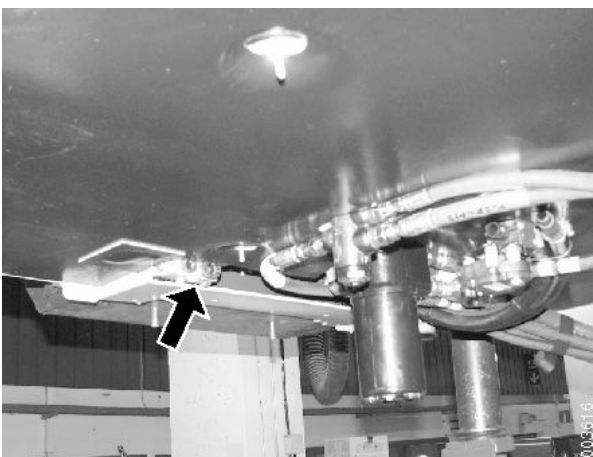
9 Remove the plate frame.



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 Replace 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, using the intended equipment.

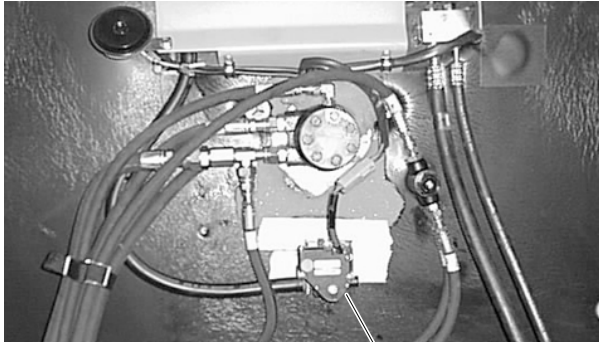
For volume, see section *F Technical data*.

IMPORTANT

Working on the air conditioning requires special authorisation.

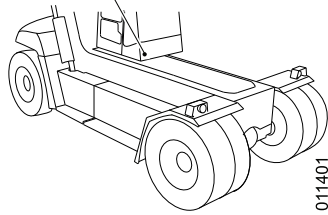
9.4.5 Water valve

Water valve, description



The water valve controls the climate control system's capacity for heating from 0 (closed valve) to 100% (open valve). The water valve is electrically controlled.

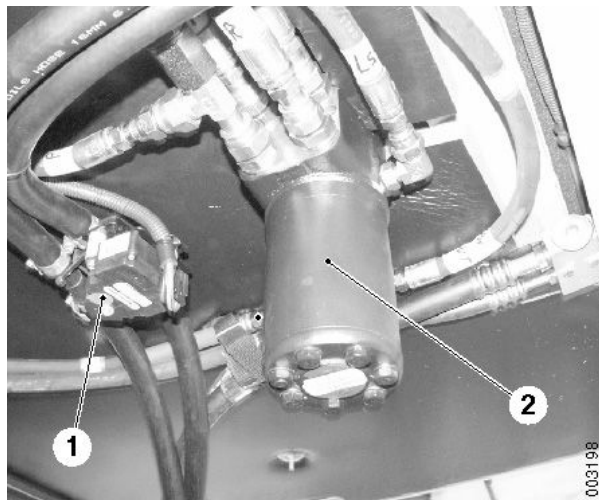
The signal can be checked from the diagnostic menu, section 8 *Control system*, group 8.4.4.1 *CLIMATE*, menu 1, 8.4.4.4 *CLIMATE*, menu 4 and 8.4.4.7 *CLIMATE*, menu 7.



Water valve position under cab floor (from below)

Water valve, replacement

- 1 Machine in service position, see section *B Safety*.
- 2 Detach the connector from the water valve.
- 3 Stop the flow of fluid to and from the water valve using hose pinch-off pliers.
- 4 Detach the coolant hoses from the water valve.
- 5 Remove the water valve from the cab floor.
- 6 Replace the water valve.
- 7 Fit in the reverse order.
- 8 Check the coolant level.



1. Water valve
2. Steering valve

9.4.6 Sensor, engine temperature

Sensor, engine temperature, description

Sensor, coolant temperature, is fitted on the engine and detects engine's coolant temperature. See supplier documentation, engine.

The signal can be checked via the diagnostic menu, section 8 *Control system*, group 8.4.4.2 *CLIMATE*, menu 2.

For location, see section 1 *Engine*.

9.4.7 Compressor

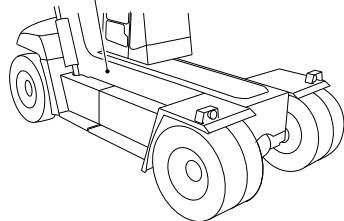
Compressor, air conditioning, description (engine alternative Yuchai YC6M360-30)



The compressor drives the air conditioning 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 an electromagnetic clutch, which is controlled by a thermostat.

The signal can be checked via the diagnostic menu, section *8 Control system*, group *8.4.4.6 CLIMATE*, menu 6.



014126

Compressor, air conditioning, replacement (engine alternative Yuchai YC6M360-30)



WARNING

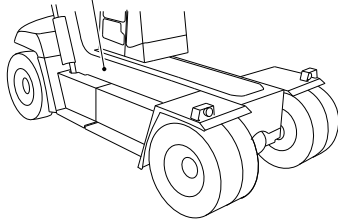
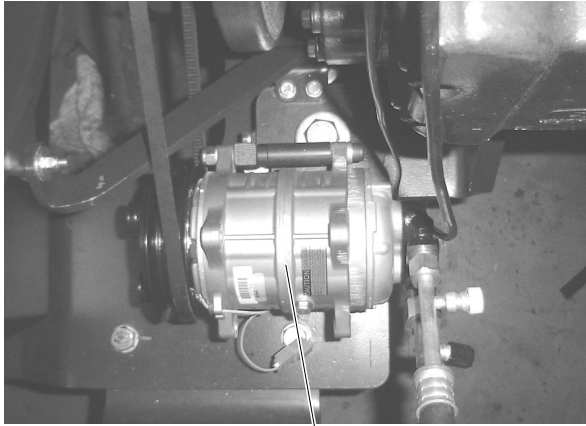
Personal injury, environmental damage.

Read the safety instructions for refrigerant, see section *B Safety*.

- 1 Machine in service position, see section *B Safety*.
- 2 Drain the AC system of R134a refrigerant.

IMPORTANT

Working on the air conditioning requires special authorisation.



014126

- 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, using the intended equipment.

For volume, see section *F Technical data*.

IMPORTANT

Working on the air conditioning requires special authorisation.

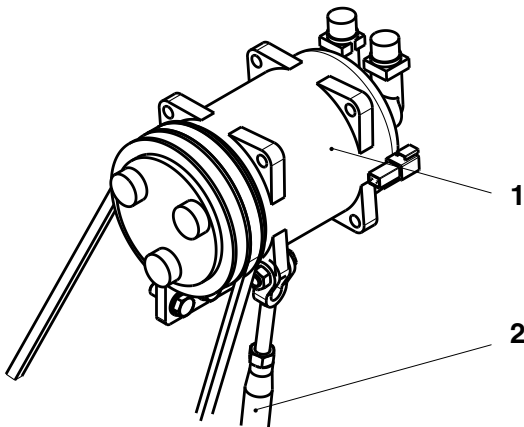
Compressor, air conditioning, description (engine alternative Cummins QSM11)



The compressor drives the air conditioning 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 an electromagnetic clutch, which is controlled by a thermostat.

The signal can be checked via the diagnostic menu, section *8 Control system*, group *8.4.4.6 CLIMATE*, menu *6*.



005000

1. Compressor air conditioning
2. Turnbuckle

Compressor, replacement (engine alternative Cummins QSM11)



WARNING

Personal injury, environmental damage.

Read the safety instructions for refrigerant, see section *B Safety*.

- 1 Machine in service position, see section *B Safety*.
- 2 Drain the AC system of R134a refrigerant.

IMPORTANT

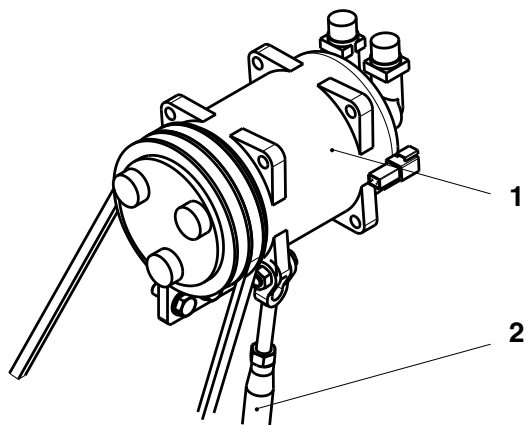
Working on the air conditioning requires special authorisation.

- 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, using the intended equipment.

For volume, see section *F Technical data*.

IMPORTANT

Working on the air conditioning requires special authorisation.

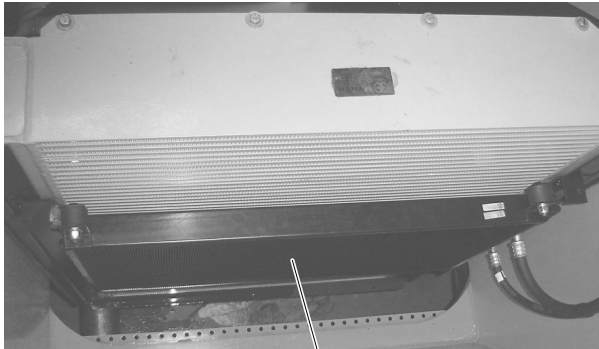


1. Compressor air conditioning
2. Turnbuckle

005000

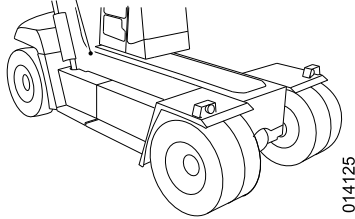
9.4.8 Condenser

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 temperature of the refrigerant in the condenser varies from approx. 50 °C to 70 °C and the pressure varies between 12 and 14 bar, depending on ambient temperature and airflow through the condenser. When the refrigerant has been condensed to liquid, it is directed on to the fluid reservoir/filter dryer.



014125

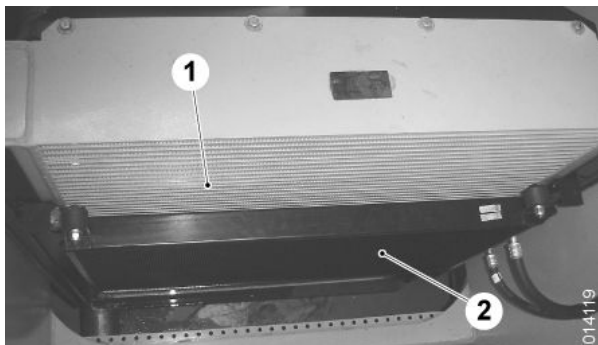
Condenser, replacement



WARNING

Personal injury, environmental damage.

Read the safety instructions for refrigerant, see section *B Safety*.



1. Radiator
2. Condenser

1 Machine in service position, see section *B Safety*.

2 Drain the AC system of R134a refrigerant.

IMPORTANT

Working on the air conditioning requires special authorisation.

- 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, using the intended equipment.
- For volume, see section *F Technical data*.

IMPORTANT

Working on the air conditioning requires special authorisation.

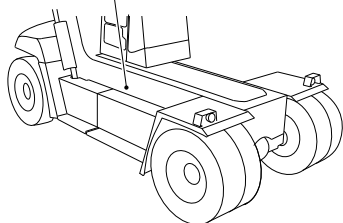
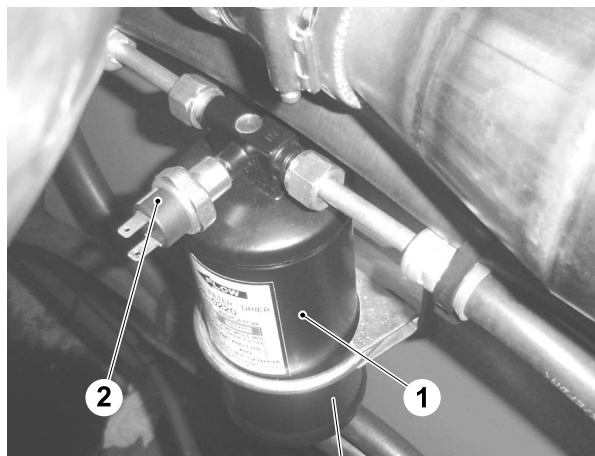
9.4.9 Receiver drier

Receiver drier, description



The receiver drier collects the liquid refrigerant, binds moisture, and filters out 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 there is flow without bubbles and that the system is adequately filled with refrigerant.



014124

1. Fluid reservoir, receiver drier
2. Pressure switch

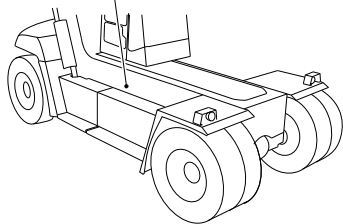
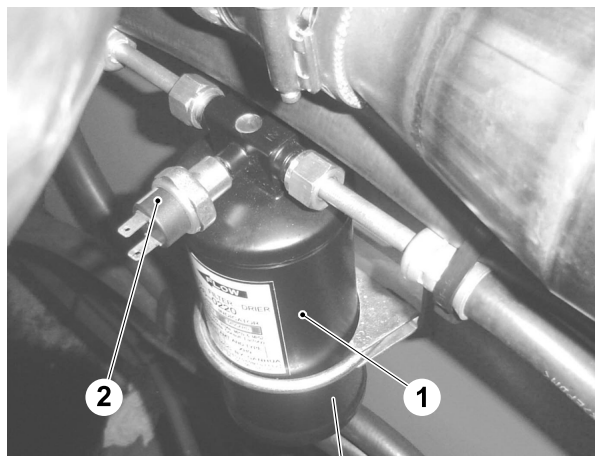
9.4.10 Pressure switch

Pressure switch, description



The pressure switch cuts off the current to the compressor's electromagnetic clutch if the pressure in the cooling circuit becomes abnormally high or low.

The signal can be checked via the diagnostic menu, section 8 *Control system*, group 8.4.4.3 *CLIMATE*, menu 3.



014124

1. Fluid reservoir, receiver drier
2. Pressure switch

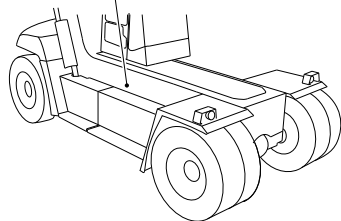
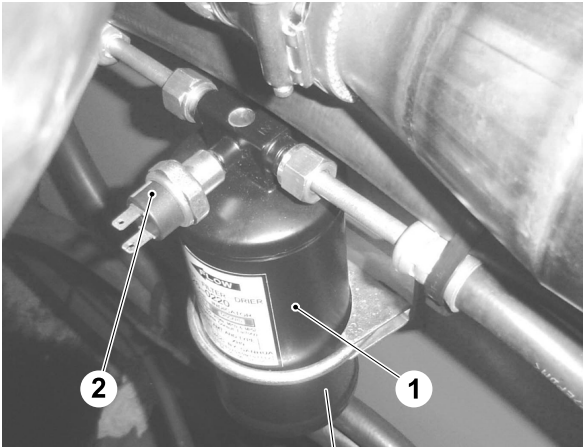
Pressure switch, replacement



WARNING

Personal injury, environmental damage.

Read the safety instructions for refrigerant, see section *B Safety*.



- 1 Machine in service position, see section *B Safety*.
- 2 Drain the machine of refrigerant, R134a.

IMPORTANT

Working on the air conditioning requires special authorisation.

- 3 Detach the connector from the pressure switch.
- 4 Unscrew the pressure switch from its mounting.
- 5 Replace the pressure switch.
- 6 Check for leaks and refill the AC-system with refrigerant R134a, using the intended equipment.

For volume, see section *F Technical data*.

IMPORTANT

Working on the air conditioning requires special authorisation.

1. Fluid reservoir, receiver drier
2. Pressure switch

014124

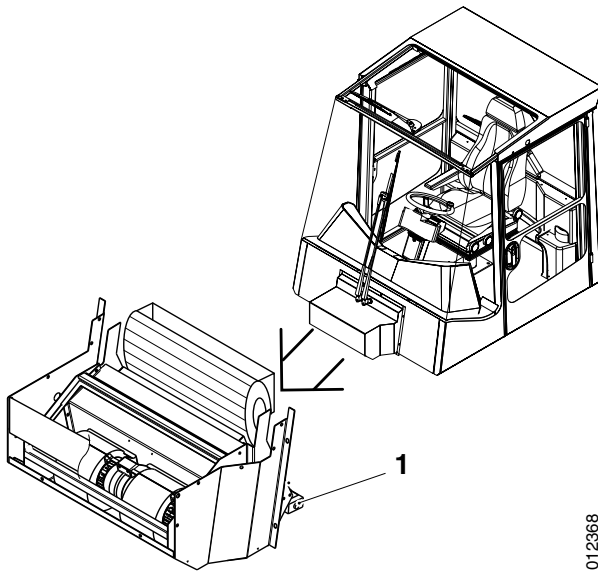
9.4.11 Expansion valve

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 through 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.



012368

1. Expansion valve

Expansion valve, replacement



WARNING

Personal injury, environmental damage.

Read the safety instructions for refrigerant, see section *B Safety*.

- 1 Machine in service position, see section *B Safety*.
- 2 Drain the AC system of refrigerant.

IMPORTANT

Working on the air conditioning requires special authorisation.

- 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 9:33.
- 6 Replace the expansion valve.
- 7 Fit in the reverse order.

- 8 Check for leaks and refill the AC-system with refrigerant R134a, using the intended equipment.

For volume, see section *F Technical data*.

IMPORTANT

Working on the air conditioning requires special authorisation.

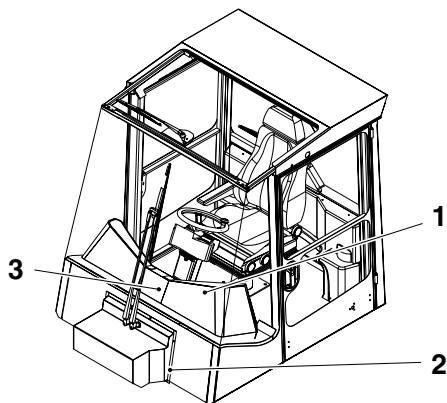
9.4.12 Sensor, temperature refrigerant

Sensor, temperature refrigerant, description



Sensor, temperature refrigerant, (position 2) detects the refrigerant temperature in the heat exchanger, cooling. This is used to control the air conditioning.

The signal can be checked via the diagnostic menu, section *8 Control system*, group *8.4.4.2 CLIMATE*, menu 2.



002226

1. Sensor cab temperature
2. Sensor temperature refrigerant
3. Sensor, temperature outlet fan

Sensor, temperature refrigerant, replacement



WARNING

Personal injury, environmental damage.

Read the safety instructions for refrigerant, see section *B Safety*.

- 1 Machine in service position, see section *B Safety*.
- 2 Drain the AC system of refrigerant.

IMPORTANT

Working on the air conditioning requires special authorisation.

- 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 9:33.
- 6 Replace the temperature sensor.
- 7 Fit in the reverse order.
- 8 Check for leaks and refill the AC-system with refrigerant R134a, using the intended equipment.
For volume, see section *F Technical data*.

IMPORTANT

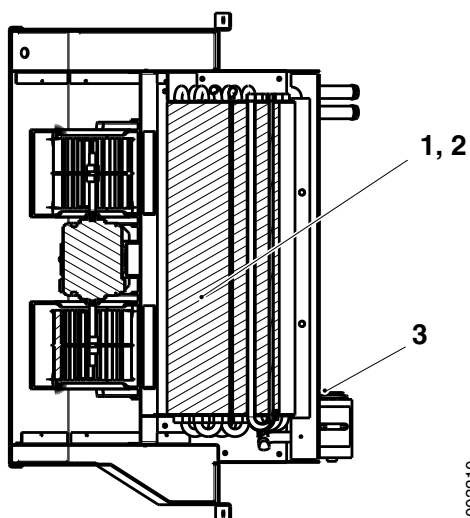
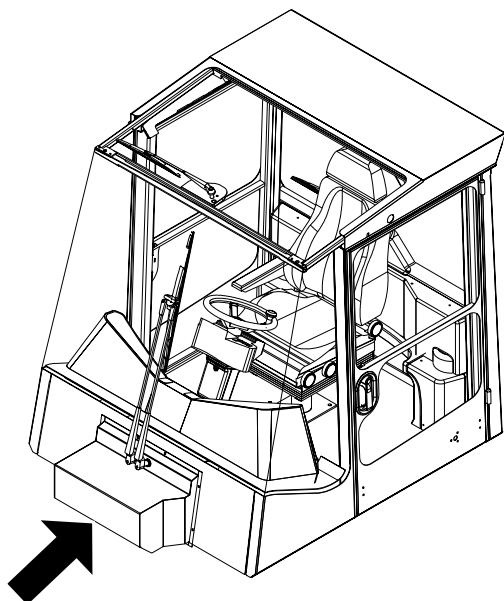
Working on the air conditioning requires special authorisation.

9.4.13 Heat exchanger, cooling

Heat exchanger, cooling, description



Heat exchanger, cooling, consists of pipes and cooling fins. The cab air is cooled as it passes through the heat exchanger, cooling. The heat exchanger is located behind the fan in the external unit for fresh air intake into the cab.



003210

Fresh air intake, cab

1. Heat exchanger heat
2. Heat exchanger, cooling
3. Expansion valve and sensor for refrigerant temperature

Heat exchanger, cooling, replacement



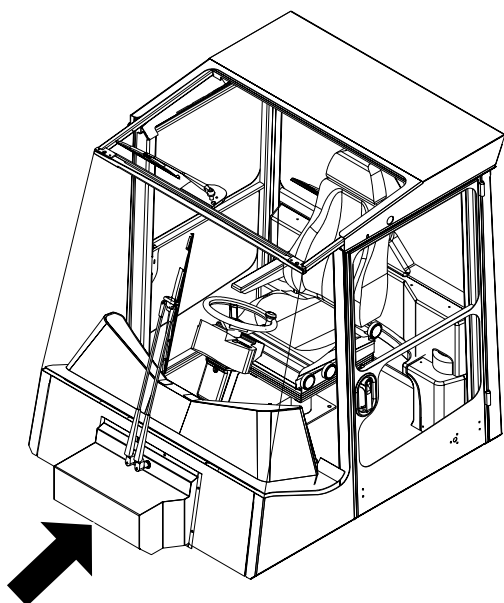
See *Heat exchanger, cooling/heating, replacement*, page 9:33.

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 system.

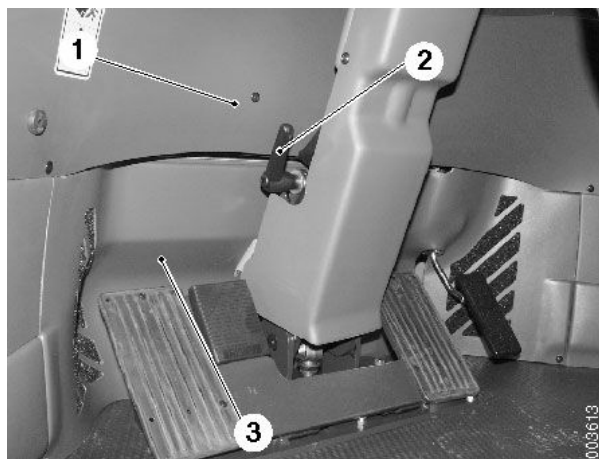
The signal can be checked from the diagnostic menu, section *8 Control system*, group *8.4.4.4 CLIMATE, menu 4* and *8.4.4.5 CLIMATE, menu 5* and *8.4.4.8 CLIMATE, menu 8*.



002230

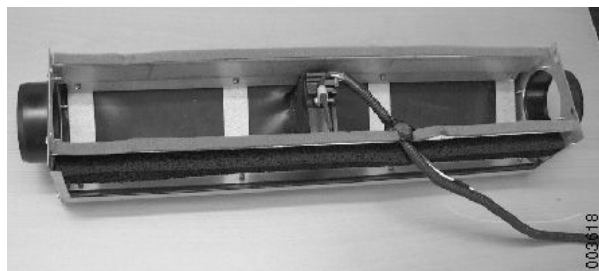
Air distributor, replacement

- 1 Machine in service position, see section *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 assembly.
- 6 Detach the air hoses from the air distributor and detach the connector.



003613

1. Instrument panel
2. Steering column adjustment
3. Lower protective cover



003718

- 7 Remove the air distributor from its mounting.
- 8 Replace the air distributor, fitting it in the reverse order.

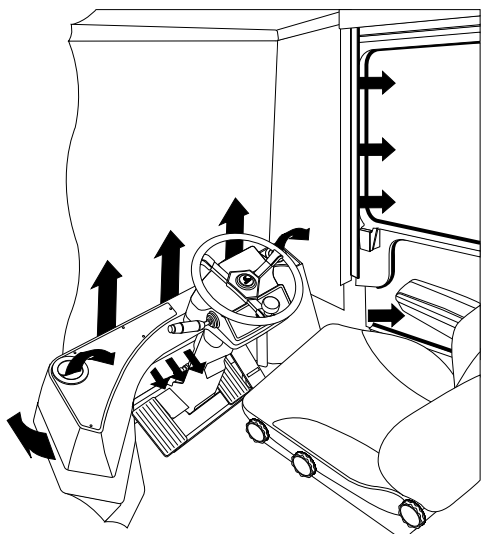
Air distributor

9.4.15 Defroster nozzles

Defroster nozzles, description

There are a number of fixed defroster nozzles in the cab's interior: at the front of the doors and the defroster for the windscreen. 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 section *B Safety*.
- 2 Remove the air damper manually.
- 3 Remove the bolts which hold the other part of the defroster nozzle in the dashboard.



003002



003003

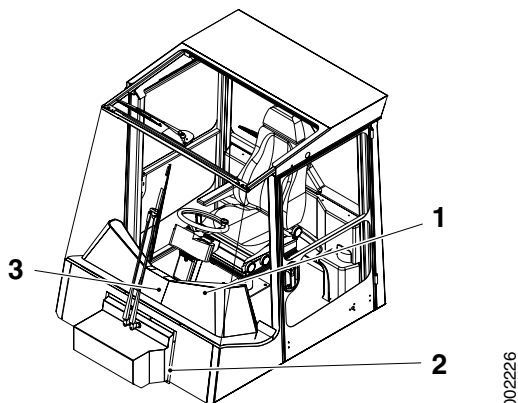
- 4 Detach the air hose from the defroster nozzle.
- 5 Replace the defroster nozzle.

9.4.16 Sensor, temperature outlet fan

Sensor, temperature outlet fan, description

Sensor, temperature outlet fan, (position 3) detects the temperature of the air that blows out in the defroster nozzles. The air conditioning is controlled by signals from the following sensors:

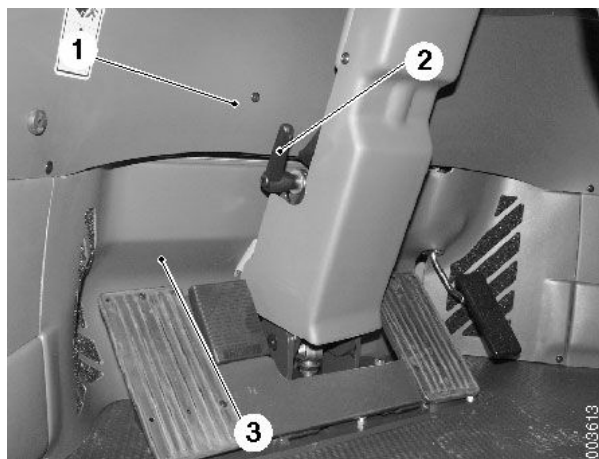
The signal can be checked via the diagnostic menu, section *8 Control system*, group *8.4.4.2 CLIMATE*, menu 2.



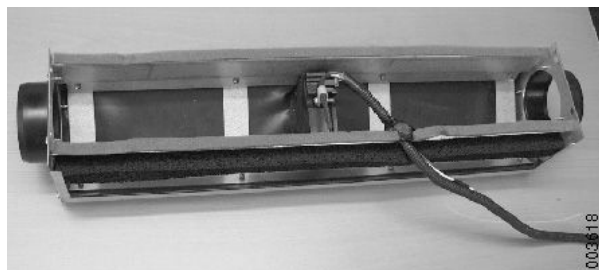
1. Sensor cab temperature
2. Sensor temperature refrigerant
3. Sensor, temperature outlet fan

Sensor, temperature outlet fan, replacement

- 1 Machine in service position, see section *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.



1. Instrument panel
2. Steering column adjustment
3. Lower protective cover



- 5 Detach the temperature sensor from the air distributor.
- 6 Fit in the reverse order.

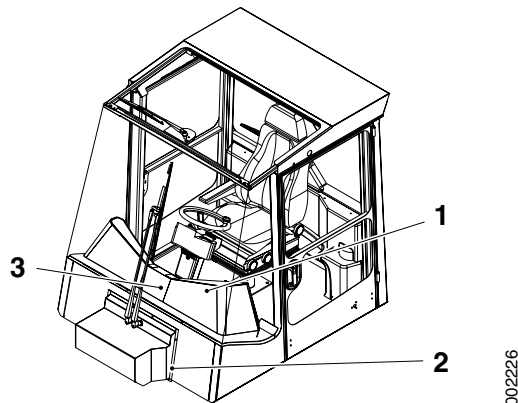
Air distributor including temperature sensor.

9.4.17 Sensor cab temperature

Sensor, cab temperature, description

Sensor, cab temperature, (position 1) detects the temperature of the air in the cab.

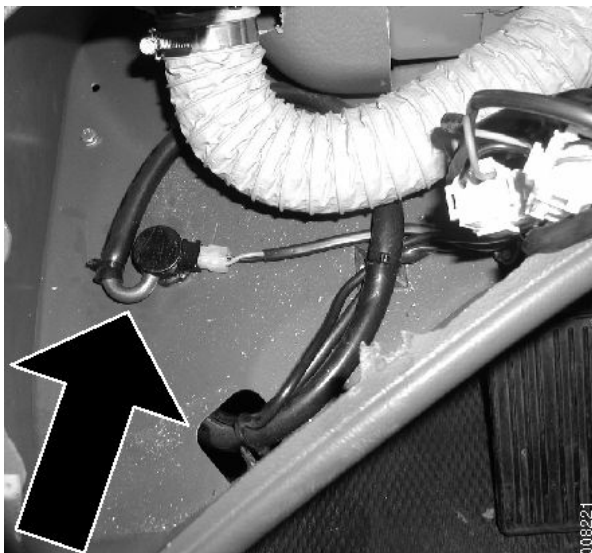
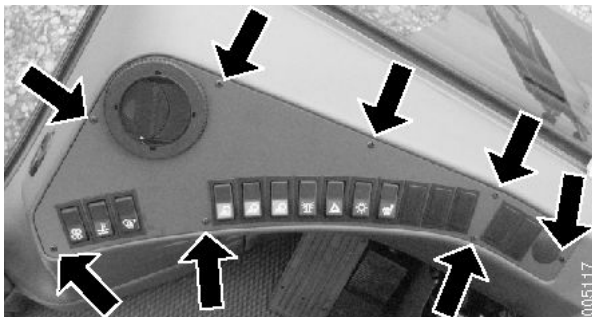
The signal can be checked via the diagnostic menu, section *8 Control system*, group *8.4.4.1 CLIMATE*, menu 1.



1. Sensor cab temperature
2. Sensor temperature refrigerant
3. Sensor, temperature outlet fan

Sensor, cab temperature, replacement

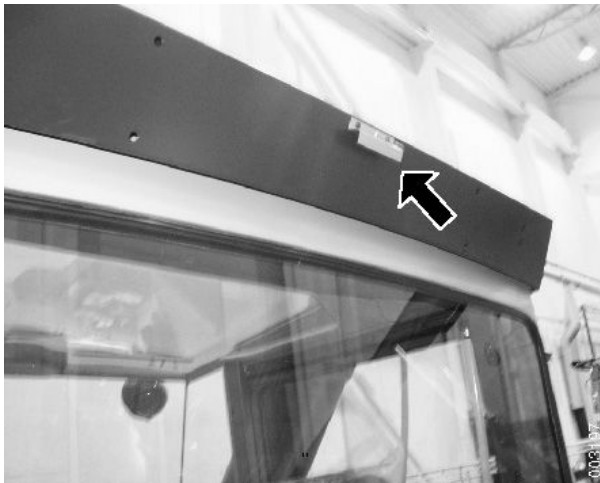
- 1 Machine in service position, see section *B Safety*.
- 2 Remove the dashboard panel.



- 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, ambient temperature

Sensor, ambient temperature, description



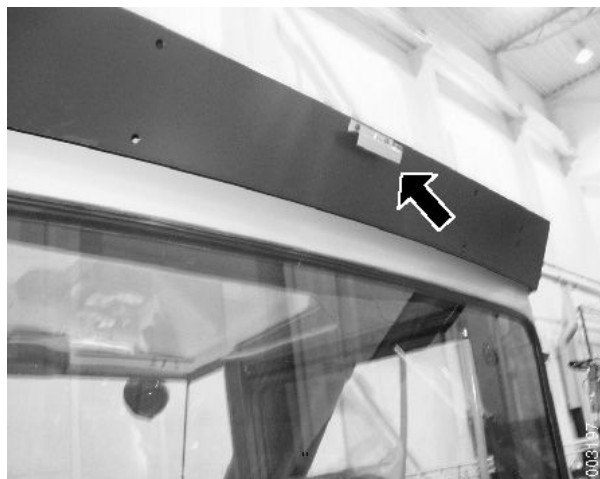
Sensor, ambient temperature, detects the temperature of the air outside the cab.

The signal can be checked via the diagnostic menu, section *8 Control system*, group *8.4.4.2 CLIMATE*, menu 2.

Sensor, ambient temperature

Sensor, ambient temperature, replacement

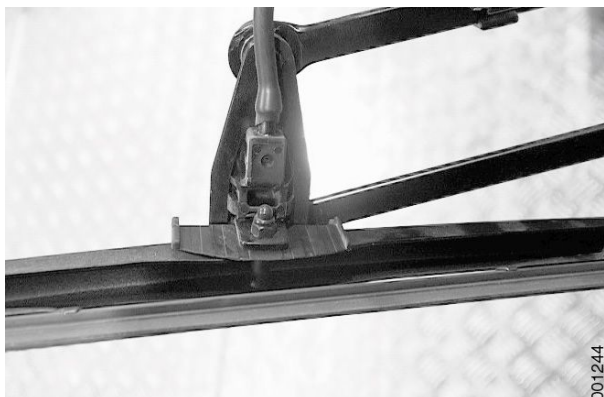
- 1 Machine in service position, see section *B Safety*.
- 2 Detach the connector from the temperature sensor.
- 3 Remove the temperature sensor from its mounting in the cab.
- 4 Replace the temperature sensor.
- 5 Fit in the reverse order.



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 position over the front window.

9.5.2 Wiper roof

Wiper roof, description

The roof wiper is the sector wiper type. Wiping angle is approx. 180 degrees.

9.5.3 Wiper rear

Wiper rear, description

The rear wiper is the sector wiper type. Wiping angle is approx. 180 degrees.

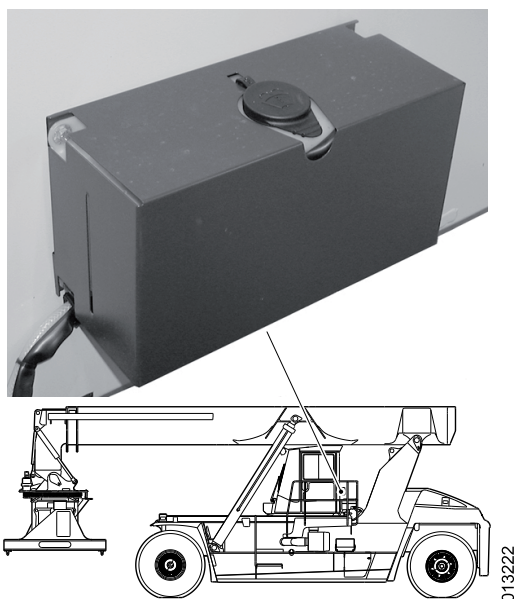
9.5.4 Washer motor and reservoir

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 minimises the time between the activation of the switch for washing and washer fluid spraying on the window.

The washer nozzles are mounted on the wiper arms.

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.3.1 *CAB*, menu 1.





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Washer fluid reservoir without protective plate.

- A Washer fluid reservoir
- B Washer motors

Washer motor and reservoir, replacement

- 1 Machine in service position, see section *B Safety*.
- 2 Remove the protection over the washer fluid reservoir.
- 3 Drain the washer fluid from the fluid reservoir.
- 4 Remove the washer motors from the fluid reservoir.
- 5 Remove the bolts which secure the fluid reservoir in the cab wall.
- 6 Replace the washer fluid reservoir. Replace the washer motor, if necessary.

9.5.5 Wiper motor front

Wiper motor front, description

The wiper motor drives the wiper for the front window. The wiper arm is mounted on the motor. The motor produces the movement of the wiper.

The signal can be checked via 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 section *B Safety*.
- 2 Remove the wiper arms.
- 3 Remove the nuts which hold the motor in the protective plate.
- 4 Remove the protective plate.
- 5 Detach the washer hose from the protective plate.
- 6 Remove the nuts which hold 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 to 16-20 Nm.



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9.5.6 Wiper motor roof

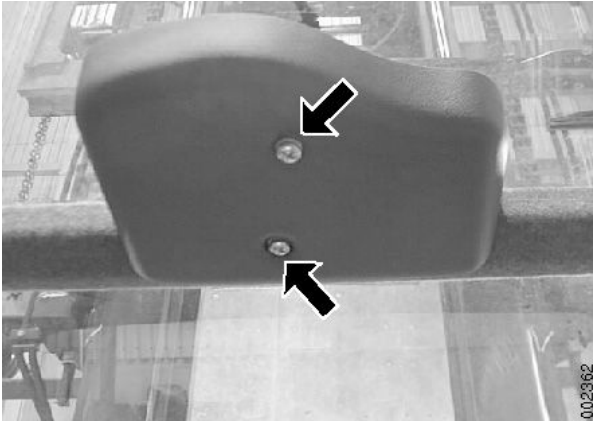
Wiper motor roof, description

The wiper motor drives the wiper for the roof window. The wiper arm is mounted on the motor. The motor produces the movement of the wiper.

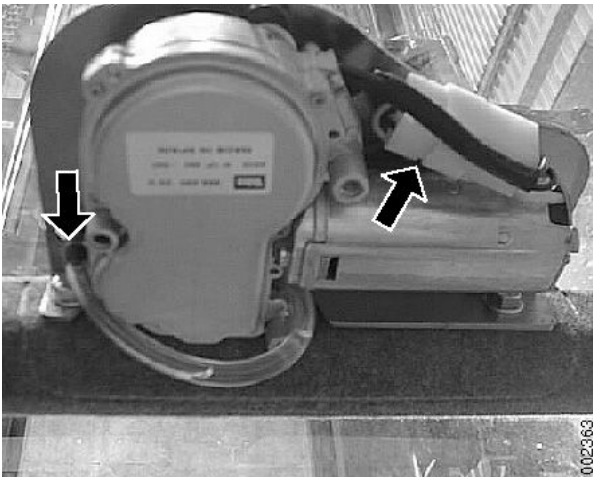
The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.3.4 *CAB, menu 4*.

Wiper motor roof, replacement

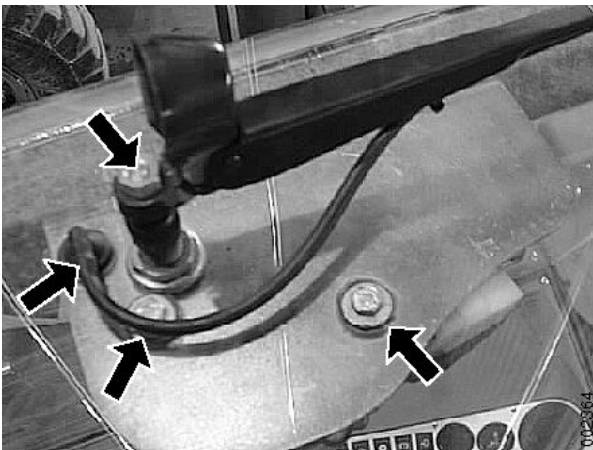
- 1 Machine in service position, see section *B Safety*.
- 2 Remove the plastic cover.



- 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 to 16-20 Nm.



9.5.7 Wiper motor rear

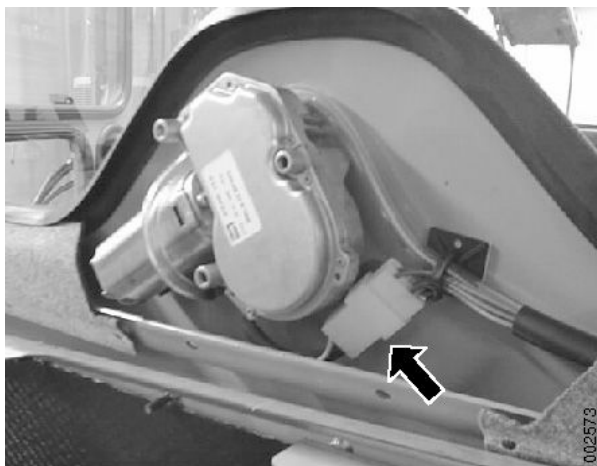
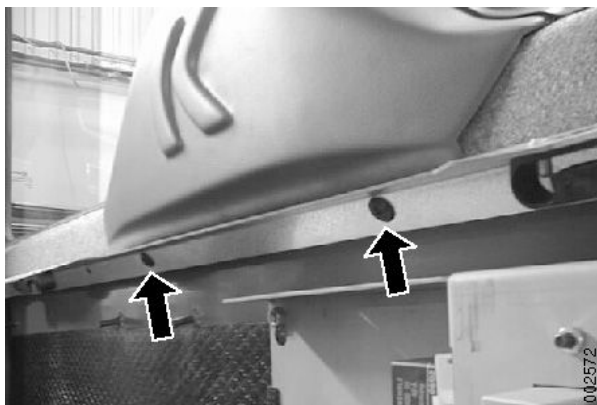
Wiper motor rear, description

The wiper motor drives the wiper for the rear window. The wiper arm is mounted on the motor. The motor produces the movement of the wiper.

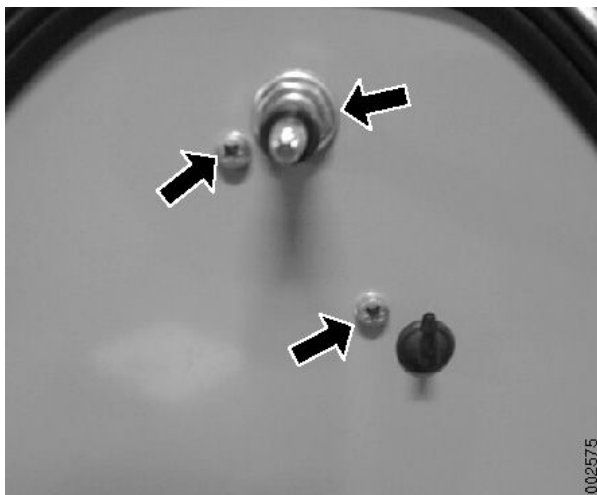
The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.3.3 *CAB*, menu 3.

Wiper motor rear, replacement

- 1 Machine in service position, see section *B Safety*.
- 2 Remove the panels behind the driver's seat.
- 3 Remove the screws holding the motor's plastic cover.



- 4 Detach the connector to the motor.
- 5 Raise the plastic cover and remove the nut securing the wiper arm. Detach the washer fluid hose.



- 6 Remove the screws securing the motor and the lock nut on the motor.
- 7 Replace the wiper motor.
- 8 Fit in the reverse order. Tighten the wiper arms to 16-20 Nm.

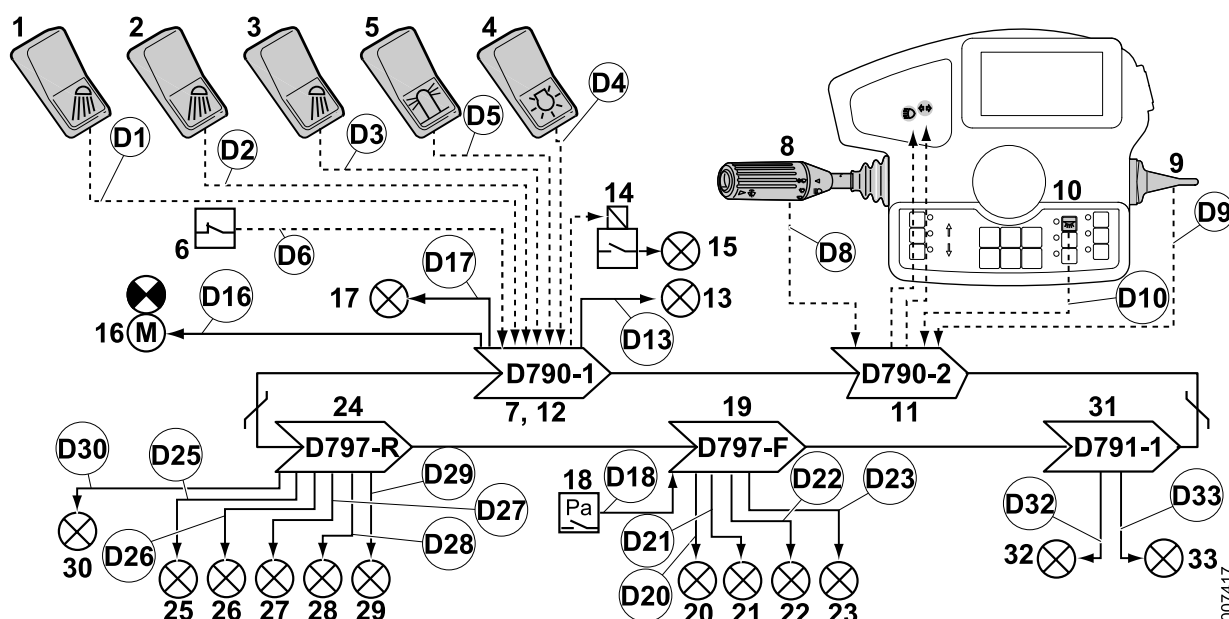
9.6 Lighting system

Lighting system, function description

The lights are shut off automatically after 5 minute's idle in order to prevent discharge of the batteries. Extra working lights are shut off after 2 minutes. The lights are activated automatically again when the operator sits in the seat, a gear is selected or the accelerator pedal is pressed.

NOTE

It is important that the right type of bulb is used for each area. See section F Technical data.



Pos	Explanation	Signal description	Reference
1	Switch, working lights cab (S105-1) sends a voltage signal to Control unit, cab (D790-1).	Switch in on position: U = 24 V	<i>Controls and instruments, overview</i> , page 9:3 D1: Diagnostic menu, see section 8 <i>Control system group 8.4.2.1 LIGHTS, menu 1</i>
2	Switch, working lights attachment (S105-2) sends a voltage signal to Control unit, cab (D790-1).	Switch in on position: U = 24 V	<i>Controls and instruments, overview</i> , page 9:3 D2: Diagnostic menu, see section 8 <i>Control system group 8.4.2.2 LIGHTS, menu 2</i>
3	Switch, working lights boom (S105-3) sends a voltage signal to Control unit, cab (D790-1).	Switch in on position: U = 24 V	<i>Controls and instruments, overview</i> , page 9:3 D3: Diagnostic menu, see section 8 <i>Control system group 8.4.2.3 LIGHTS, menu 3</i>
4	Switch, headlights (S100) sends a voltage signal to Control unit, cab (D790-1).	Switch in on position: U = 24 V	<i>Controls and instruments, overview</i> , page 9:3 D4: Diagnostic menu, see section 8 <i>Control system group 8.4.2.4 LIGHTS, menu 4</i>

Pos	Explanation	Signal description	Reference
5	Switch, revolving beacon (S110) sends a voltage signal to Control unit, cab (D790-1).	Switch in on position: U = 24 V	<i>Controls and instruments, overview</i> , page 9:3 D5: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.9 <i>LIGHTS</i> , menu 9
6	Break contact (opening switch) door (S226-LE & S226-RI) sends a voltage signal to Control unit, cab (D790-1).	Door open: U = 24 V	<i>Interior lighting cab, description</i> , page 9:65 D6: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.12 <i>LIGHTS</i> , menu 12
7	Control unit, cab (D790-1) transmits "switch on lights" messages on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
8	Multi-function lever (S162) sends a voltage signal to Control unit KIT (D790-2).	Lever in high beam position: $U_{S162/56a} = 24\text{ V}$	<i>Gear selector and multi-function lever, description</i> , page 9:8 D8: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.6 <i>LIGHTS</i> , menu 6
9	Lever, direction indicator (S161) sends a voltage signal to Control unit KIT (D790-2).	Left: $U_{S161/6} = 24\text{ V}$ Right: $U_{S161/1} = 24\text{ V}$	<i>Controls and instruments, overview</i> , page 9:3 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 a voltage signal to Control unit KIT (D790-2).	Checked by control system, error shown with error code.	<i>Controls and instruments, overview</i> , page 9:3 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 a "switch on lights" message on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.11 <i>Control unit, KIT</i>
12	Control unit, cab (D790-1) supplies voltage to the lights in and around the cab.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
13	Working lights, cab (E404-1L & E404-1R) are switched on when the cab working lights are activated.	Light on: U = 24 V	<i>Working lights, cab, description</i> , page 9:64 D13: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.1 <i>LIGHTS</i> , menu 1
14 	Relay, extra working lights boom (K304) is activated when the boom working lights are activated and supplies voltage to Extra working lights, boom (E404-5L & E404-5R).	$U_{K304/30} = 24\text{ V}$ $U_{K304/85} = 0\text{ V}$ Working lights boom switched on: $U_{K304/86} = 24\text{ V}$ $U_{K304/87} = 24\text{ V}$ Working lights boom switched off: $U_{K304/86} = 0\text{ V}$ $U_{K304/87} = 0\text{ V}$	<i>Working lights, boom, lights</i> , page 9:64
15 	Extra working lights, boom (E404-5L & E404-5R) are switched on when the boom working lights are activated.	Light on: U = 24 V	<i>Working lights, boom, lights</i> , page 9:64

Pos	Explanation	Signal description	Reference
16	Revolving beacon (H428) is switched on when the revolving working light is activated.	Light on: U = 24 V	<i>Revolving beacon, description</i> , page 9:63 D16: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.9 <i>LIGHTS</i> , menu 9
17	Interior lighting is switched on when a door is opened or if the interior lighting is activated with the switch on Control unit KIT (D790-2).	Light on: U = 24 V	<i>Interior lighting cab, description</i> , page 9:65 D17: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.12 <i>LIGHTS</i> , menu 12
18	Make-contact (closing switch) brake light (S216) sends a voltage signal to Control unit, frame front (D797-F).	Brake pressure over 0.2 MPa: U = 24 V	Section 4 <i>Brakes</i> , group 4.3.8 <i>Make-contact (closing switch) brake lights</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 the front lights on the machine.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame front</i>
20	Direction indicators, front (H422 & H423) are switched on when they or the flashing hazard lights are activated.	Light on: U = 24 V	<i>Direction indicators, description</i> , page 9:63 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 switched on together with the headlight.	Light on: U = 24 V	<i>Running lights, description</i> , page 9:61 D21: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.5 <i>LIGHTS</i> , menu 5
22	Headlights, low beam (E400L & E400R) are switched on when the headlight is activated.	Light on: U = 24 V	<i>Headlights, description</i> , page 9:61 D22: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.6 <i>LIGHTS</i> , menu 6
23	Headlights, high beam (E402L & E402R) are switched on when high beam is activated.	Light on: U = 24 V	<i>Headlights, description</i> , page 9:61 D23: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.6 <i>LIGHTS</i> , menu 6
24	Control unit, frame rear (D797-R) supplies voltage to the rear lights on the machine.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.3 <i>Control unit, frame rear</i>
25	Tail lights, red (H412L & H412R) are switched on when the headlight is activated.	Light on: U = 24 V	<i>Tail lights, description</i> , page 9:62 D25: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.5 <i>LIGHTS</i> , menu 5
26	Brake lights (H411L & H411R) are switched on when the brake is activated.	Light on: U = 24 V	<i>Brake lights, description</i> , page 9:62 D26: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.11 <i>LIGHTS</i> , menu 11
27	Direction indicators, rear (H426 & H427) are switched on when they or the flashing hazard lights are activated.	Light on: U = 24 V	<i>Direction indicators, description</i> , page 9:63 D27: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.8 <i>LIGHTS</i> , menu 8
28	Running lights, rear (H416-2 & H417-2) are switched on when the headlight is activated.	Light on: U = 24 V	<i>Running lights, description</i> , page 9:61 D28: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.5 <i>LIGHTS</i> , menu 5

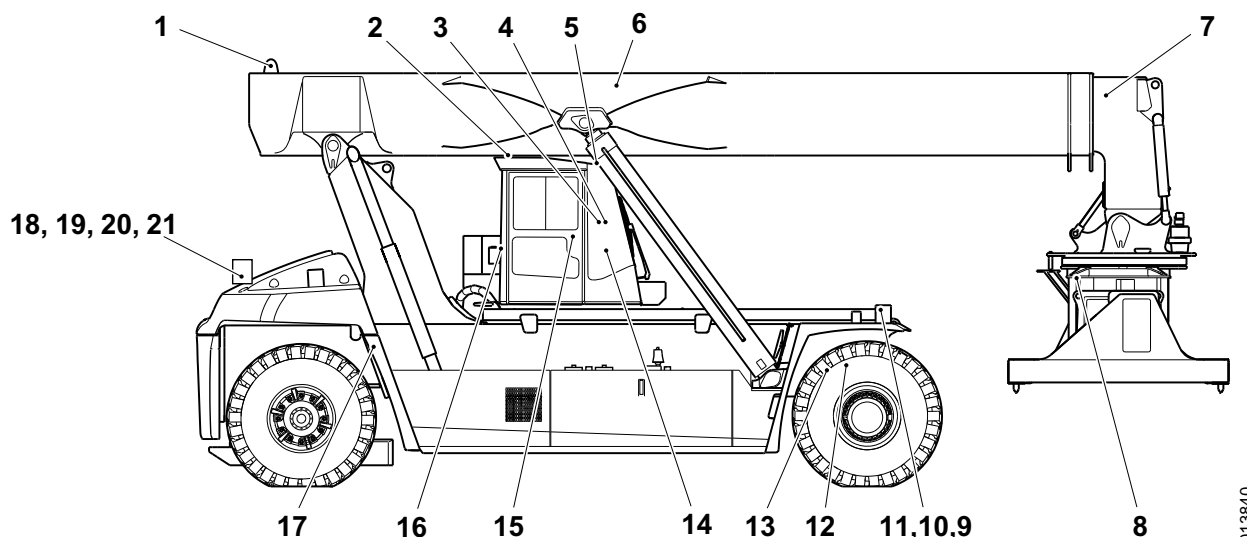
Pos	Explanation	Signal description	Reference
29	Back-up lights, white (E405L & E405R) are switched on when reverse gear is selected.	Light on: U = 24 V	<i>Back-up lights, description</i> , page 9:62 D29: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.11 <i>LIGHTS</i> , menu 11
30	Working lights, boom (E404-3L & E404-3R) are switched on when the boom working lights are activated.	Light on: U = 24 V	<i>Working lights, boom, lights</i> , page 9:64 D30: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.3 <i>LIGHTS</i> , menu 3
31	Control unit, attachment (D791-1) supplies voltage to the attachment's lights.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.5 <i>Control unit, attachment</i>
32	Working lights, attachment (E406-L & E406R) are switched on when the attachment's working lights are activated.	Light on: U = 24 V	<i>Working lights, attachment, description</i> , page 9:65 D32: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.2 <i>LIGHTS</i> , menu 2
33 	Extra working lights, attachment (E404-4L & E404-4R) are switched on when the attachment working lights are activated.	Light on: U = 24 V	<i>Working lights, attachment, description</i> , page 9:65 D33: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.2 <i>LIGHTS</i> , menu 2

Lighting system, component location

The purpose of the lighting is to increase safety during operation and load handling. The following lighting is fitted on the machine:

NOTE

It is important that the right type of bulb is used for each area. See section F Technical data.



- | | |
|--|--|
| 1. Revolving beacon (H428) | Headlights, high beam (E402L & E402R) |
| 2. Interior lighting | 12. Make-contact (closing switch) brake light (S216) |
| 3. Control unit KIT (D790-2) | 13. Control unit, frame front (D797-F) |
| 4. Multi-function lever (S162) | 14. Switch, see <i>Controls and instruments, overview</i> , page 9:3 |
| 5. Working lights, cab (E404-1L & E404-1R) | 15. Break contact (opening switch) door (S226-LE & S226-RI) |
| 6. Working lights, boom (E404-3L & E404-3R)
Extra working lights boom (E404-5L & E404-5R)(+) | 16. Control unit, cab (D790-1) |
| 7. Control unit, attachment (D791-1) | 17. Control unit, frame rear (D797-R) |
| 8. Working lights, attachment (E406-L & E406R)
Extra working lights attachment (E404-4L & E404-4R)(+) | 18. Running lights, rear (H416-2 & H417-2) |
| 9. Direction indicators, front (H422 & H423) | 19. Back-up lights, white (E405L & E405R) |
| 10. Running lights, front (H416-1 & H417-1) | 20. Tail lights, red (H412L & H412R)
Brake lights (H411L & H411R) |
| 11. Headlights, low beam (E400L & E400R) | 21. Direction indicators, rear (H426 & H427) |

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 the options of high beam and low beam (for meeting other traffic).

Switch between high and low beam with the gear and multi-function lever. The signal travels to Control unit, cab (D790-1).

High and low beam signals can be checked from the diagnostic menu, section 8 *Control system*, group 8.4.2.6 *LIGHTS*, menu 6.

9.6.2 Running lights

Running lights, description

The running lights are fitted 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 headlight switch. The signal travels to Control unit, cab (D790-1).

The lights and their signal can be checked from the diagnostic menu, section 8 *Control system*, group 8.4.2.5 *LIGHTS*, menu 5.

9.6.3 Tail lights

Tail lights, description

The tail lights are fitted on 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 tail lights are controlled by selecting with the headlight switch. The signal travels to Control unit, cab (D790-1).

The lights and their signal can be checked from the diagnostic menu, section 8 *Control system*, group 8.4.2.11 *LIGHTS*, menu 11.

9.6.4 Brake lights

Brake lights, description

The brake lights are fitted on 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 regulated by brake pedal position (via actuated break contact (opening switch)). The signal travels to Control unit, frame front (D797-F), which supplies power to the brake lights.

The lights and their signal can be checked from the diagnostic menu, section 8 *Control system*, group 8.4.2.11 *LIGHTS*, menu 11.

9.6.5 Back-up lights

Back-up lights, description

The back-up lights are fitted on 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 back-up lights are controlled by the selected travel direction with the gear selector and multi-function lever (S162) which send a voltage signal to Control unit KIT (D790-2).

The back-up lights are supplied voltage by Control unit, frame rear (D797-R)

The lights and their signal can be checked from the diagnostic menu, section 8 *Control system*, group 8.4.2.11 *LIGHTS*, menu 11.

9.6.6 Direction indicators

Direction indicators, description

The direction indicators are located on both the front and rear of the machine to provide surrounding traffic and the environment an indication that the machine is changing direction, i.e. turning.

The direction indicators are controlled by selecting with Switch, direction indicators (S161) that sends a voltage signal to Control unit KIT (D790-2).

The direction indicators are supplied voltage by Control unit, frame front (D797-F) and Control unit, frame rear (D797-R).

The lights and their signal can be checked from the diagnostic menu, section 8 *Control system*, group 8.4.2.8 *LIGHTS*, menu 8.

9.6.7 Flashing hazard lights

Flashing hazard lights, description

Flashing hazard lights (Hazard) are used to warn the surroundings, flashing hazard lights activate all direction indicators simultaneously.

The flashing hazard lights are controlled by selecting with the switch for flashing hazard lights. The signal travels to Control unit (D790-2).

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.2.8 *LIGHTS*, menu 8.

9.6.8 Revolving beacon

Revolving beacon, description

A revolving beacon is located at a high level 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. An indication to bystanders to exercise caution.

The revolving beacon is controlled by selecting with the revolving beacon switch. The signal travels to Control unit, cab (D790-1).

The lights and their signal can be checked from the diagnostic menu, section 8 *Control system*, group 8.4.2.9 *LIGHTS*, menu 9.

9.6.9 Working lights, cab

Working lights, cab, description

Working lights on the cab provide visibility when handling a load in darkness.

The working lights are controlled by selecting with the switch for working lights, cab roof. The signal travels to Control unit, cab (D790-1), which in turn supplies power to the working lights.

The lights and their signal can be checked from the diagnostic menu, section 8 *Control system*, group 8.4.2.1 *LIGHTS*, menu 1.

Working lights, replacement (product alternative Xenon lights)



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DANGER

Xenon lights are activated with high voltage. Always switch off the system voltage before working on Xenon lights.

Handle the headlight 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

Working lights, boom, lights

Working lights on the boom provide increased visibility when handling a load in darkness.

The working lights are controlled by selecting with the switch for working lights, boom. The signal travels to Control unit, cab (D790-1).

The lights and their signal can be checked from the diagnostic menu, section 8 *Control system*, group 8.4.2.3 *LIGHTS*, menu 3.

The lifting boom can be equipped with two extra working lights (⊕).

Working lights, replacement (product alternative Xenon lights)



See *Working lights, replacement (product alternative Xenon lights)*, page 9:64.

9.6.11 Working lights, attachment

Working lights, attachment, description

Working lights on the attachment provide increased visibility when handling a load in darkness.

The working lights are controlled by selecting with the switch for working lights, attachment. The signal travels to Control unit, cab (D790-1).

The lights and their signal can be checked from the diagnostic menu, section 8 *Control system*, group 8.4.2.2 *LIGHTS*, menu 2.

The attachment can be equipped with two extra working lights ()

Working lights, replacement (product alternative Xenon lights)



See *Working lights, replacement (product alternative Xenon lights)*, page 9:64.

9.6.12 Interior lighting

Interior lighting cab, description

The interior lighting illuminates the cab when the doors are opened or when activated with the interior lighting switch.

There is background lighting in all switches, function keys and rotary controls. This is so that the operator will be able to read their functions and settings in darkness. Brightness is controlled by the plus and minus keys.

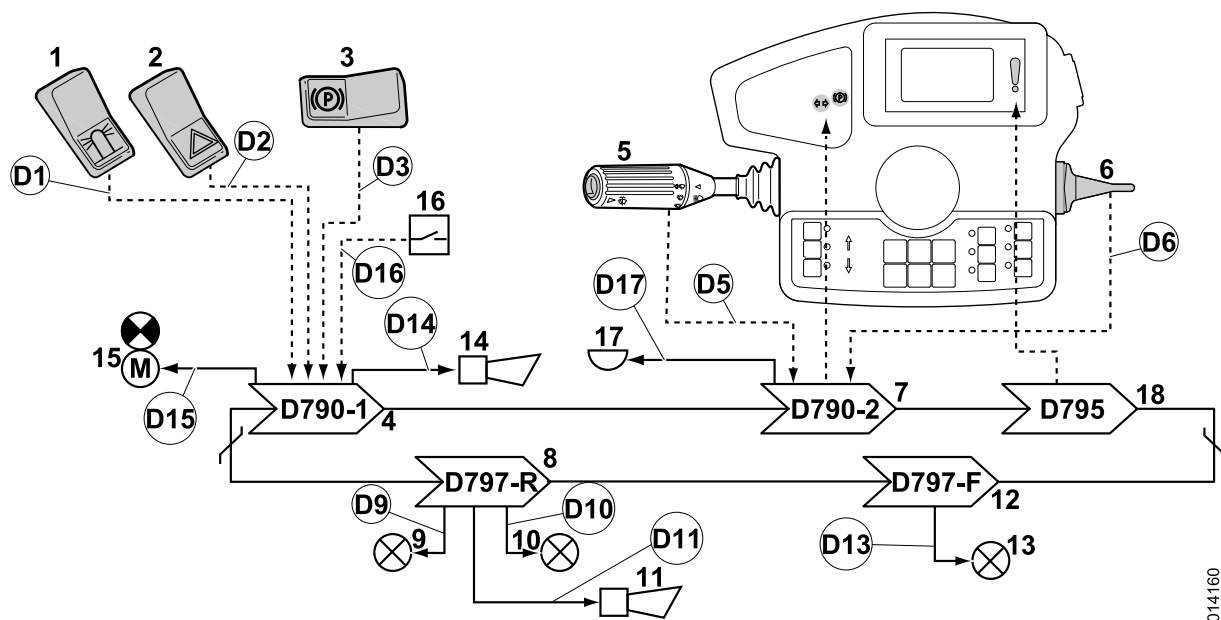
The lights and their signal can be checked from the diagnostic menu, section 8 *Control system*, group 8.4.2.12 *LIGHTS*, menu 12.

9.7 Signalling system

Signalling system, function description

NOTE

It is important that the right type of bulb is used for each area. See section F Technical data.

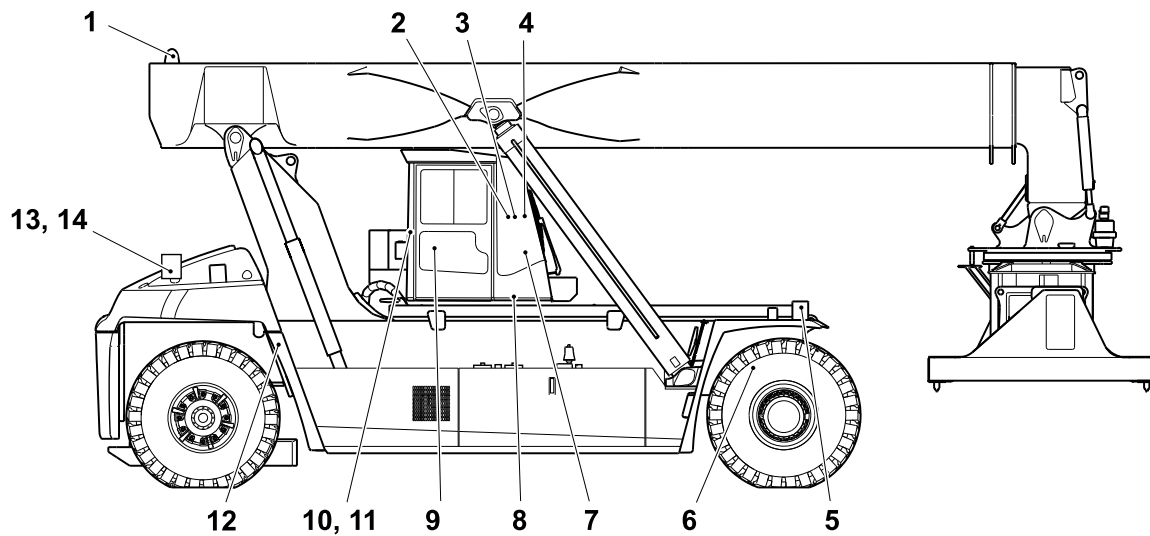


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Pos	Description	Signal description	Reference
1	Switch, revolving beacon (S110) sends a voltage signal to Control unit, cab (D790-1).	Switch in on position: U = 24 V	<i>Controls and instruments, overview</i> , page 9:3 D1: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.9 <i>LIGHTS</i> , menu 9
2	Switch, flashing hazard lights (Hazard) (S109) sends a voltage signal to Control unit, cab (D790-1).	Switch in on position: U = 24 V	<i>Controls and instruments, overview</i> , page 9:3 D2: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.8 <i>LIGHTS</i> , menu 8
3	Switch, parking brake (S107) sends a voltage signal to Control unit, cab (D790-1).	Switch in on position: U = 24 V	<i>Controls and instruments, overview</i> , page 9:3 D3: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.5.4 <i>HYD</i> , menu 4
4	Control unit, cab (D790-1) sends messages about activation on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.1 <i>Control unit, cab</i>
5	Multi-function lever (S162) sends a voltage signal to Control unit KIT (D790-2).	Signal button pressed in: U _{S162/H} = 24 V	<i>Gear selector and multi-function lever, description</i> , page 9:8 D5: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.3.5 <i>CAB</i> , menu 5
6	Lever, direction indicator (S161) sends a voltage signal to Control unit KIT (D790-2).	Left: U _{S161/6} = 24 V Right: U _{S161/1} = 24 V	<i>Controls and instruments, overview</i> , page 9:3 D6: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.7 <i>LIGHTS</i> , menu 7
7	Control unit KIT (D790-2) sends messages about activation on the CAN bus.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.11 <i>Control unit, KIT</i>
8	Control unit, frame rear (D797-R) supplies voltage to the rear lights and buzzer on the machine.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.3 <i>Control unit, frame rear</i>

Pos	Description	Signal description	Reference
9	Direction indicators, rear (H426 & H427) are switched on when the flashing hazard lights are activated.	Light on: U = 24 V	<i>Direction indicators, description</i> , page 9:63 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 switched on when reverse gear is selected.	Light on: U = 24 V	<i>Back-up lights, description</i> , page 9:62 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>Reverse alarm, description</i> , page 9:69 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 the front lights on the machine.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.2 <i>Control unit, frame front</i>
13	Direction indicators, front (H422 & H423) are switched on they are activated.	Light on: U = 24 V	<i>Direction indicators, description</i> , page 9:63 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, description</i> , page 9:68 D14: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.3.5 <i>CAB</i> , menu 5
15	Revolving beacon (H428) is switched on when the flashing hazard light is activated.	Light on: U = 24 V	<i>Revolving beacon, description</i> , page 9:68 D15: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.2.9 <i>LIGHTS</i> , menu 9
16	Make-contact (closing switch) operator-in-seat (S230) sends a voltage signal to Control unit, cab (D790-1) when there is a load on the driver's seat.	Operator in seat: U = 24 V	<i>Sensor, operator-in-seat, description (product alternative Hao Bang)</i> , page 9:17 D16: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.3.6 <i>CAB</i> , menu 6
17	In the event of warnings, Buzzer, cab (H853) is supplied voltage by Control unit KIT (D790-2) to draw the operator's attention to the warning message.	Checked by control system, error shown with error code.	D17: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.3.6 <i>CAB</i> , menu 6
18	In the event of warnings, control unit KID (D795) activates the warning lamp to draw the operator's attention to the warning message.	A clicking sound is audible when then termination resistor is activated.	Section 11 <i>Common electrics</i> , group 11.5.3.12 <i>Control unit, KID</i>

Signalling system, component location



013841

- | | |
|---|--|
| 1. Revolving beacon (H428) | 8. Horn (H850) |
| 2. Control unit KIT (D790-2) | 9. Make-contact (closing switch) operator-in-seat (S230) |
| 3. Buzzer, cab (H853) | 10. Control unit, cab (D790-1) |
| 4. Control unit, KID (D795) | 11. Buzzer, cab (H853) |
| 5. Direction indicators, front (H422 & H423) | 12. Control unit, frame rear (D797-R) |
| 6. Control unit, frame front (D797-F) | 13. Direction indicators, rear (H426 & H427) |
| 7. Switch, see <i>Controls and instruments, overview</i> , page 9:3 | 14. Reverse alarm (H965) |

9.7.1 Horn

Horn, description

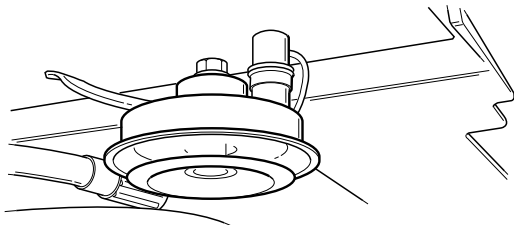
The horn is electromagnetic.

The horn is activated from the gear and multi-function lever. The horn can also be activated with the switch for open twistlocks on the control lever, when the attachment does not have alignment with a container.

The horn is located under the cab.

001247

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.3.5 *CAB*, menu 5.



9.7.2 Flashing hazard lights

Flashing hazard lights, description

See *Flashing hazard lights, description*, page 9:63.

9.7.3 Revolving beacon

Revolving beacon, description

See *Revolving beacon, description*, page 9:63.

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 driver's seat (see *Sensor, operator-in-seat, description (product alternative Hao Bang)*, page 9:17) indicates to the control system if the operator leaves the seat.

The buzzer is located in the steering wheel panel.

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.3.6 *CAB*, menu 6.

9.7.5 Back-up alarm

Reverse alarm, description

When reverse is selected, a warning sound and the back-up lights are activated. This is to give surrounding traffic an indication that the machine is reversing. Indication to bystanders to take caution. An indication to bystanders to exercise caution.

The signal can be checked via 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 prepared with a connector for customer accessories, see section *11 Common electrics*, group *11.5.2.1 Electronic box, cab*.

Entertainment and communication, repair



Repairs should be left to authorised personnel.

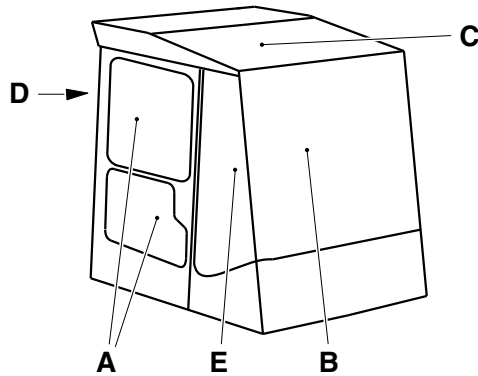
9.9 Glass/windows/mirrors

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.

The rear view mirrors are of the convex mirror type. There is an interior rear view mirror on all machines.



001512

- A Side windows
- B Windscreen (front window)
- C Roof window
- D Rear window
- E Windscreen (front side window)

Silicone adhesive, handling advice

The window panes are secured with decor strips 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 the windscreen and roof window on the Spirit Delta cab.

- *Silicone adhesive 923854.0100 is a quick-hardening, two-component silicone adhesive that can withstand temperatures between -50 °C and +200 °C. The hardening properties of the adhesive are extremely dependent on the ambient temperature. An increase of 10 °C cuts hardening time in half.*

Silicone adhesive 923854.0100 is mixed at a ratio of 1:10 in a static mixer. Change mixer after every interruption that lasts more than 5 minutes. The short setting time means that work has to be planned carefully in order 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.*
- *The recommended storage temperature is between -30 °C and +20 °C. Storage in a refrigerator or a colder environment is recommended.*

9.9.1 Windscreen

Windscreen, description

The windscreen consists of the front window and side windows. The windscreen is attached to the cab with a decor strip and is glued to the roof window with silicone adhesive. Front and side windows are joined with silicone adhesive to give good all-round visibility from the operator's station.

For location see, *Glass/windows/mirrors, description*, page 9:71.

Windscreen, replacement

NOTE

*Read the handling advice for silicone adhesive before starting work.
See Silicone adhesive, handling advice, page 9:72.*

- 1 Machine in service position, see section *B Safety*.
- 2 Remove the decor strip.
- 3 Remove the broken window pane and check that no remains of 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 replaced, then all bolts must be removed before the silicone adhesive is cut away.



Figure 1: Removing the decor 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.
- 5 Fit masking tape on the inside and outside of the window panes by the surfaces that are to be glued.

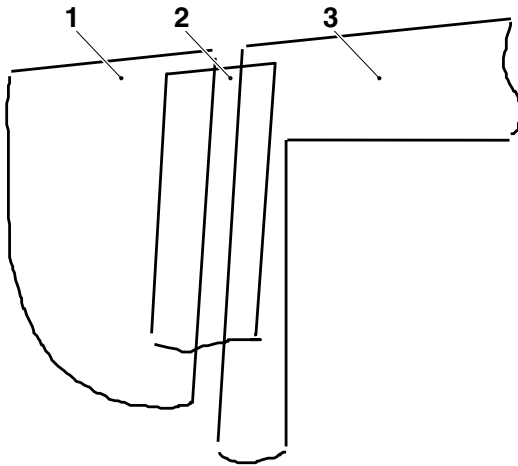


Figure 2: Adjusting side window - cab roof

1. Side window
2. Rubber strip
3. Cab frame/door opening

- 6 When the windscreen or a side window is to be replaced, then the window panes must be adjusted so that the upper edge on the side window has the same height as the upper edge of the roof (see Figure 2) and so that the distance between windscreen and side window is as shown in Figure 3.

Use spacers against the roof member to ensure that the distances are maintained.

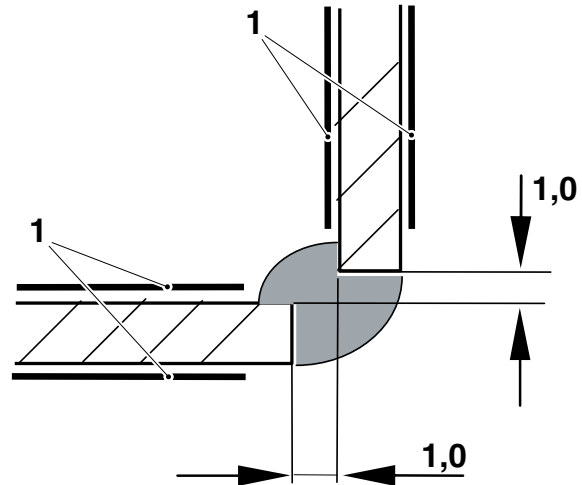


Figure 3: Adjusting side window - windscreen

1. Masking tape

- 7 Fit the decor 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 in order to create a good seam.

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.

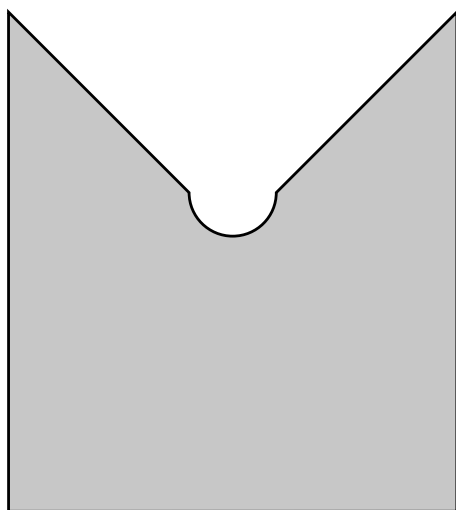


Figure 4: Tool template for silicone joint, scale 1:1

- 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 replaced, apply silicone adhesive 923854.0100 by the cab frame (where it was glued earlier).
- 12 Align 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.
- 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 minimised.

9.9.2 Side window

Side window, description

The side windows are secured in the cab and doors with decor strips.
For further details, see *Glass/windows/mirrors, description*, page 9:71.

Side window, replacement

NOTE

The method describes a general procedure.

- 1 Machine in service position, see section *B Safety*.
- 2 Use special tools to detach the decor strip.



- 3 Remove the decor strip which runs around the whole window.
- 4 Carefully remove any remains of glass from the rubber strip.



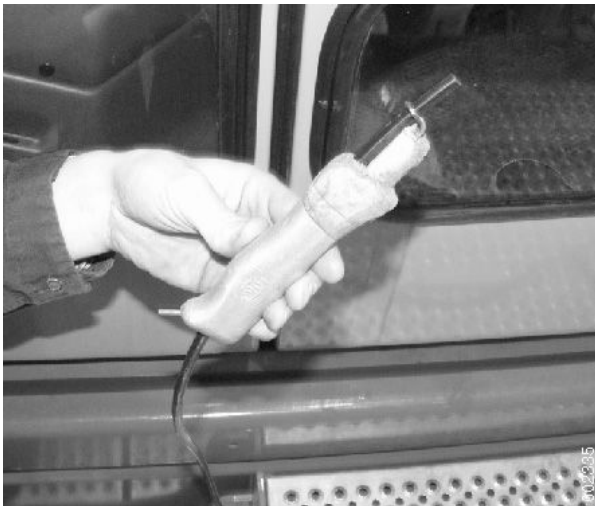
- 5 Fit the new window, securing it at the bottom edge.



- 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 decor strip with a special tool.
9 Pull the decor strip around the whole window.



- 10 Cut off the decor strip approx. 2 cm too long.
- 11 Fit the other end of the decor strip edge to edge.
- 12 Adjust the decor 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 plate is elastic.

Safety is maintained within a temperature interval of 120 °C to -45 °C (becomes brittle at -110 °C, glass conversion temperature 145 °C). The roof window has a patented surface layer that increases its resistance to wear, UV light and chemicals.

The roof window is joined with the windscreen. Joints between the window panes and between roof window and cab are sealed tightly with silicone adhesive. Align a new seal of silicone adhesive when replacing.

For location, see *Glass/windows/mirrors, description*, page 9:71.



WARNING

The strength of the roof window may be significantly reduced in case of exposure to substances containing aromatic hydrocarbons, ketones, esters, or chlorinated hydrocarbons.

Low strength! Danger!

Check the surface layer of the roof window and clean only with washer fluid or mild detergent. Rinse thoroughly with lukewarm water afterwards. Replace a damaged roof window that shows cracks or scratches immediately!

Roof window, replacement

See *Windscreen, replacement*, page 9:73, for the general procedure.

The roof window is joined with the windscreen. The joint is sealed with silicone. Align a new seal of silicone when replacing.

9.9.4 Rear window

Rear window, description

The rear window is attached to the cab with a decor strip.

For further details, see *Glass/windows/mirrors, description*, page 9:71.

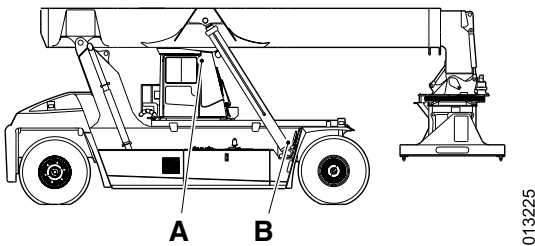
Rear window, replacement

See *Side window, replacement*, page 9:75 for the general procedure.

9.9.5 Rear view mirror

Rear view mirror, description

The cab has a rear view mirror (position A) located in the cab as well as rear view mirrors (position B) on left and right-hand front wing. The function of the rear view mirror is to give the operator visibility around the machine.



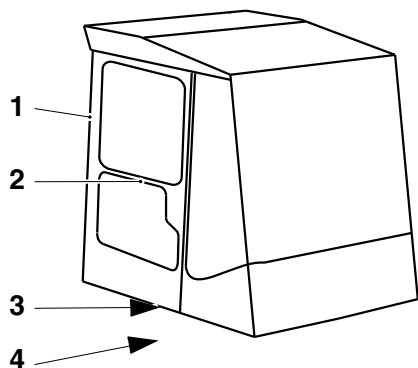
013225

- A Rear view mirror
- B External mirror

9.10 Cab structure and suspension

Cab structure and suspension, description

The cab is mounted in a cab substructure via strong rubber insulators fitted on the underside of the cab. This minimises 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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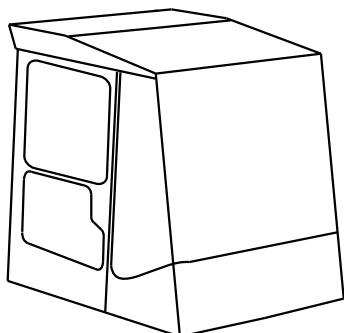
Cab Spirit Delta

1. Cab frame
2. Door
3. Cab suspension
4. Cab substructure

9.10.1 Cab frame

Cab frame, description

The cab frame is made of high-strength steel sheet profiles. The cab is dimensioned to handle impacts and, to some degree, dropped loads. The frame must not be modified!



002210

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:

- hand rail
- handle
- key lock
- openable window (emergency exit 

Switches in the doors' locks 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 via the diagnostic menu. See section 8 *Control system*, group 8.4.2.12 *LIGHTS*, menu 12.

9.10.3 Cab substructure

Cab substructure, description

The cab is mounted on a cab substructure via strong rubber insulators fitted on the underside of the cab. This minimises vibrations from the frame to the cab.

The cab substructure runs on wheels in a mounting which is fitted on the machine's chassis (frame). The cab can be slid manually for access during service.

9.10.3.1 Cab substructure, sliding cab

Cab substructure, sliding cab, description

The cab substructure 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.

9.10.4 Sliding cab

Manual sliding cab, description

Manual sliding cab means that the cab can be moved forward to facilitate access for service and maintenance in the engine compartment.

The cab is pushed forward and back 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 locking catches at the rear edge of the cab.



DANGER

The cab is very heavy and the machine must not be moved without first securing the cab.

Extreme danger! Risk of crushing!

Secure the cab on both sides, with the locking catches and pins before starting to operate the machine.



WARNING

It is important that the locking catches are intact! They should be checked regularly. However, it is not included as part of the service schedule for preventive maintenance!

9.10.4.1 Cab cradle

Cab cradle, description

The cab is secured on a cradle which runs on wheels in rails on the frame. See *Cab substructure, description*, page 9:80.

9.11 Cab interior

9.11.1 Instrument and control panels

Steering wheel panel, description

The steering wheel panel is secured to the steering column and contains warning and indicator lights, display (KID), function keys (KIT) and switches.

Left-hand dashboard panel, description

The left-hand dashboard panel is located in the left-hand corner of the cab. It contains rotary controls, switches, and ventilation.

Panel for load handling functions, description

The panel is mounted on the driver's seat. The panel includes switches for load handling functions and emergency stop switches to interrupt ongoing load handling functions. The control lever is located next to the panel.

Steering wheel panel, replacement

- 1 Machine in service position, see section *B Safety*.
- 2 Remove the steering wheel centre cover.
- 3 Remove the nut and the steering wheel.

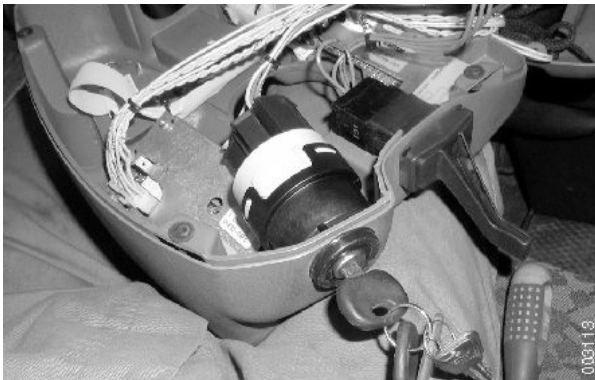


- 4 Remove the bolts on the underside of the steering wheel panel.





- 5 Remove the bolts on the top of the steering wheel panel.



- 6 Unplug the connector from the multi-function levers, ignition key lock, 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 fittings, plastic

Interior fittings, plastic, description

The interior of the cab consists of recyclable material.

9.11.3 Interior fittings, textile

Interior fittings, textile, description

The interior of the cab consists of recyclable material.

9.11.4 Floor covering

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.

9.12 Chassis

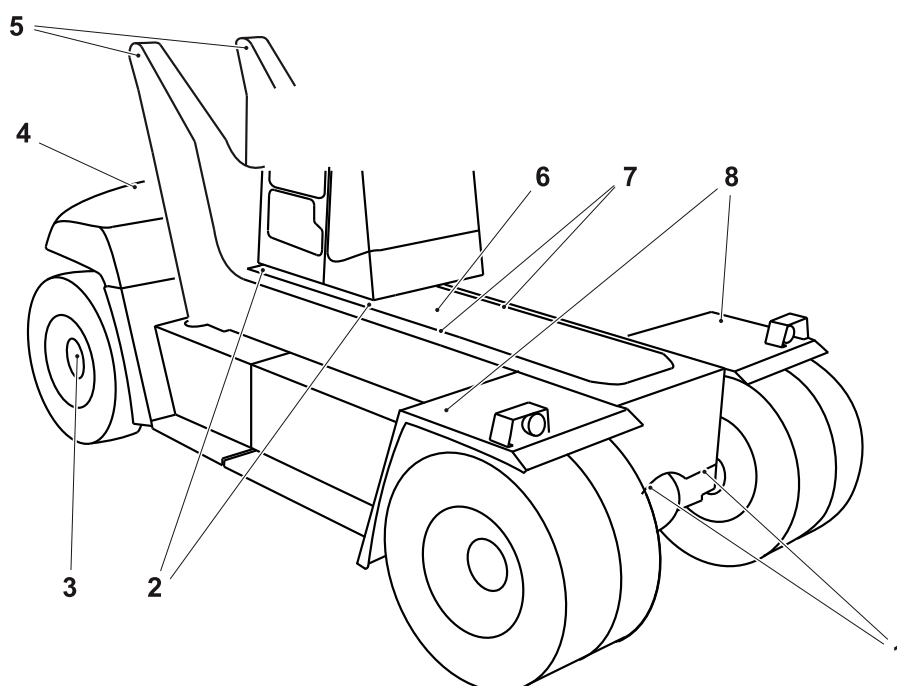
Chassis, description

The frame is a modular construction and consists of front section, rear section and a beam pair. This design provides advantages in terms of rigidity and strength.

There are mounting points in the frame for engine, transmission, 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 number of which is adapted to the machine in question. The counterweights are designed to allow as good visibility rearwards as possible.

The front wings are bolted into the frame (which has advantages when delivering the machine).



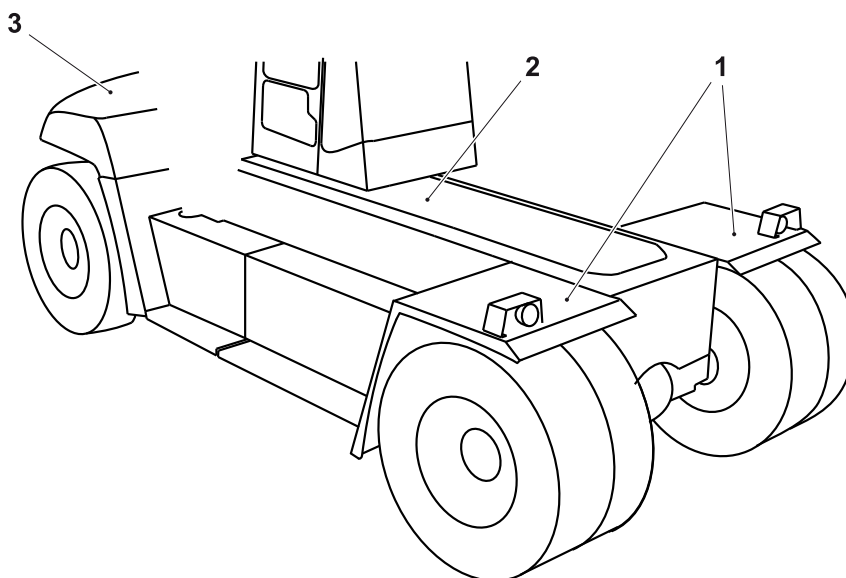
1. Frame's front section with drive axle mounting
2. Cab mounting (4 points)
3. Steering axle mounting
4. Frame's rear section with counterweights
5. Boom mounting
6. Engine compartment with mountings for engine and transmission
7. Beam pair
8. Bracket for front wings

013231

9.13 Body structure

Body structure, description

The body structure's components comprise:



1. Wings
2. Hood engine compartment
3. Counterweight

9.13.1 Wings

Wings, description

There are wings over the wheels to protect from dirt thrown up by the wheels during operation. The design of the counterweight (see *Counterweights, description*, page 9:85) acts as a mudguard for the rear wheels.

9.13.2 Hood engine compartment

Hood engine compartment, description

The machine's engine compartment is protected by tread plates which function as an engine hood. The tread plates are divided into several sections and these are secured with retaining bolts. The tread plates are designed for walking on and are ribbed to provide sure footing.

9.13.3 Footsteps and hand rail

Footsteps and hand rail, description

The cab has footsteps and handrail for easy access.

013232

9.13.4 Counterweights

Counterweights, description

The machine has counterweights to balance the machine's lift capacity and these may therefore vary in quantity and weight.

The counterweights are located at the very back of the frame for maximal leverage.

The machine has counterweights in the following locations:

- Furthest back on the machine there are vertical counterweights secured in the rear edge of the frame; the outer has a towing eye.
- Upper horizontal counterweight.

Under the horizontal counterweight, there 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.

9.15 Paint/coatings

Paint/coatings, description

The machine is painted with an alkyd-based mono-component paint that is applied with a brush or a spray. For paint codes (RAL), see machine card.

Check the machine frequently for stone chips, dents and paint scratches, rectify them at once to prevent corrosion on the underlying metal. Only use touch-up paint for small stone chips and scratches. More extensive paint damage should be repaired by a paint workshop.

NOTE

Before touching up, the surfaces to be touched up must be thoroughly cleaned.

Please contact Cargotec for information about other surface treatment and material colours.

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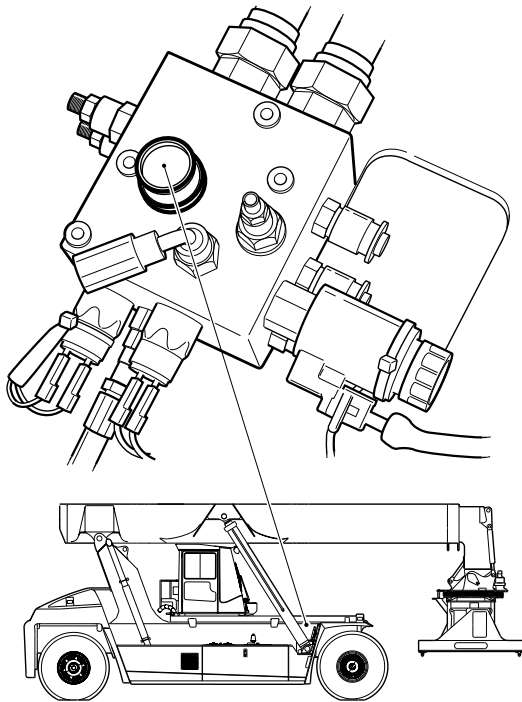
10 Common hydraulics

10.2 Safety valves

10.2.1 Accumulator drain valve

Accumulator drain valve, description

The accumulator drain valve is fitted on the accumulator charging valve. See section 4 *Brakes*, group 4.3.3 *Accumulator charging valve*.

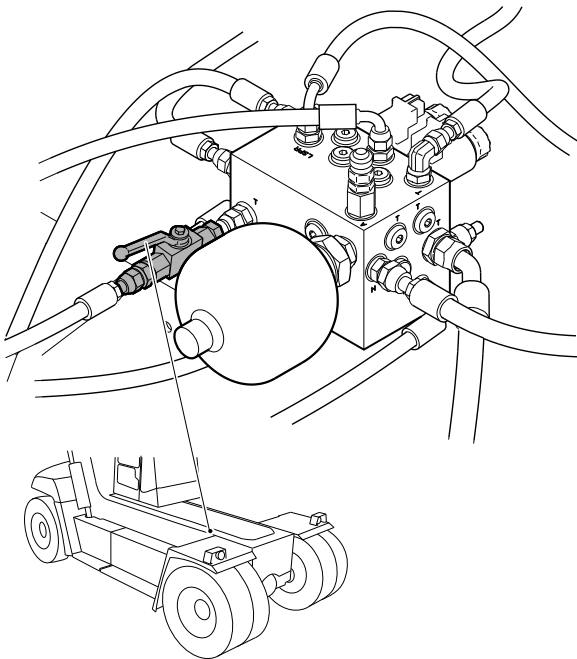


013233

10.2.2 Relief valve, attachment

Relief valve attachment, description

The relief valve is fitted on valve block servo pressure. See *Valve block servo pressure, general*, page 5:14.



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10.2.3 Pipes and hoses

Pipes and hoses, general

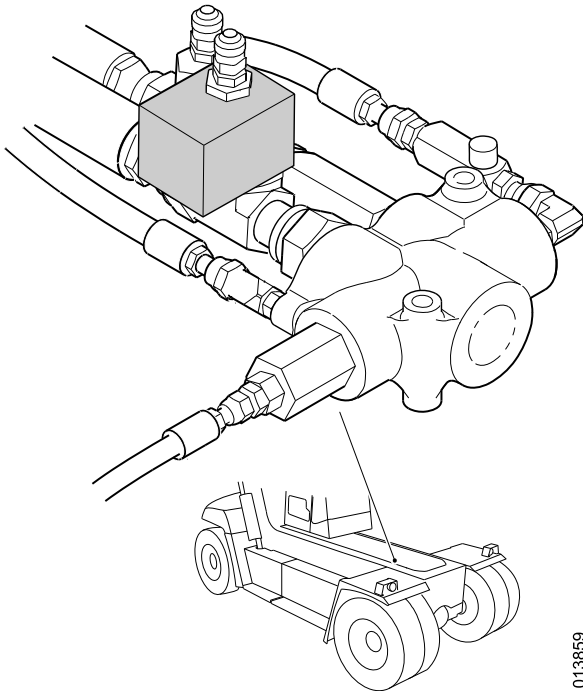
See *Pipes and hoses, general*, page 10:21.

10.2.4 Pressure limiting valve

Pressure limiting valve, description

The pressure limiting valve leads excessively high pressure in the hydraulic oil supply to tank, protecting the hydraulic system against excessive pressures.

The pressure limiting valve is fitted on the supply to control valve lift after the priority valve. The priority valve is fitted on the right-hand side of the hydraulic plate in the engine compartment in front of the transmission.



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10.3 Tanks and accumulators

10.3.1 Tank

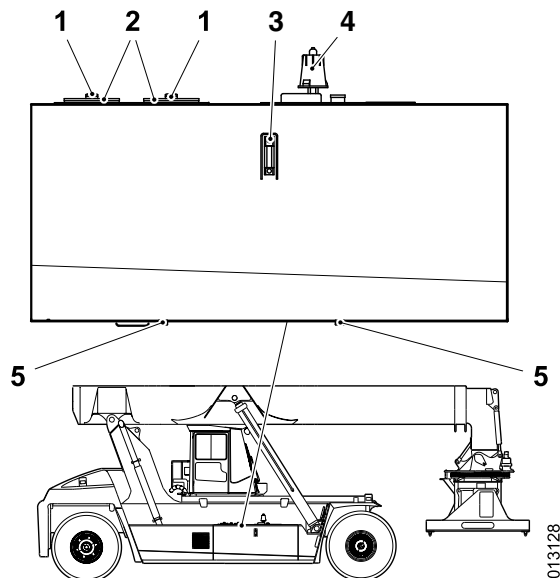
Tank, description

The hydraulic oil tank forms part of the side panel on the right-hand side of the machine. The oil filters for the working hydraulics are fitted inside the tank. 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 section *F Technical data*. The whole filter unit can be removed to facilitate access for cleaning. There is a drain plug located at the bottom of the tank.

The tank is equipped with filtered breather that allows volume changes in the tank, due to temperature variations and use.

The oil level is checked on the sight glass on the tank's side when all hydraulic cylinders are in the bottom position.



1. Hydraulic oil filler plug
2. Hydraulic oil filter cover
3. Sight glass hydraulic oil
4. Breather filter hydraulic oil tank
5. Hydraulic oil drain plugs

10.3.2 Pipes and hoses

Pipes and hoses, general

See *Pipes and hoses, general*, page 10:21.

10.4 Pumps

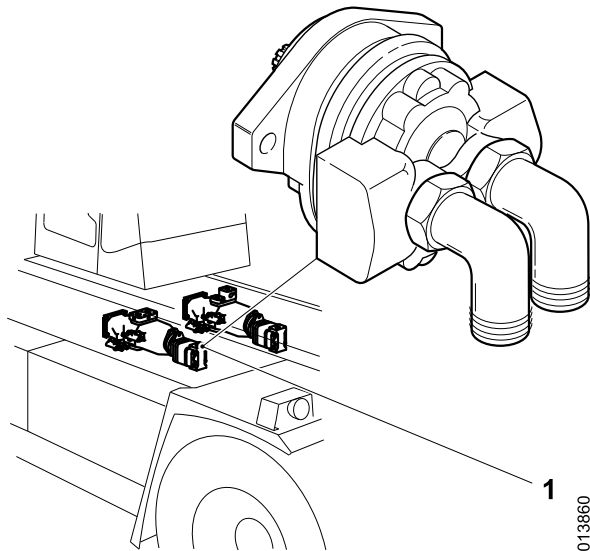
10.4.1 Gear pump with fixed displacement

Gear pump with fixed displacement, description

There are two gear pumps with fixed displacement. One supplies the brake system with pressure, see section 4 *Brakes*, group 4.3.1 *Brake oil pump*. The other gear pump (position 1) circulates hydraulic oil for working hydraulics through the cooler and filter.

The gear pump pumps oil using two gear 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 fitted on the right-hand main pump and is driven by the main pump shaft from the transmission's power take-off. The brake oil pump's speed is directly dependent on engine speed. Pump flow increases and engine speed increases.



1. Hydraulic oil pump cooling and filtering working hydraulics

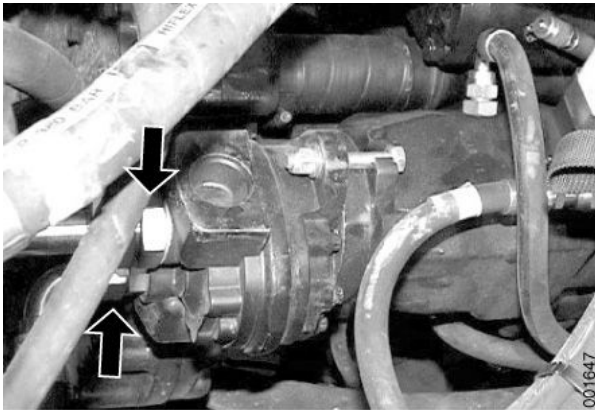
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Gear pump, replacement

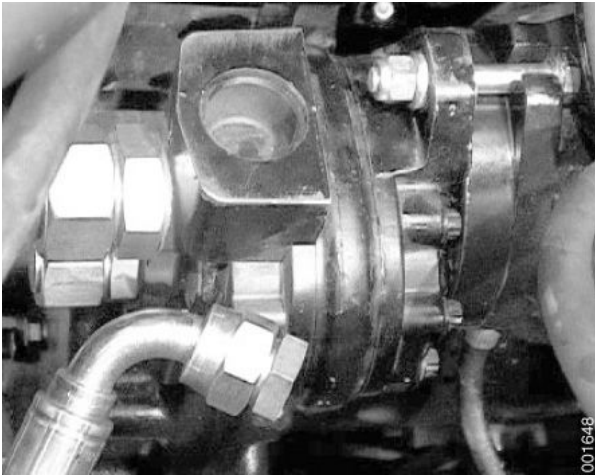
NOTE

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

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



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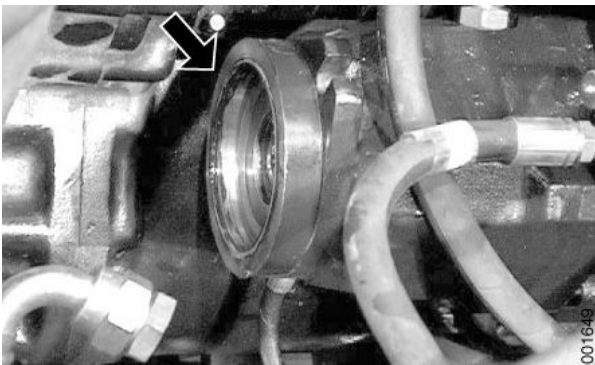
- 4 Remove the gear pump.
Remove the attaching bolts, pull the pump out backwards and lift it away.
- 5 Transfer the connection adapters to the new gear pump.



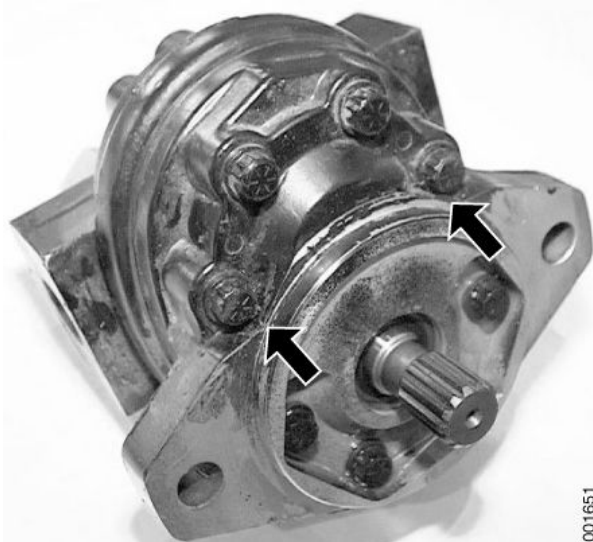
- 6 Remove the spacer ring from the gear pump or axial piston pump.
Clean the O-rings' contact surfaces on the spacer ring.
- 7 Check the O-rings and replace if necessary. Fit the O-rings on the spacer ring. Brush sealing silicone onto the sealing face against the gear pump, see section *F Technical data*.

NOTE

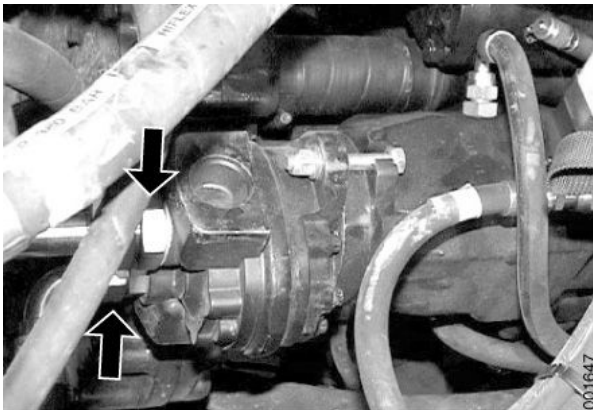
Only use silicone on the side facing the gear pump.



- 8 Fit the spacer ring on the axial piston pump.



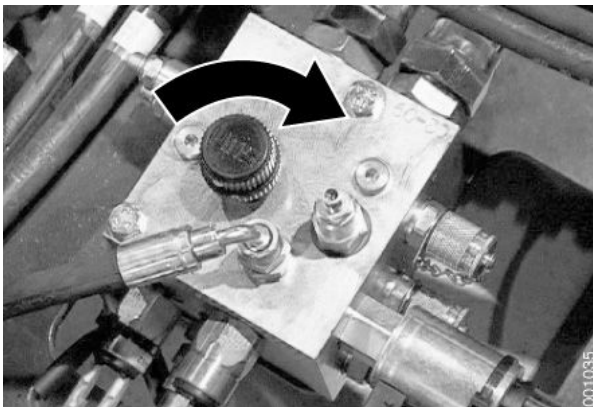
- 9 Brush sealing silicone onto the sealing face of the gear pump against the spacer ring, see section *F Technical data*.
- 10 Fit the gear pump on the axial piston pump.
Fit the pump and check that the gear engages in the shaft and that the spacer ring is fitted directly against the gear pump. Fit the pump's attaching bolts.



- 11 Connect the hydraulic hoses to the gear pump.

NOTE

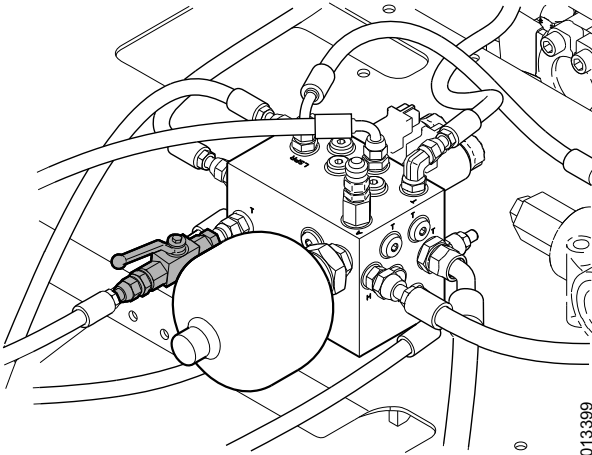
Check that the O-rings are intact, clean and in the correct position.



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

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



Relief valve for top lift, the figure shows an open valve.



- 13 Close the relief valve for top lift.



CAUTION

Hydraulic oil may be directed the wrong way.

Risk of damage to the fine filter for hydraulic oil.

Check that the relief valve for top lift is closed before starting the engine.

- 14 Switch on the system voltage and start the engine.
- 15 Check that the hose connections and seal between gear pump and axial piston pump are sealed tightly.

- 16 Check the oil level in the brake or hydraulic system, depending on which pump has been replaced, fill if necessary.



CAUTION

Do not overfill!

Leakage and environmental damage!

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

NOTE

If the pump is replaced due to malfunction, change the oil and filter in the brake system as well.

- 17 If the brake oil pump is replaced:
Check the brake pressure; see section 4 *Brakes*, group 4.3.1 *Brake oil pump*.

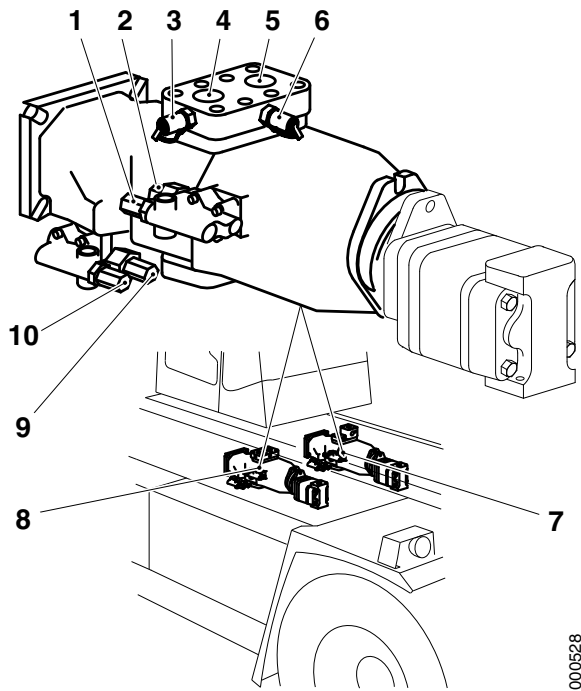
10.4.2 Axial piston pump with variable displacement

Axial piston pump with variable displacement, description

The hydraulic oil pumps are of the type variable axial piston pump, and are controlled by load signals depending on the flow demand from each function.

The hydraulic oil pumps are assembled in pairs with an inlet section for the suction line. The inlet section leads oil to and from the pumps. At the inlet section is a connection block containing test outlets for checking pump pressure. On the connection block are non-return valves that prevent the oil being pumped around between the pumps instead of out into the hydraulic system.

One of the left-hand pumps' connection blocks also contains a branching unit to the attachment hydraulics with a separate non-return valve.



Hydraulic oil pump unit

1. Adjusting screw standby pressure front pump
2. Adjusting screw max. pressure front pump
3. Test outlet pump pressure rear pump
4. Connection pressure side rear pump
5. Connection pressure side front pump
6. Test outlet pump pressure front pump
7. Left hydraulic oil pump unit
8. Right hydraulic oil pump unit
9. Adjusting screw max. pressure rear pump
10. Adjusting screw standby pressure rear pump

Axial piston pump with variable displacement, function description



Pos	Explanation	Signal description	Reference
1	The lift and extension control valve sends a load signal to valve block servo pressure when a function is activated.	See pressure plate Servo pressure lift and extension on left-hand frame member.	Section 7 <i>Load handling</i> , group 7.2 <i>Lifting/lowering</i>
2	Valve block servo pressure sends the load signal on to hydraulic oil pump No. 1, No. 2, No. 3 and No. 4.	See pressure plate Servo pressure lift and extension on left-hand frame member.	<i>Valve block servo pressure, general</i> , page 5:14
3	Hydraulic oil pump No. 1 increases the flow.	See pressure plate Max. pressure hydraulic oil pumps on left-hand frame member.	<i>Axial piston pump with variable displacement, description</i> , page 10:10
4	The non-return valve prevents the oil being pumped between the pumps.	-	-
5	Hydraulic oil pump No. 2 increases the flow.	See pressure plate Max. pressure hydraulic oil pumps on left-hand frame member.	<i>Axial piston pump with variable displacement, description</i> , page 10:10
6	The valve block distributes the oil between the control valves	-	-
7	The non-return valve prevents the oil being pumped between the pumps.	-	-
8	Hydraulic oil pump No. 3 increases the flow.	See pressure plate Max. pressure hydraulic oil pumps on left-hand frame member.	<i>Axial piston pump with variable displacement, description</i> , page 10:10
9	The non-return valve prevents the oil being pumped between the pumps.	-	-

Pos	Explanation	Signal description	Reference
10	Hydraulic oil pump No. 4 increases the flow.	See pressure plate Max. pressure hydraulic oil pumps on left-hand frame member.	<i>Axial piston pump with variable displacement, description, page 10:10</i>
11	The non-return valve prevents the oil being pumped between the pumps.	-	-
12	The priority valve controls the pressure from the pumps to the steering valve.	See the pressure plate, control pressure, on the left-hand frame member.	Section 5 <i>Steering</i> , group 5.2.2 <i>Priority valve</i>
13	For boom in Control unit, frame rear (D797-R) activates Solenoid valve, pump unloading (Y6062).	U = 24 V	Section 11 <i>Common electrics</i> , group 11.5.3.3 <i>Control unit, frame rear</i> Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.8.2 <i>BOOM menu 2</i>
14	Solenoid valve, pump unloading (Y6062) is activated and acts on the valve slide in valve block servo pressure.	-	Section 7 <i>Load handling</i> , group 7.3.9 <i>Valve block pump unloading</i>
15	Valve block servo pressure leads the load signal to hydraulic oil pump No. 1 and No. 2 to tank.	-	<i>Valve block servo pressure, general, page 5:14</i>
16	Hydraulic oil pump No. 1 stops pumping oil to control valve lift, lower and extension (standby pressure only).	1.8 MPa	<i>Axial piston pump with variable displacement, description, page 10:10</i>
17	Hydraulic oil pump No. 2 stops pumping oil to control valve lift, lower and extension (standby pressure only).	2.1 MPa	<i>Axial piston pump with variable displacement, description, page 10:10</i>
18	The steering valve sends a load signal to the priority valve and valve block servo pressure when the steering wheel is turned.	-	Section 5 <i>Steering</i> group 5.2.3 <i>Steering valve</i>
19	Valve block servo pressure leads the load signal on to hydraulic oil pump No. 3 and No. 4.	-	<i>Valve block servo pressure, general, page 5:14</i>
20	Hydraulic oil pump No. 3 increases the flow.	See pressure plate Max. pressure hydraulic oil pumps on left-hand frame member.	<i>Axial piston pump with variable displacement, description, page 10:10</i>
21	The non-return valve prevents the oil being pumped between the pumps.	-	-
22	Hydraulic oil pump No. 4 increases the flow.	See pressure plate Max. pressure hydraulic oil pumps on left-hand frame member.	<i>Axial piston pump with variable displacement, description, page 10:10</i>
23	The non-return valve prevents the oil being pumped between the pumps.	-	-
24	The priority valve directs pressure from hydraulic oil pump No. 3 and No. 4 to the steering valve.	-	Section 5 <i>Steering</i> , group 5.2.2 <i>Priority valve</i>
25	The adjusting valve leads an adjusted load pressure back to the priority valve to compensate for the pressure drop.	-	-
26	If any attachment function is activated then Control unit, frame rear (D797-R) activates Solenoid valve, top hydraulics (Y6003).	U = 24 V	Section 11 <i>Common electrics</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, menu 6</i> .
27	Solenoid valve, top hydraulics (Y6003) acts on a valve slide in valve block servo pressure.	-	Section 7 <i>Load handling</i> , group 7.4.2 <i>Valve block, top lift hydraulics</i>

Pos	Explanation	Signal description	Reference
28	Valve block servo pressure directs an unloaded constant pressure to hydraulic oil pump No. 2, this functions as a load signal. When Solenoid valve, top hydraulics (Y6003) is not activated, the unloaded pressure is directed to tank.	-	<i>Valve block servo pressure, general, page 5:14</i>
29	Hydraulic oil pump No. 2 increases the flow.	See pressure plate Max. pressure hydraulic oil pumps on left-hand frame member.	<i>Axial piston pump with variable displacement, description, page 10:10</i>
30	The non-return valve prevents the oil being pumped between the pumps.	-	-
31	Control valve, attachment directs pressure to the correct function.	-	<i>Section 7 Load handling, group 7.4.3 Control valve, attachment</i>
32	Valve block servo pressure reduces the standby pressure from the hydraulic oil pumps to servo pressure.	-	<i>Valve block servo pressure, general, page 5:14</i>
33	Accumulator servo pressure stores and equalises the servo pressure.	-	<i>Section 7 Load handling, group 7.2.4 Accumulator servo circuit</i>
34	The servo filter cleans the oil.	-	<i>Section 7 Load handling, group 7.22 Servo filter</i>
35	The pressure limiting valve drains the pressure from the hydraulic oil pumps to tank if the feed pressure becomes too high.	Opening pressure: 28 MPa	<i>Pressure limiting valve, description, page 10:4</i>

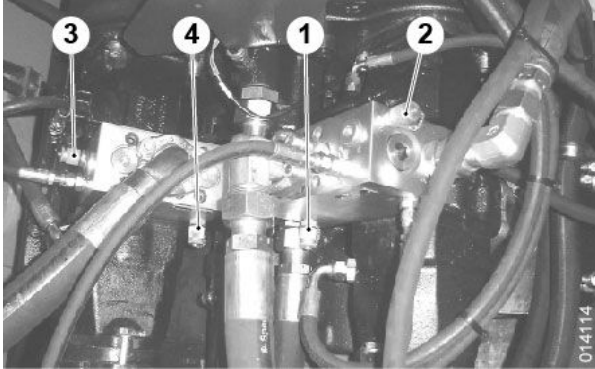
Hydraulic diagram, see section *E Schematics*, group *10 Common hydraulics*, *Hydraulic diagram, basic machine*.

Hydraulic diagram, see section *E Schematics*, group *10 Common hydraulics*, *Hydraulic diagram, top lift*.

Hydraulic oil pump, checking

NOTE

Read the safety instructions for oil before working, see section 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 engine.
- 3 Connect a pressure gauge to measuring outlet on hydraulic oil pump 1.
- 4 Start the engine and run it at idle.
- 5 Check the standby 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 may have higher standby pressure. For correct standby pressure, see pressure plate. However, the difference in pressure between the different pumps must always be maintained.

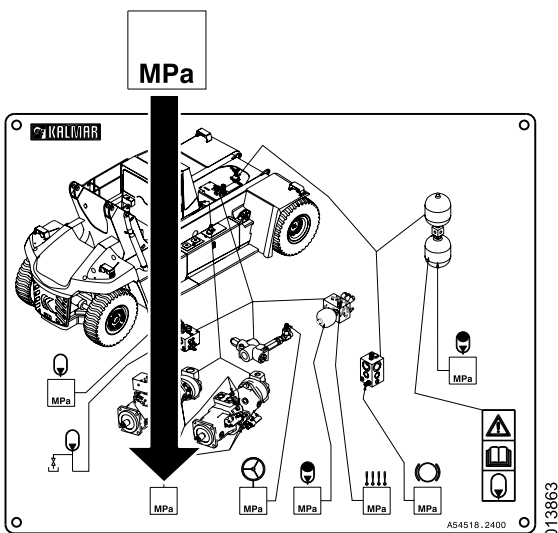
- 6 Increase engine speed to approx. 1100 rpm and run the extension function against end-position (overflow).

Run out the boom to max. and continue to request max. extension with the control lever. This will cause the overflow of the extension function.

- 7 Check the max. pressure on hydraulic oil pump 1, the pressure should correspond with the value on the pressure plate.
All pumps should give the same pressure. The sequence between the pumps is of no importance.

- 8 Turn off 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, replacement

NOTE

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

- 1 Park the machine with the cab in the rearmost position and the boom fully raised, and half extended.

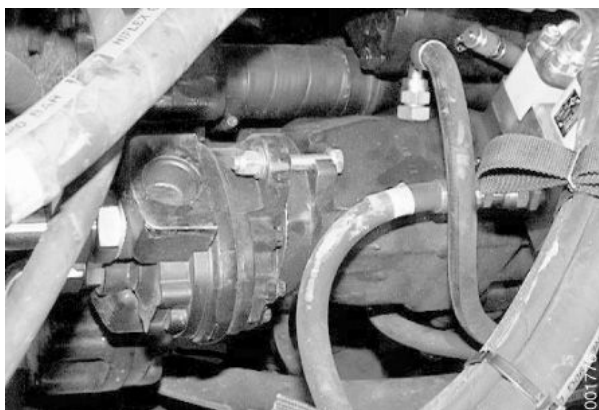


CAUTION

Make sure that the oil level in the hydraulic oil tank is below the mouth of the axial piston pump's suction hose.

If there is not enough room to lift the boom, the hydraulic oil tank must be drained, see *Hydraulic oil, changing*, page 10:33.

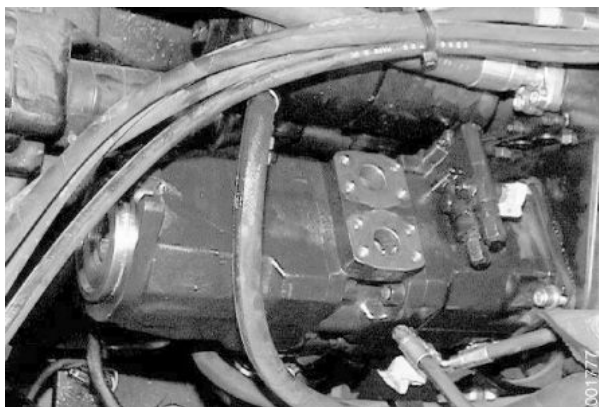
- 2 Switch off the system voltage.
- 3 Depressurise the brake and hydraulic systems, see section *B Safety*.
- 4 Release the brake oil pump or cooling pump from the hydraulic oil pump depending on the pump to be replaced.
- 5 Suspend the gear pump.
- 6 Use a plastic bag or similar to protect the connection to the gear pump.



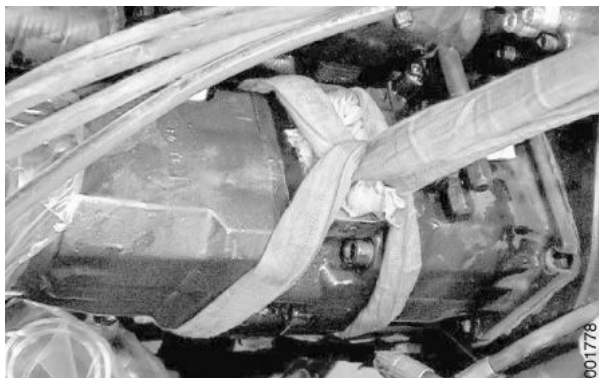
- 7 Mark up and detach the hydraulic hoses from the axial piston pump.

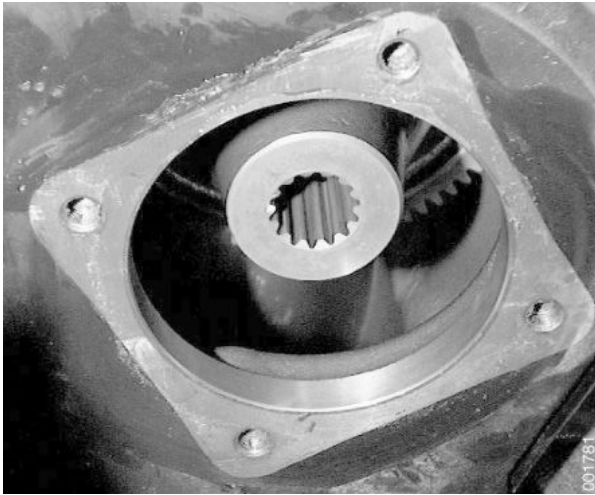
NOTE

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 attaching bolts and lift away the pump.





- 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, clean and in the correct position.

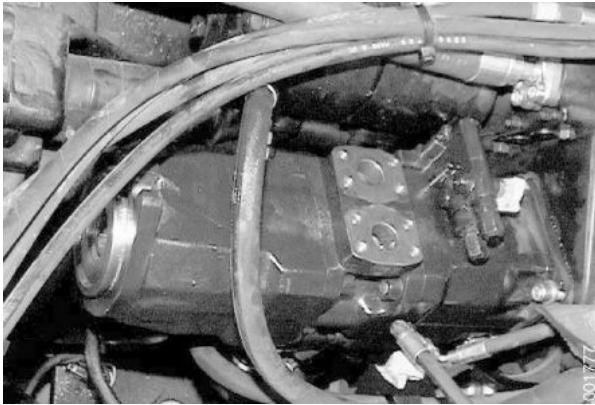


- 12 Brush sealing silicone on the axial piston pump flange where it makes contact with the gearbox, see section *F Technical data*.

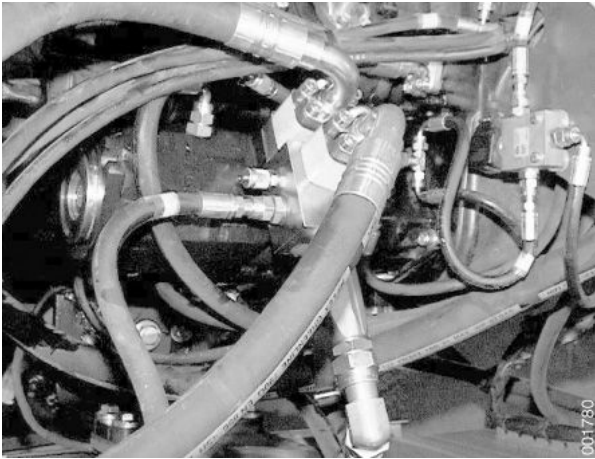
- 13 Fit the axial piston pump.

Position the axial piston pump so that the pump shaft engages the gearbox transmission. Fit the attaching bolts.

- 14 Connect the suction hose to the axial piston pump.



- 15 Fill the pump with oil through the connections on the top.



- 16 Connect the hydraulic hoses to the axial piston pump in accordance with the marking.

NOTE

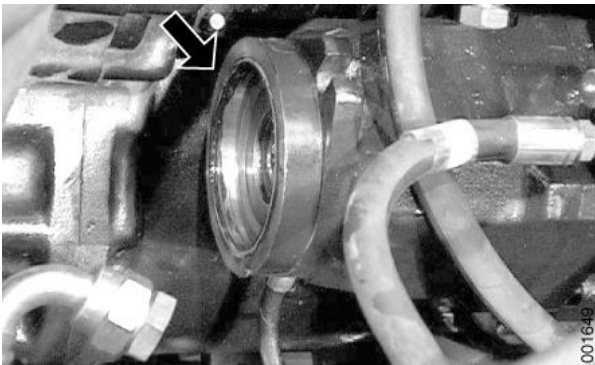
Check that the O-rings are intact, clean and in the correct position.



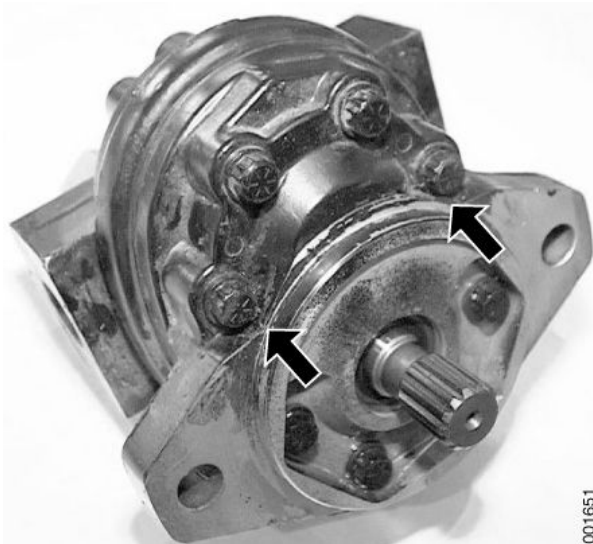
- 17 If the spacer ring remains in place on the axial piston pump. Remove the spacer ring between the gear pump and axial piston pump.
- If the spacer ring remains in place on the gear pump, go to step 20.
- Clean the O-rings' contact surfaces on the spacer ring.
- 18 Check the O-rings and replace if necessary. Fit the O-rings on the spacer ring. Brush sealing silicone onto the sealing face against the gear pump, see section *F Technical data*.

NOTE

Only use silicone on the side facing the gear pump.

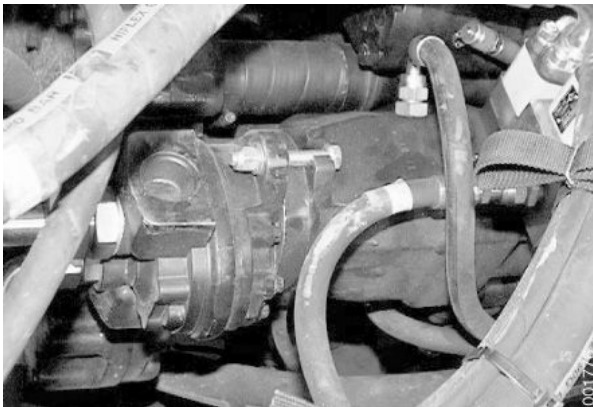


- 19 Fit the spacer ring on the axial piston pump.



The illustration shows a loose pump.

- 20 Brush sealing silicone onto the sealing face of the gear pump against the spacer ring, see section *F Technical data*.

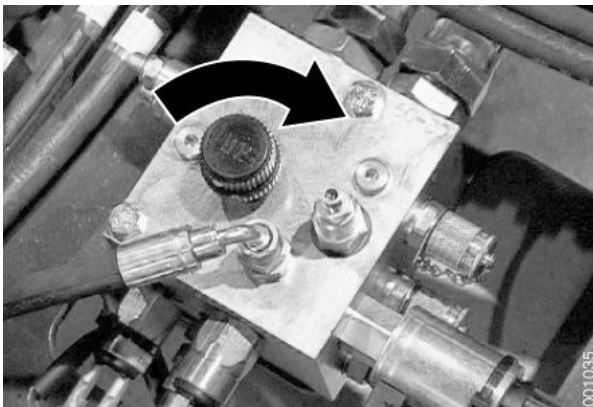


- 21 Fit the gear pump.
Fit the gear pump on the axial piston pump and fit the attaching bolts. Exercise cautions that the O-ring on the spacer ring is correctly aligned and that the gear pump's shaft engages the axial piston pump's output shaft.
- 22 Vent the axial piston pump, see *Axial piston pump with variable displacement, bleeding*, page 10:20.



CAUTION

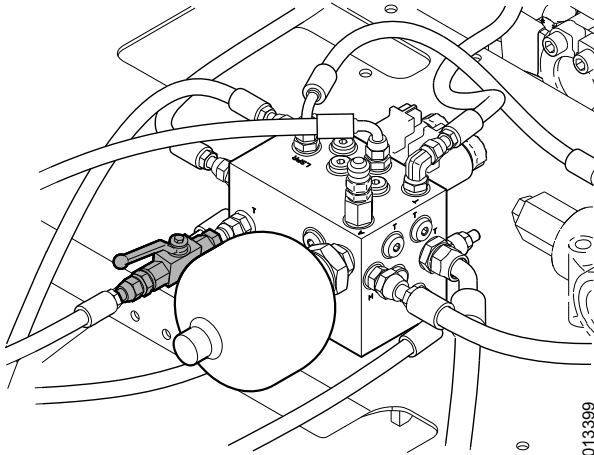
**Vent the axial piston pump before starting the engine.
The oil in the axial piston pump may cavitate and cause product damage.**



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

NOTE

Check that the accumulator drain valve is fully closed and tighten the lock ring.



Relief valve for top lift, the figure shows an open valve.



- 24 Close the relief valve for top lift.



CAUTION

Hydraulic oil may be directed the wrong way.

Risk of damage to the fine filter for hydraulic oil.

Check that the relief valve for top lift is closed before starting the engine.

- 25 Switch on the system voltage and start the engine.
- 26 Check that the hose connections and seal between the axial piston pump and gear pump are sealed tightly.
- 27 Check the pump pressures, see *Hydraulic oil pump, checking*, page 10:14.
- 28 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 centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.

NOTE

If the pump is replaced due to malfunction, change the oil and filter in the hydraulic system as well.



CAUTION

Do not overfill!

Leakage and environmental damage!

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

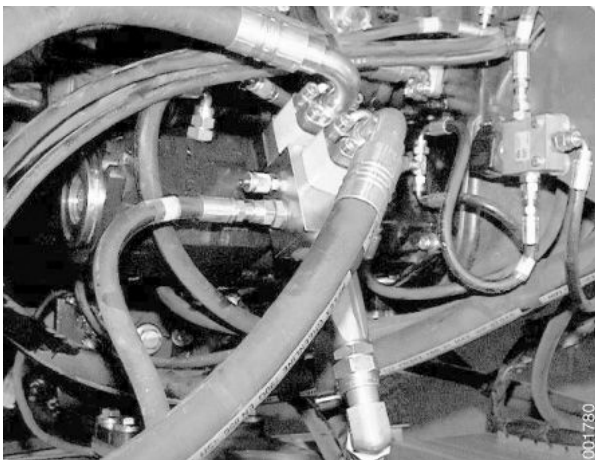
Axial piston pump with variable displacement, bleeding

NOTE

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



- 1 Remove the hydraulic oil tank's 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 Switch on the system voltage and start the engine.
- 6 Let the engine idle for at least one minute. Check that all the connections are sealed tightly.
- 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 engine.
- 9 Wash the engine compartment.

10.4.3 Pipes and hoses

Pipes and hoses, general

See *Pipes and hoses, general*, page 10:21.

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 must not be twisted. (A twist of 7% reduces service life by 90%.)
3. Minimise 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 section *F Technical data*.

NOTE

Straight coupling requires a counterhold wrench to prevent damage to the O-ring.

7. The O-rings must not be oiled when fitted.

Hose length

Hose length is measured on a hose laid out between the sealing surfaces. On angled connections, measure from the sealing surface's centre line [C/L] as illustrated.

Cleanliness

The function and service life of hydraulic components depend to a great extent on how clean the hydraulic oil is. It is therefore very important to prevent dirt from entering the brake and hydraulic system.

Some simple advice to keep the hydraulic system clean.

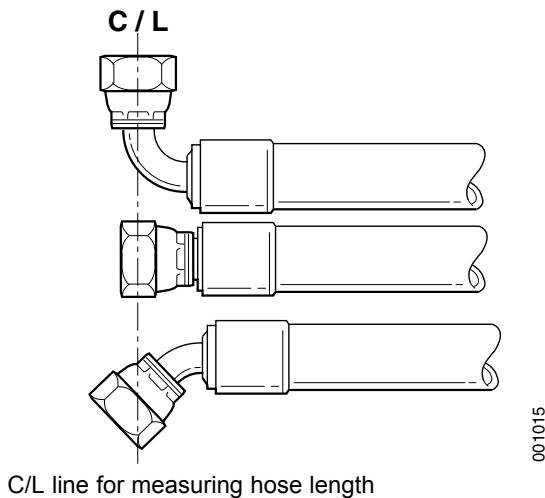
- Always clean the area around a component before starting to work.
- Plug hose connections immediately after disconnecting. If possible, use correct plugs for the connection type. If plugs are missing, use clean plastic bags and cable ties or tape to seal the connection.
- Never re-use oil that has 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

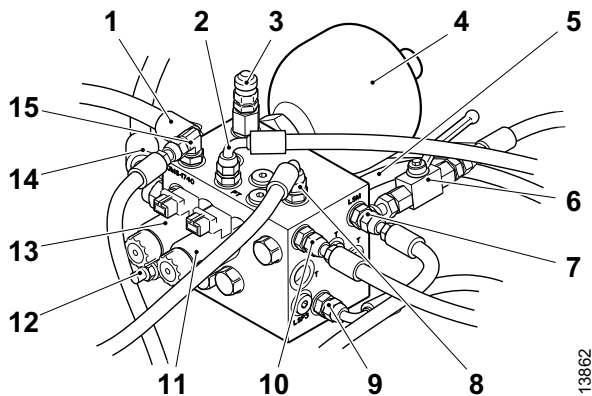
Priority valve, description

See section 5 *Steering*, group 5.2.2 *Priority valve*.



10.5.7 Valve block servo pressure

Valve block servo pressure, description



1. Servo pressure to control valve lift, lower and extension [H]
2. Unloaded constant pressure from hydraulic oil pump 2
3. Test outlet servo pressure [A]
4. Accumulator servo pressure [A]
5. Control signal hydraulic oil pump 1 [LSP2]
6. Relief valve attachment [T]
7. Load signal from control valve lift, lower and extension [LSM]
8. Load signal from steering valve [LSPR]
9. Control signal hydraulic oil pump 2 [LSP3X]
10. Control signal hydraulic oil pump 3 and 4 [LSP1]
11. Solenoid valve, top hydraulics (Y6003)
12. Adjusting screw servo pressure
13. Solenoid valve, pump unloading (Y6062)
14. Drain to hydraulic oil tank [EE]
15. Leakage line from control valve lift, lower and extension [AA]

Valve block servo pressure controls load signals from the load handling functions and steering to the variable axial piston pumps. Also fitted on the valve are accumulator servo pressure and relief valve attachment. The valve block contains pressure reducers for servo pressure, shuttle valves and valve slides.

Valve block servo pressure is fitted to the right of the hydraulic plate in the engine compartment in front of the transmission.

The following are fitted on the valve block: Accumulator servo circuit, see 7 *Load handling*, group 7.2.4 *Accumulator servo circuit*; Solenoid valve, pump unloading (Y6062), see 7 *Load handling*, group 7.3.9 *Valve block pump unloading* and Solenoid valve, top hydraulics (Y6003) 7 *Load handling*, group 7.4.2 *Valve block, top lift hydraulics*.

Pressure reducer

The pressure reducer reduces the pressure from the hydraulic oil pumps to servo pressure for the control valve.

The servo pressure is stored in Accumulator servo circuit 7 *Load handling*, group 7.2.4 *Accumulator servo circuit*. A built-in non-return valve prevents pressure leakage from the accumulator when the machine is not in use.

Shuttle valve

Shuttle valves select the strongest of two pressures and lead it further. Valve block servo pressure contains three shuttle valves which ensure that the function that requires most pressure is the function that controls the flow of the pumps.

Valve, pump unloading

For boom in, only a small oil flow is required. Valve slide pump unloading drains the control signal for hydraulic oil pump 1 and 2, to the tank. This results in only hydraulic oil pumps 3 and 4 building up pressure, which reduces the use of engine power and thus fuel consumption. If other functions are activated at the same time, the pressure signal will pass through the shuttle valves in valve block servo pressure. The valve slide is controlled by Solenoid valve, pump unloading (Y6062), see 7 *Load handling*, group 7.3.9 *Valve block pump unloading*.

Solenoid valve, pump unloading (Y6062) is supplied with voltage by Control unit, frame rear (D797-R) on activation.

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.8.2 *BOOM, menu 2*.

Valve, top hydraulics

To ensure pressure supply when the attachment functions are used, valve slide top hydraulics leads an unloaded constant pressure as load signal to hydraulic oil pump 2 when attachment functions are activated. The valve slide is controlled by Solenoid valve, engagement hydraulic pressure (Y6003), see Solenoid valve, top hydraulics (Y6003) 7 *Load handling*, group 7.4.2 *Valve block, top lift hydraulics*.

When the solenoid valve is activated, pressure is routed from the top hydraulics' supply through a shuttle valve to control of the hydraulic oil pumps. A restriction before the valve block ensures that pressure for control of the hydraulic oil pumps does not become too high. When the solenoid valve is not activated, the load signal is drained to the 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 via the diagnostic menu. See section 8 *Control system*, group 8.4.5.6 *HYD*, menu 6.

Collection block returns

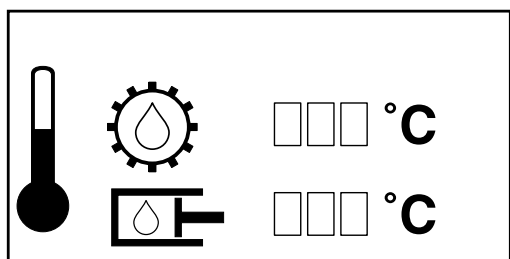
The valve block also collects the drainage lines from different valves and leads them on back to the tank. The drain lines are very sensitive to back-pressure, if pressure builds up in the drain lines the valves will not work properly.

Servo pressure, checking and adjustment

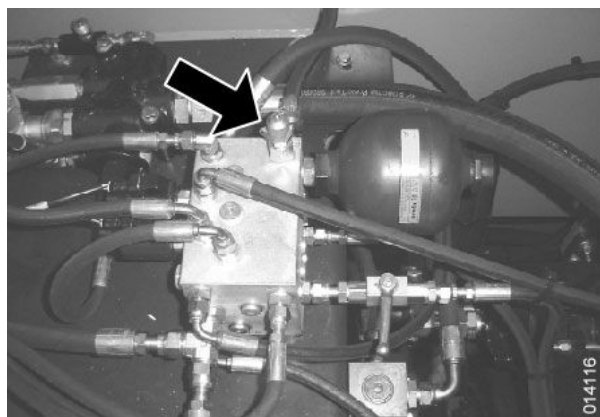
NOTE

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

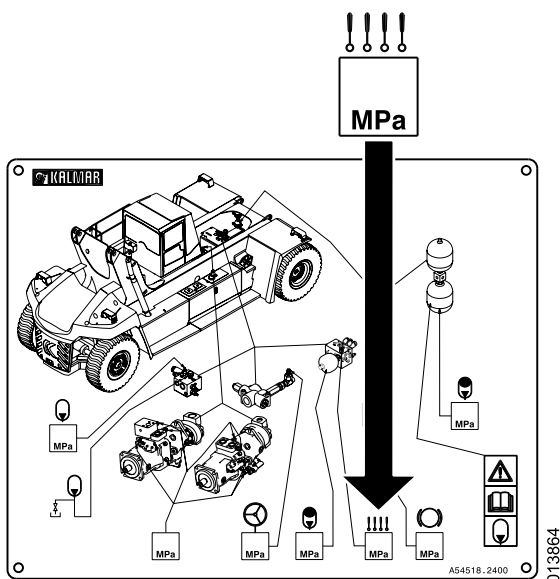
- 1 Operate and warm up the machine so that the hydraulic oil is at operating temperature, at least 50 °C. As an alternative, operate until the cooling fan is activated.
- 2 Machine in service position, see section *B Safety*.



Operating menu, hydraulic oil temperature



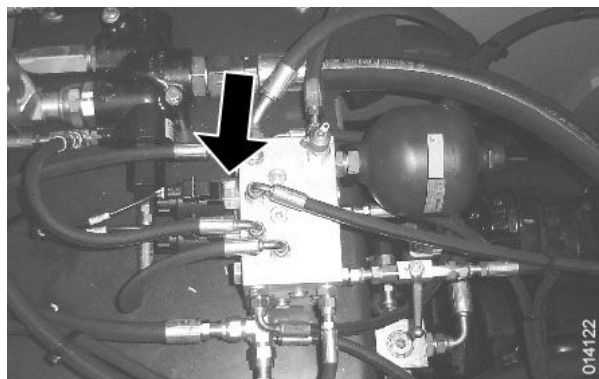
- 3 Connect a pressure gauge (0-25 MPa) to the measuring outlet on the pressure reducing valve.



The appearance of the pressure plate may vary, but the symbols are the same.

- 4 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.



- 5 If necessary, 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.

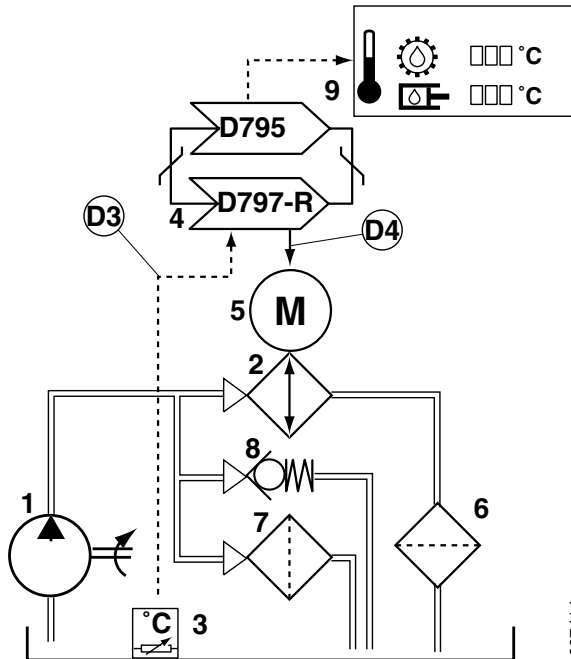
Clockwise: reduce pressure.

Anticlockwise: increase pressure.

- 6 Remove the pressure gauge and fit the protective cap on the measuring outlet.

10.6 Temperature control, cleaning and hydraulic oil

Temperature control, cleaning and hydraulic oil, function description



The oil of the hydraulic system is cooled and cleaned through circulation by a separate pump through the cooler and filters. The cooler has a temperature-regulated electric fan that prevents overheating.

Temperature control consists of a hydraulic oil tank, hydraulic oil pump, hydraulic oil cooler, cooling fan, hydraulic oil filter, fine filter, hydraulic oil temperature sensor and bypass valve.

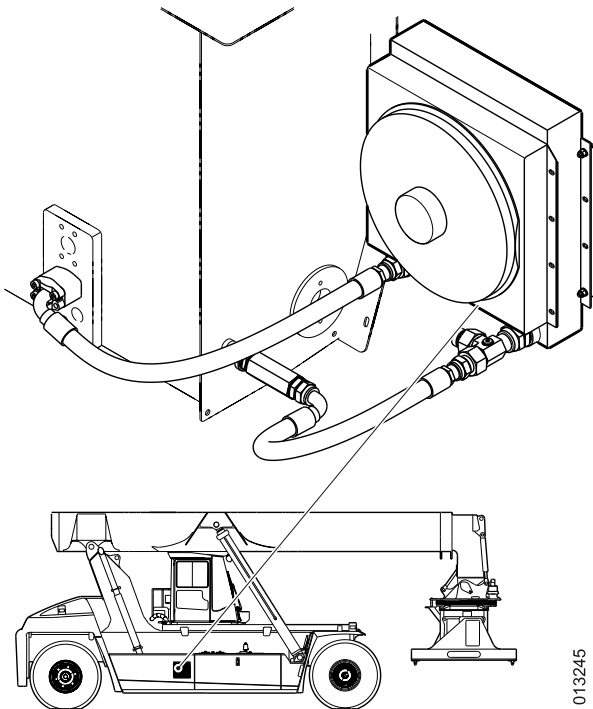
The hydraulic oil pump pumps oil (from the tank) which is cooled in the hydraulic oil cooler and cleaned by the oil filters in the tank. Some of the oil is filtered by the fine filter. An electric cooling fan increases the air flow through the cooler when the temperature needs to be lowered. A bypass valve leads the hydraulic oil past the cooler directly to the tank if the resistance through the cooler and filters is too high. The temperature sensor controls fan activation and temperature display.

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 10:6</i>
2	The hydraulic oil cooler cools the oil.	-	<i>Hydraulic oil cooler, description, page 10:26</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 10:27</i> D3: Diagnostic menu, see section 8 <i>Control system</i> group 8.4.5.1 <i>HYD, menu 1</i>
4	Control unit, frame rear (D797-R) transmits temperature on the CAN bus and supplies power to the cooling fan as necessary.	Hydraulic fan active: U = 24 V	Section 11 <i>Common electrics</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, menu 1</i>
5	The cooling fan (M668) increases air flow through the cooler.	-	<i>Cooling fan, description, page 10:27</i>
6	The hydraulic oil filters clean the hydraulic oil.	-	<i>Hydraulic oil filter, description, page 10:31</i>
7	Some of the oil is pumped through the hydraulic oil fine filter for deep cleaning.	-	<i>Fine filter hydraulic oil, description, page 10:33</i>
8	If resistance through the oil cooler and hydraulic oil filter becomes too great, the cooler bypass valve opens and directs the oil to the tank.	-	<i>Bypass valve, cooler, description, page 10:29</i>
9	Control unit KID (D795) shows hydraulic oil temperature in the display.	Checked by control system, error shown with error code.	Section 11 <i>Common electrics</i> , group 11.5.3.12 <i>Control unit, KID</i>

10.6.2 Hydraulic oil cooler

Hydraulic oil cooler, description

The working hydraulics use a through-flow cooler with electric cooling fan (the same type of cooler as used for the brake system). The oil is cooled when it passes through the cooler. The cooler is fitted inside the side panel on the right-hand side behind the hydraulic oil tank.



013245

Hydraulic oil cooler, replacement

NOTE

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

- 1 Machine in service position, see section B Safety.
- 2 Drain the oil from the hydraulic oil tank, see *Hydraulic oil, changing*, page 10:33.
- 3 Mark up and detach the hydraulic hoses from the cooler. Let the oil in the cooler drain into the receptacle.

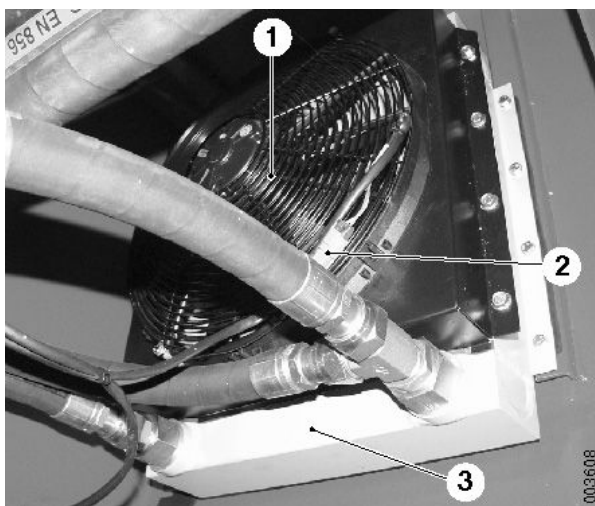
NOTE

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

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

NOTE

Check that the O-rings are intact, clean and in the correct position.



003608

1. Cooling fan
2. Connector
3. Radiator



- 10 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 centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

Do not overfill!

Leakage and environmental damage!

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

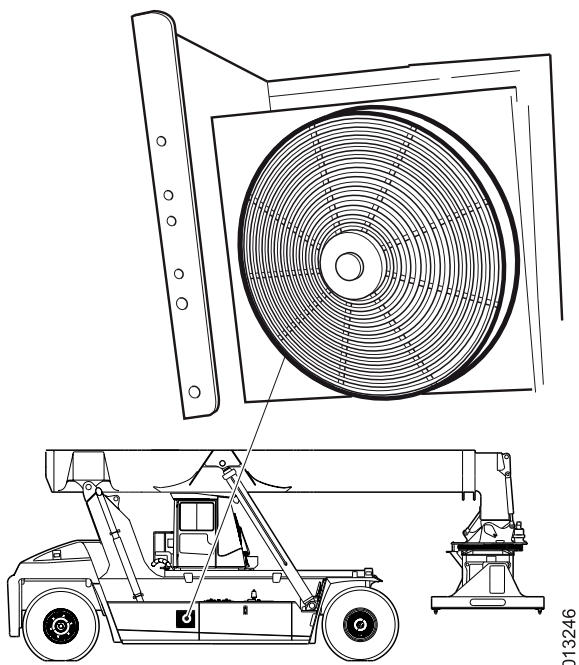
10.6.3 Cooling fan

Cooling fan, description

The electric cooling fan is forcing. 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 voltage by Control unit, frame rear (D797-R) upon activation when the engine is running. The cooling fan is activated when oil temperature is 65 °C in the hydraulic oil tank and the fan is deactivated when oil temperature is 55 °C.

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.5.1 *HYD*, menu 1.



10.6.4 Sensor hydraulic oil temperature

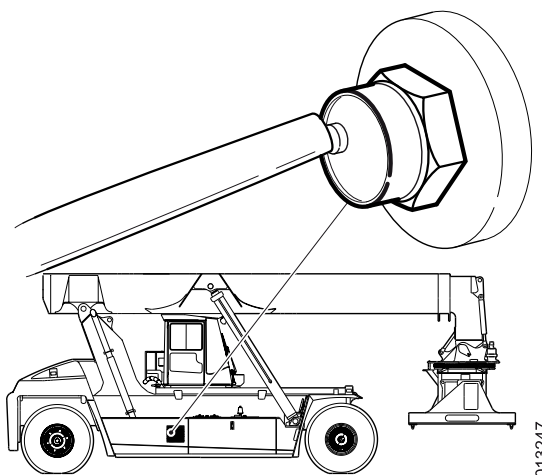
Sensor, hydraulic oil temperature, description

Sensor, hydraulic oil temperature (B776) detects the temperature of the hydraulic oil. The sensor is fitted on the hydraulic oil tank's rear short side.

The sensor detects the oil temperature in the tank, and therefore takes into account the accumulated heat in the hydraulic oil. Because of this, the cooling fan may continue to run after the machine has been parked and switched off.

Sensor, hydraulic oil temperature (B776) is supplied voltage by, and sends a voltage signal proportional to the oil temperature to, Control unit, frame rear (D797-R).

The signal can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.5.1 *HYD*, menu 1.



Sensor, hydraulic oil temperature, replacement

NOTE

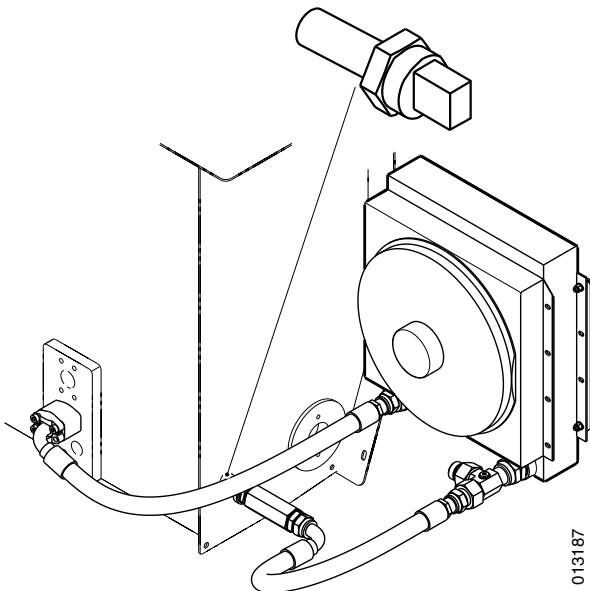
Read the safety instructions for oil before working, see section B Safety.

- 1 Machine in service position, see section B Safety.
- 2 Drain the oil from the hydraulic oil tank, see *Hydraulic oil, changing*, page 10:33.
- 3 Disconnect the cable harness from Sensor, hydraulic oil temperature (B776).
- 4 Replace Sensor, hydraulic oil temperature (B776).

NOTE

Check that the O-rings are intact, clean and in the correct position.

- 5 Connect the cable harness to the sensor.



Sensor, hydraulic oil temperature (B776)



- 6 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 centre of the sight glass. Top up if necessary, for grade see section F Technical data.



CAUTION

Do not overfill!

Leakage and environmental damage!

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

DIAG HYD	1 (6)
HYDRAULIC OIL	
TEMP	XXX
FAN	XY

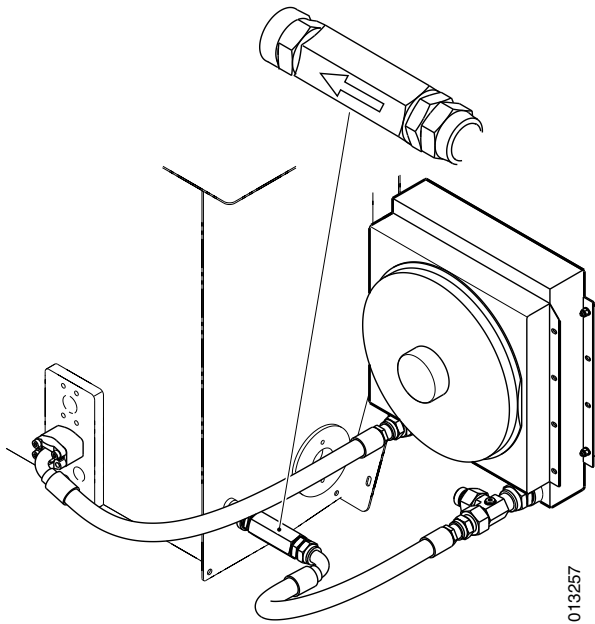
Diagnostic menu Hyd, menu 1

- 7 Use the display, go to the diagnostic menu, see section 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 Bypass valve, cooler

Bypass valve, cooler, description

The bypass valve protects the cooler from overpressure. The valve opens a passage past the cooler directly to the tank if resistance in the cooler becomes too high.



Bypass valve, cooler, replacement

NOTE

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

IMPORTANT

Ensure cleanliness around the filter and filling point when working on the hydraulic tank.

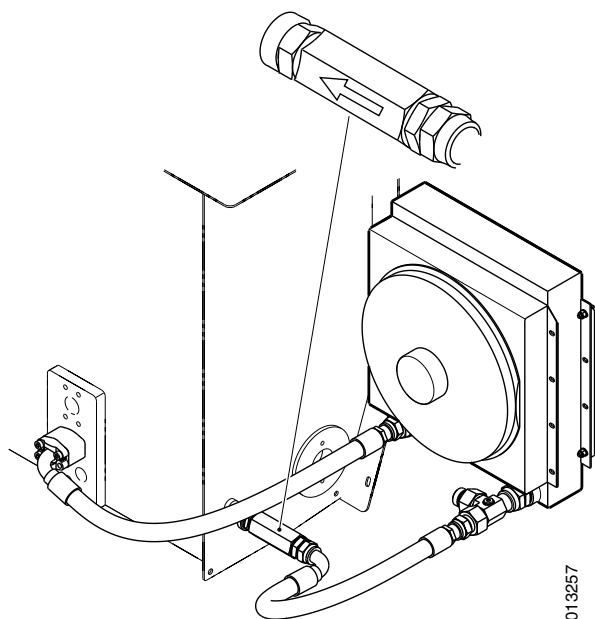
Dirt particles may cause machine damage.

- 1 Machine in service position, section *B Safety*.
- 2 Depressurising removed.
- 3 Drain the oil from the hydraulic oil tank, see *Hydraulic oil, changing*, page 10:33.
- 4 Disconnect the bypass valve from the tank.

NOTE

Note how the bypass valve faces; the valve is marked with an arrow.

- 5 Install the new bypass valve, turning the valve to face the same way as the old one. Use Loctite when fitting the bypass valve.



Bypass valve



- 6 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 centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

Do not overfill!

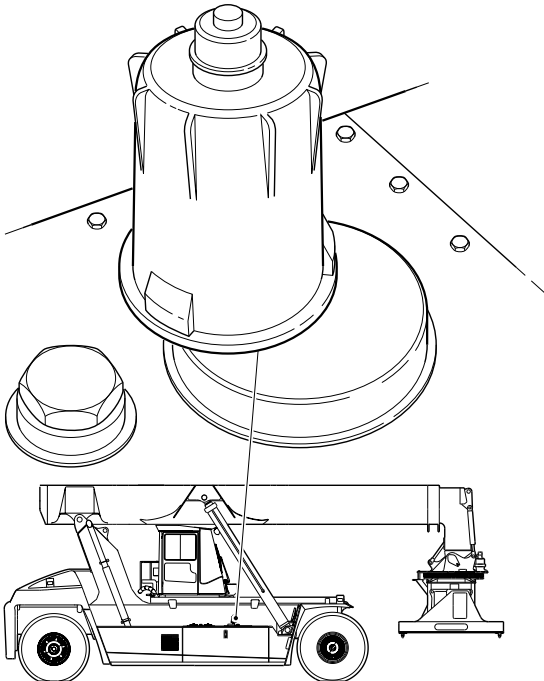
Leakage and environmental damage!

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

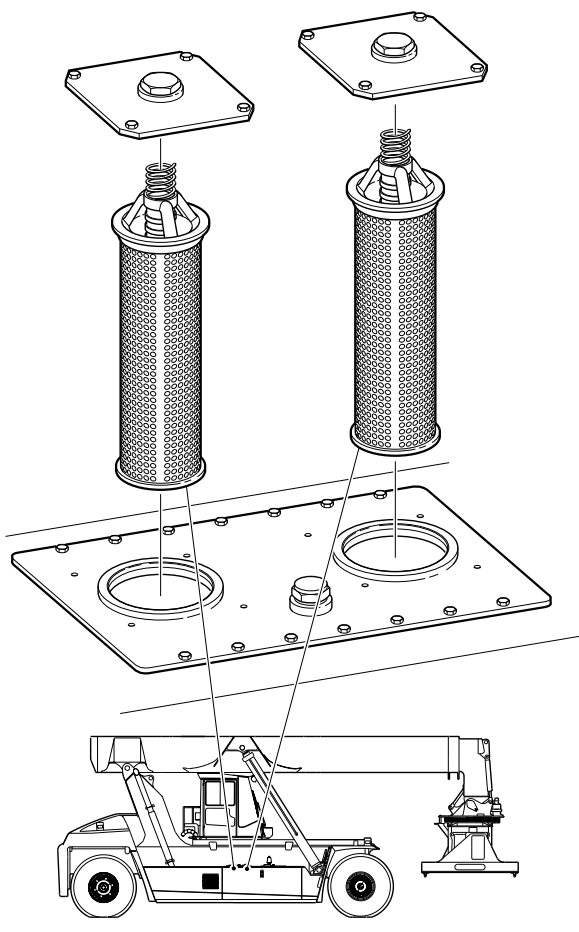
A breather filter of insert type is mounted on the hydraulic oil tank to protect the tank from impurities. On the top of the filter housing is an indicator that shows when the filter is clogged and needs to be changed.



10.6.7 Hydraulic oil filter

Hydraulic oil filter, description

The oil in the hydraulic system is cleaned by two return filters fitted inside the hydraulic oil tank. The oil is pumped through the cooler and back through the filters by the cooling pump. Some of the return oil from the load handling functions also passes through the filters.



Hydraulic oil filter, replacement

NOTE

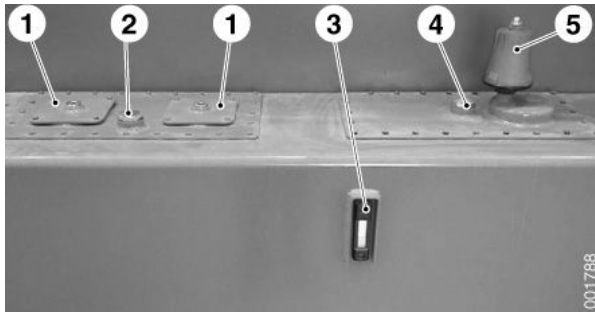
Read the safety instructions for oil before working, see section B Safety.

IMPORTANT

Ensure cleanliness around the filter and filling point when working on the hydraulic tank.

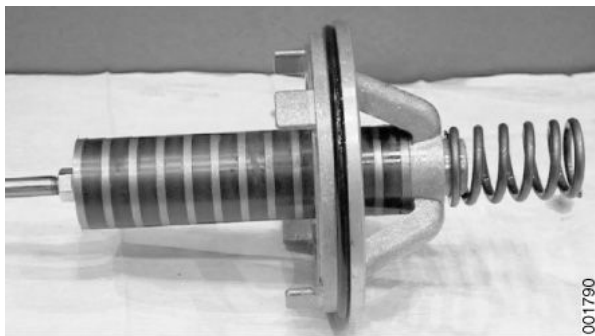
Dirt particles may cause machine damage.

- 1 Switch off the engine and switch off the system voltage.



1. Oil filter cover
2. Filling point hydraulic oil
3. Sight glass hydraulic oil
4. Filling point hydraulic oil
5. Breather filter hydraulic oil tank

- 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 Separate the filter unit and remove the filter insert. Handle the filter insert as environmentally hazardous waste. Note the position of the parts.



Magnetic rod

- 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 crosswise.



- 8 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 centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

Do not overfill!

Leakage and environmental damage!

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

10.6.8 Hydraulic oil

Hydraulic oil, changing

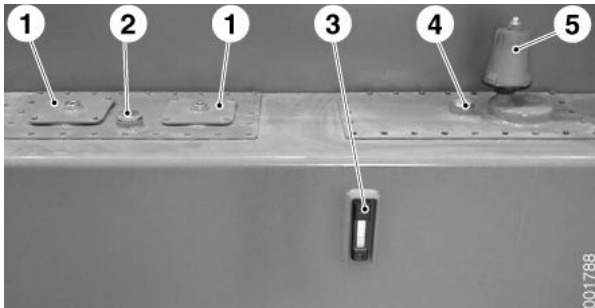
NOTE

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

IMPORTANT

Ensure cleanliness around the filter and filling point when working on the hydraulic tank.

Dirt particles may cause machine damage.



1. Oil filter cover
2. Filling point hydraulic oil
3. Sight glass hydraulic oil
4. Filling point hydraulic oil
5. Breather filter hydraulic oil tank

- 1 Machine in service position, see section B Safety.
- 2 Remove the filler cap and pump out the hydraulic oil into a receptacle.
- 3 When as much oil as possible has been pumped out. Place a receptacle 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 out.

NOTE

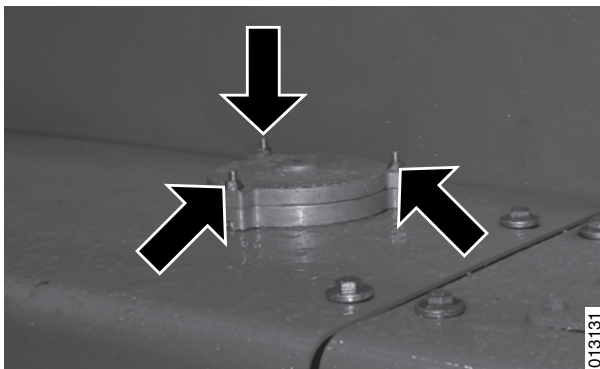
Make sure that the seal washer for the drain plug is fitted as well.

- 5 If the hydraulic oil filters are to be changed, change them before filling the tank with oil, see *Hydraulic oil filter, replacement*, page 10:31.
- 6 Fill new hydraulic oil through the filler holes on the filters' covers. This results in the filtering of the oil that is filled and protects the hydraulic system from impurities.

Fill oil until the oil level is in the middle of the sight glass. For volume and grade, see section F *Technical data*.

10.6.9 Fine filter hydraulic oil

Fine filter hydraulic oil, description



The fine filter is fitted on the frame member in the engine compartment. The filter is connected to hydraulic oil pump cooling and filtration. The filter is connected in parallel to the hydraulic oil filters in the hydraulic oil tank.

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 amount of oil but with a higher degree of filtration when the machine is running.

Fine filter hydraulic oil, replacement

NOTE

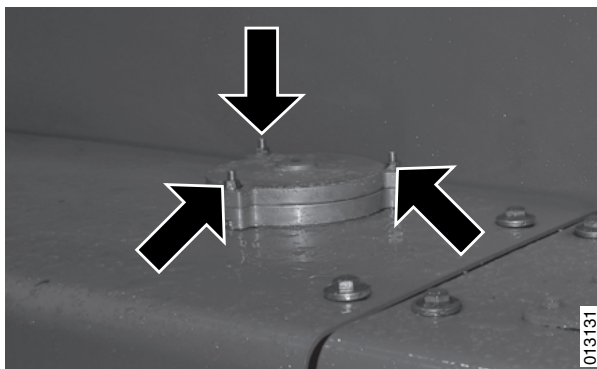
Read the safety instructions for oil before working, see section B Safety.

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 section *B Safety*.
- 2 Remove the cover.
- 3 Lift up the filter insert and place it in the receptacle. Let the hydraulic oil drain.
- 4 Fit the new filter insert and refit the cover over the fine filter.



- 5 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 centre of the sight glass. Top up if necessary, for grade see section *F Technical data*.



CAUTION

Do not overfill!

Leakage and environmental damage!

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

10.6.10 Pipes and hoses

Pipes and hoses, general

See Pipes and hoses, general, page 10:21.

10.7 Other

10.7.1 Hydraulic cylinders

Hydraulic cylinders, repairs

Fault tracing, leakage

1



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.

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 face end welds
- At sleeve coupling welds
- Between cylinder barrel and cylinder head

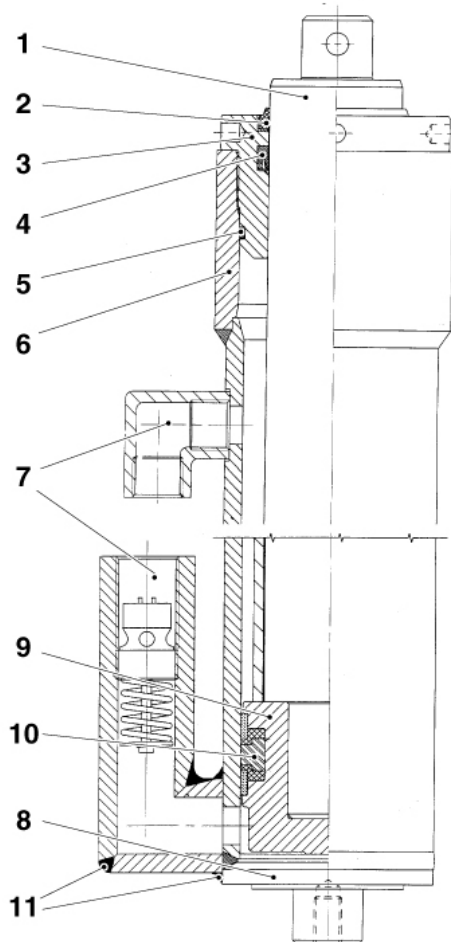
This could be due to a defective O-ring or damaged O-ring sealing surfaces. Both faults can be rectified with the cylinder in situ.

- 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. Pressurise the cylinder and check whether the piston sinks back.

This could be due to a worn piston seal.



001493

1. Piston rod
2. Scraper
3. Cylinder head
4. Piston rod seal
5. O-ring with support ring
6. Cylinder barrel
7. Sleeve coupling
8. Welded cylinder end face
9. Piston
10. Piston seal, double-acting
11. Example of weld

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 my. Slight damage to the chromium plating may not necessarily cause leakage directly.
 - all slide surfaces (dynamic surfaces), e.g. cylinder barrel and piston rod. These are always the hardest to seal.



CAUTION

When fitting the cylinder head:

Get it absolutely straight. This is best done by hand. Under no circumstances hit it with a mallet of any type.

If the cylinder head is fitted crooked, the sealing lip of the piston rod seal could be damaged, making an improper seal. This applies to all types of piston rod seals.

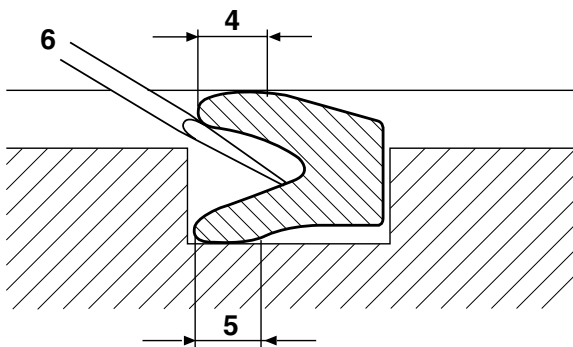
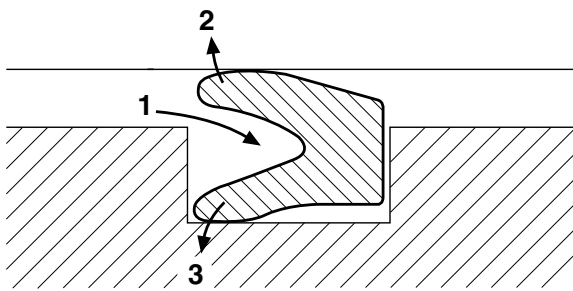
Function and removal of the seals

Piston rod seal

The piston rod seal is the seal that sits in the groove in the cylinder head and seals against the piston rod. This seal is very exposed to wear since it is both a dynamic and a static seal, i.e. it seals against a moving surface on the piston rod while the sealing surface with the cylinder head is fixed. There are different types of piston rod seals:

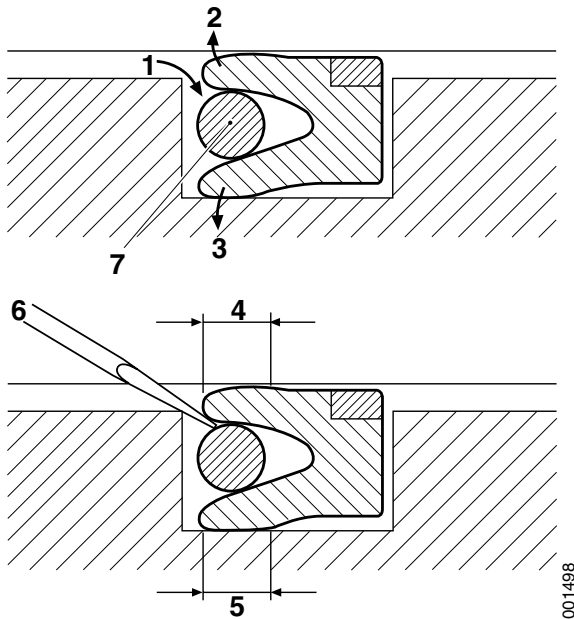
- Single V-seal
- Pre-stressed V-seal with support ring
- Compressible seal

The single V-seal has a V-shaped section with two lips that seal in opposite directions. The hydraulic pressure acts in the V-shape, pressing the sealing lips out towards the sealing surfaces on the piston rod and in the cylinder barrel. Even minor damage to the sealing lips can generate large leaks. Examine the sealing lips by carefully using a fingernail to feel around the seal. To remove, use a screwdriver to prise the seal outward and bend it up (see illustration). It is extremely important that the screwdriver is always inserted in the V-shape so that it cannot touch and thereby damage a sealing surface. A mark from a screwdriver on a sealing surface can have a devastating effect and cause major leakage.



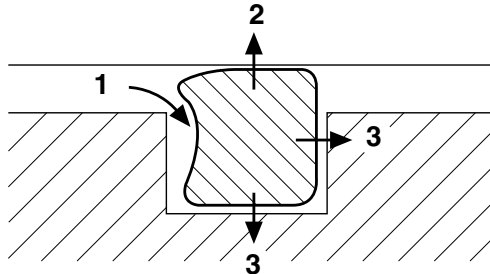
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1. Hydraulic pressure
2. Seal lip pressed out toward piston rod
3. Seal lip pressed inward toward cylinder head
4. Sealing surface, piston rod
5. Sealing surface, cylinder head
6. Screwdriver



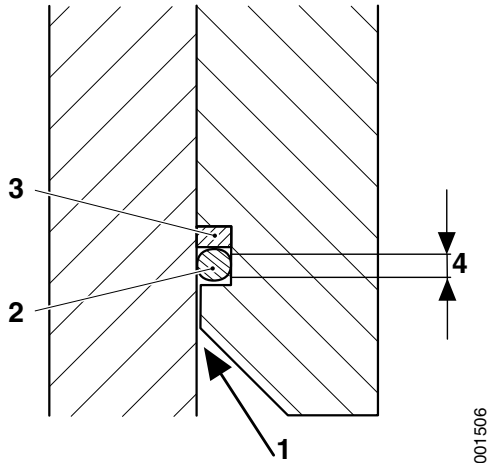
The pretensioned V-seal also has an O-ring in the seal's V-shaped space. The O-ring creates a strong seal at low hydraulic pressure since the O-ring already presses the sealing lips out toward the sealing surfaces when unloaded. It is equally sensitive to damage as the V-seal. Examine in the same way. To remove, use a screwdriver to prise the seal outward and bend it up (see illustration). It is extremely important that the screwdriver is always inserted in the V-shape so that it cannot touch and thereby damage a sealing surface. A mark from a screwdriver on a sealing surface can have a devastating effect and cause major leakage.

1. Hydraulic pressure
2. Seal lip pressed out toward piston rod
3. Seal lip pressed inward toward cylinder head
4. Sealing surface, piston rod
5. Sealing surface, cylinder head
6. Screwdriver
7. O-ring



The compressible piston rod seal consists of a solid rubber profile and provides a larger contact face than the V-seals. To remove, use a screwdriver to prise the seal outward and bend it up (see illustration). With this type of seal with sealing surfaces that cover so much of the seal groove, it is particularly important that marks are not made with the screwdriver.

1. Hydraulic pressure
2. Seal lip pressed out toward piston rod
3. Seal lip pressed inward toward cylinder head
4. Sealing surface, piston rod
5. Sealing surface, cylinder head
6. Screwdriver



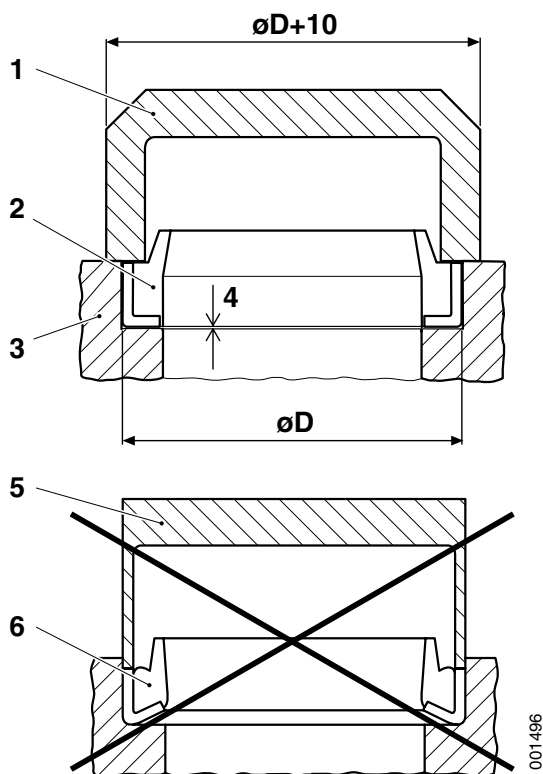
1. Hydraulic pressure
2. O-ring
3. Support ring
4. Sealing surface, cylinder head

Support ring and O-ring

The support 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 support ring is to lend rigidity to the O-ring so that it is not deformed. The O-ring is pressed against the support ring and the sealing surface by the hydraulic pressure in the cylinder.

When the cylinder head is mounted in the barrel: Take extreme care not to damage the O-ring.



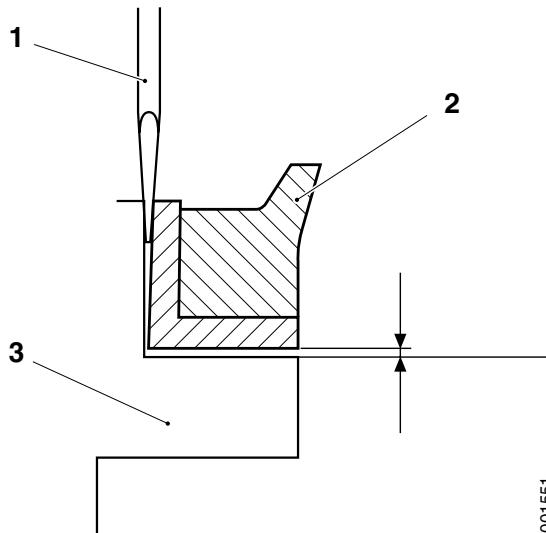
1. Correct assembly tool
2. Scraper, correctly fitted
3. Cylinder head
4. Clearance between scraper and bottom of cylinder head recess
5. Incorrect assembly tool
6. Deformed scraper

Scraper

The purpose of the scraper is to scrape the piston rod clean and prevent impurities from entering the cylinder barrel.

The scraper must be fitted with a special fitting tool. This tool must have a greater outer diameter than the scraper so that the press force against the scraper ceases precisely when the scraper is pressed into its position. If the scraper were to be pressed in further, the metal capsule would be deformed (see lower illustration), which would impair the function of the scraper.

To prevent the scraper from bottoming in its recess in the cylinder head, the recess is slightly deeper than the width of the scraper.



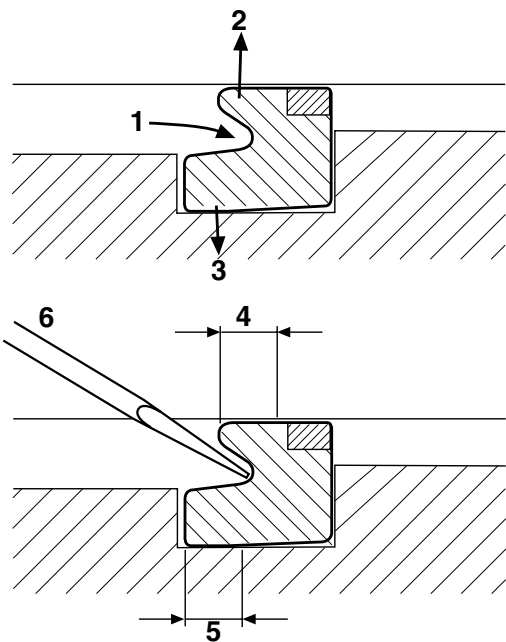
1. Screwdriver
2. Scraper
3. Cylinder head

A screwdriver can be used for removal. This must always be applied against the outer edge of the scraper (see illustration). Carefully tap the screwdriver down between the scraper and the cylinder head and then prise out the scraper. Polish away any damage to the cylinder head.



CAUTION

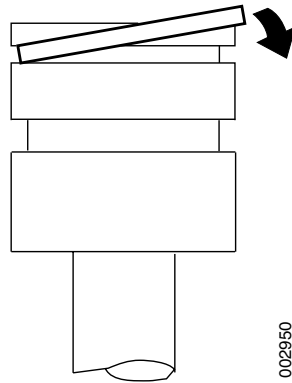
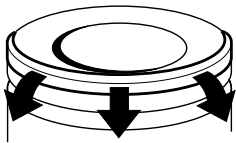
No tool may be applied from the inside. This could give rise to burrs on the cylinder head which could in turn damage the piston rod. Burrs may also damage the piston rod seal when fitting the piston.



1. Hydraulic pressure
2. Seal pressed out toward cylinder barrel
3. Seal pressed in toward piston
4. Sealing surface, cylinder barrel
5. Sealing surface, piston
6. Screwdriver

On the single-acting V-seal it is always the long side that seals against the fixed surface and the short side that seals against the moving surface.

To remove, use a screwdriver to prise the seal outward and bend it up (see illustration). It is extremely important that the screwdriver is always inserted in the V-shape so that it cannot touch and thereby damage a sealing surface. A mark from a screwdriver on a sealing surface can have a devastating effect and cause major leakage.



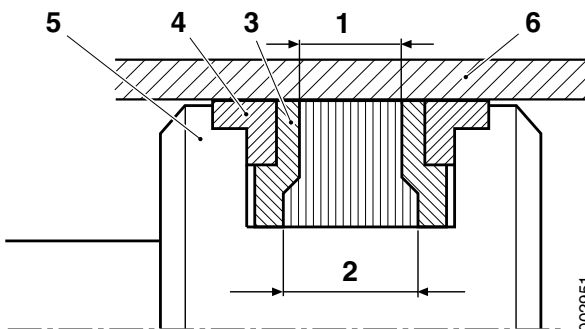
The seal must always be fitted as a single assembly together with the support ring.

Always assemble by hand. No tools should be used as they could easily damage the surface of the piston.

To facilitate assembly the seal can be heated in hot water to make it soft.

Lubricate with hydraulic oil.

002950



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 caution when fitting the piston in the cylinder barrel, making sure that the seal is not damaged by the cylinder barrel threads.

002951

1. Variable sealing surface to cylinder barrel
2. Fixed sealing surface with piston
3. Guide ring
4. Support ring
5. Piston head
6. Cylinder barrel

Dismantling:

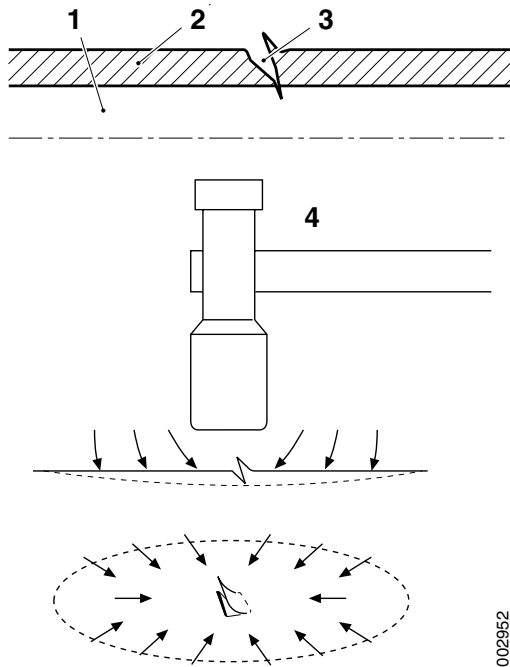
- 1 Remove guide rings and support rings.
- 2 Move the seal body over to one side of the sealing groove.
- 3 Press up the material so that there is a gap between seal and piston.
- 4 Without damaging the surface of the piston - cut off the seal with a knife.
- 5 Carefully examine the seal to find any damage that could 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 seal body, then support rings and farthest out guide rings.
- 2 First fit the seal body, then the support rings and finally the guide rings - all must be done by hand without tools to avoid damage.

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 micrometres and can be treated to make good minor damage. This may be a satisfactory alternative to costly disassembly.



002952

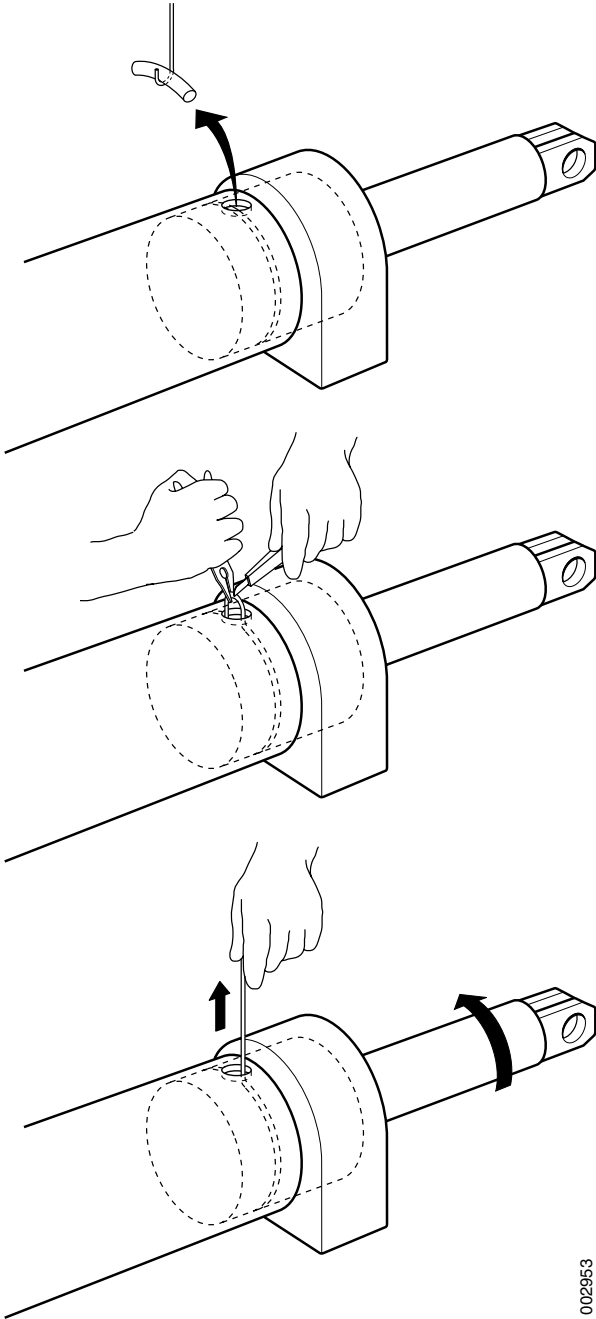
1. Piston rod
2. Chromium plating
3. Impact mark
4. Highly-polished hammer

- 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

Dismantling the steering cylinders

It can prove extremely difficult to extract the piston rod from the cylinder barrel on steering cylinders. This is because the O-ring in the cylinder head fastens in the lock 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 Insert 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 similar 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 lock ring from the cylinder barrel.
- 10 Carefully extract the piston rod from the cylinder barrel.



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11 Common electrics

11.2 Electric protection

11.2.1 Battery disconnecter

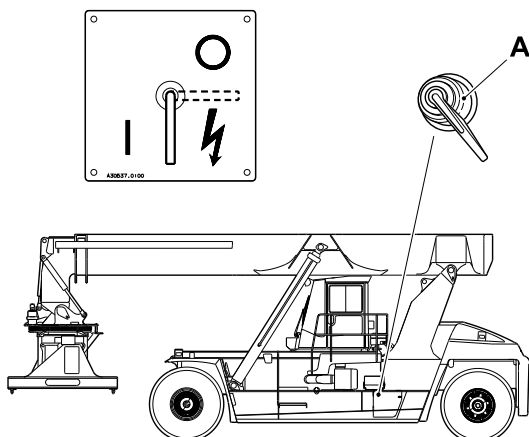
Battery disconnecter, description

The positive terminals of the batteries connected in series are connected to the machine's electrical system via the battery disconnecter. The battery disconnecter cuts off all power from the batteries to the machine's electrical system.

IMPORTANT

Never switch off the voltage with the battery disconnecter when the engine is running. This could damage the alternator.

The battery disconnecter must not be used for emergency stop!



A Position of battery disconnecter

013250

11.2.2 Fuses

Fuses, changing

When checking and changing the main fuse:

- 1 Switch off the system voltage (battery disconnecter).
- 2 Remove the plastic cover.
- 3 Check that the fuses are intact. Replace if necessary.
The fuses are 25 A or 50 A.

When checking and changing fuses:

- 1 Switch off the system voltage (battery disconnecter).
- 2 Remove the cover from the electronic box.
- 3 Check and, if necessary, replace fuses.
The fuse plate gives information about each fuse.

11.2.3 Control breaker

Emergency stop switch, description

See *Emergency stop switch voltage (15E), function description*, page 11:11.

11.3 Batteries

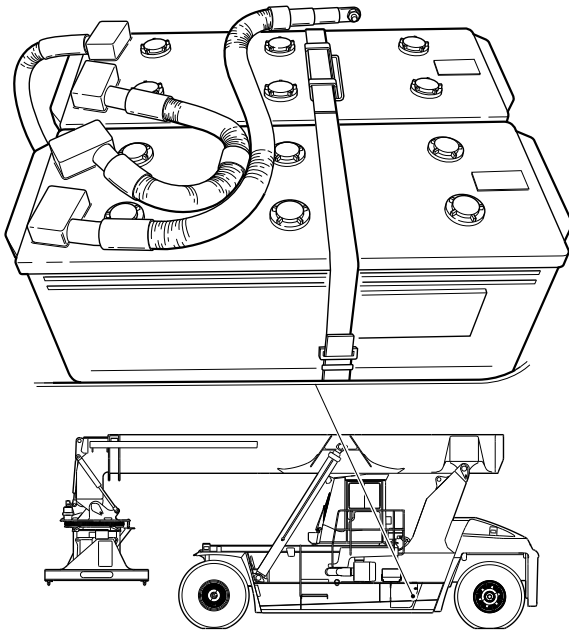
11.3.1 Start battery

Start battery, description

The machine's electrical system is supplied by two 12 V batteries connected in series.

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 Yuchai YC6M360-30)*, page 11:6 or *Alternator, description (engine alternative Cummins QSM11)*, page 11:6.



013251



WARNING

Battery electrolyte contains corrosive sulphuric acid.

Risk of corrosive injuries! Health hazard!

Use protective glasses and protective gloves when working with the batteries. Immediately remove any electrolyte on bare skin. Wash with soap and plenty of water. If the electrolyte has found its way into your eyes, rinse immediately with lots of water and contact a doctor immediately.



WARNING

Risk of explosion!

Personal injury!

During charging, hydrogen gas forms around the batteries. Sparks could ignite the hydrogen gas, causing an explosion. Disconnect the battery with the battery disconnecter.



WARNING

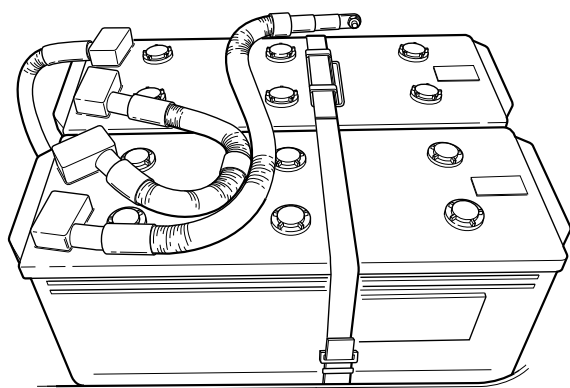
Short-circuiting of battery.

Risk of explosion! Fire hazard! Risk of personal injury!

The battery's terminals must not be connected to each other or to common grounding point (chassis).

Start battery, replacement

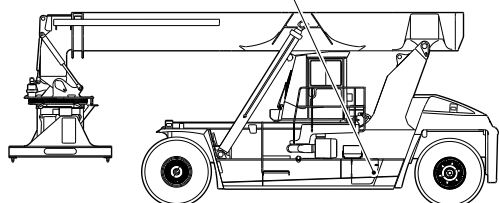
- 1 Machine in service position, see section *B Safety*.



- 2 Disconnect the cables from the battery terminals. Start with the negative (minus) cable.
- 3 Replace the batteries.
- 4 Connect the cables to the battery terminals. Connect the negative cable last of all.

NOTE

Take great care when reconnecting the cables to prevent short circuiting.



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11.4 Alternator

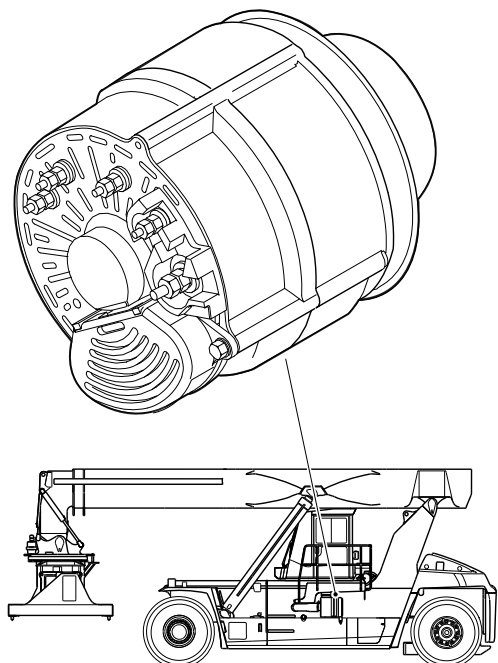
11.4.1 Alternator

Alternator, description (engine alternative Yuchai YC6M360-30)

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 via the diagnostic menu, section 8 *Control system*, section 8.4.6.4 *ENGINE*, menu 4.



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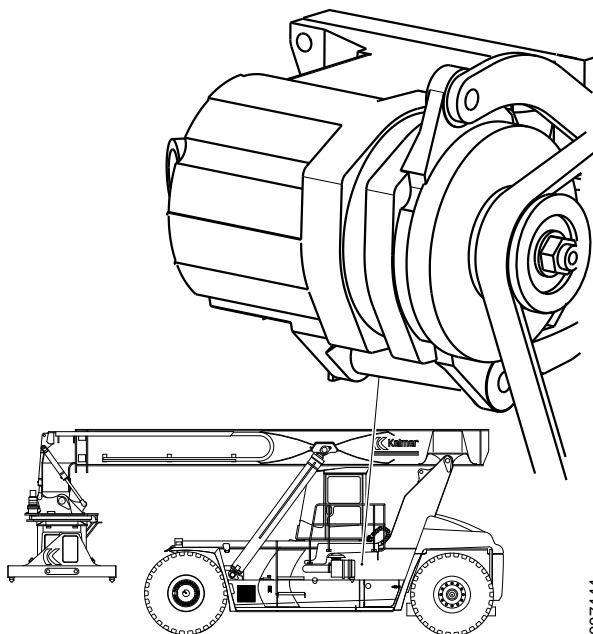
Alternator, description (engine alternative Cummins QSM11)



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 via the diagnostic menu, section 8 *Control system*, section 8.4.6.4 *ENGINE*, menu 4.



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Alternator, replacement

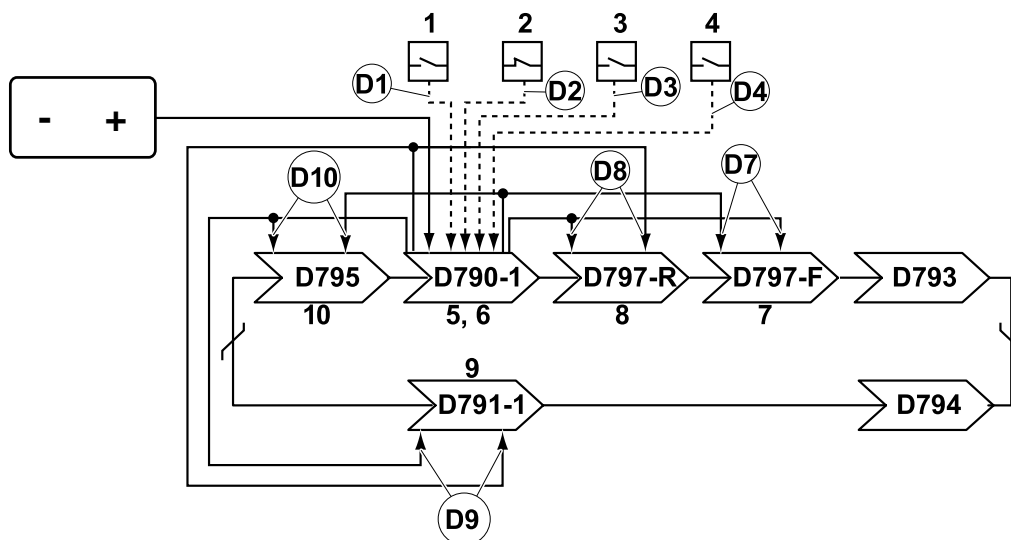
See *supplier documentation*, engine.

11.5 Distribution of electricity

11.5.1 Voltage feed

11.5.1.2 Redundant voltage feed of control units

Redundant voltage feed of control units, function description



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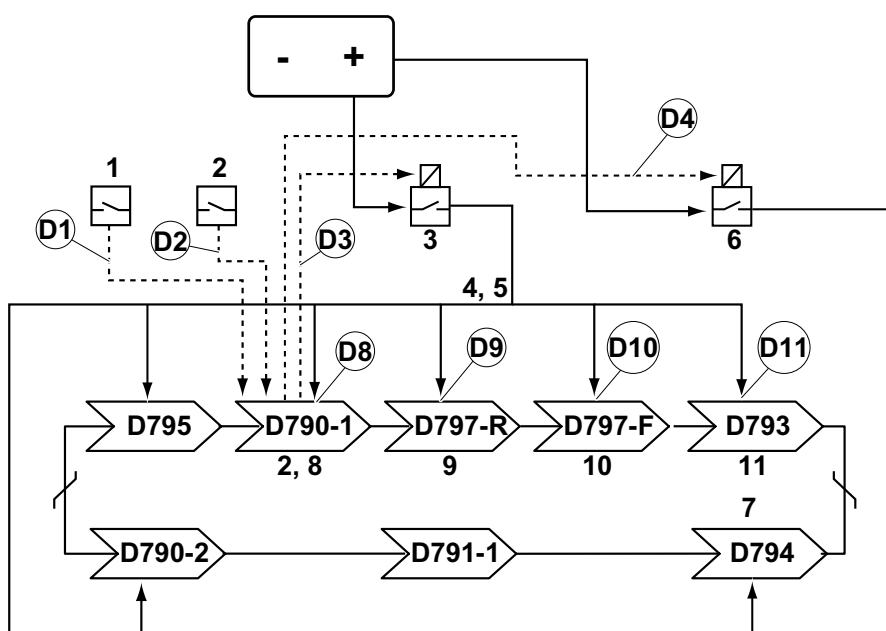
Pos	Explanation	Signal description	Reference
1	Break contact (opening switch) operator's door (S 266-LE) or break contact (opening switch), operator's door (S 266-RI) sends a voltage signal to Control unit, cab (D790-1) when the door is opened.	U = 24 V	Section 9 <i>Frame, body, cab and accessories</i> , group 9.10.2 <i>Doors</i> D1: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.2.12 <i>LIGHTS</i> , menu 12 or 8.4.11.2 <i>SLIDING-CAB</i> , menu 1
2	Switch, interior lighting on Control unit KIT (D790-2) sends a voltage signal to Control unit, cab (D790-1).	-	Section 9 <i>Frame, body, cab and accessories</i> , group 9.6.12 <i>Interior lighting</i> D2: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.2.12 <i>LIGHTS</i> , menu 12
3	Switch, flashing hazard lights (S109) sends a voltage signal to Control unit, cab (D790-1).	U = 24 V	Section 9 <i>Frame, body, cab and accessories</i> , group 9.6.7 <i>Flashing hazard lights</i> D3: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.2.8 <i>LIGHTS</i> , menu 8
4	Ignition key lock (S150) is turned to position I and sends a voltage signal to Control unit, cab (D790-1).	U = 24 V	Section 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instruments</i> D4: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.4 <i>CAN/POWER</i> , menu 4
5	Control unit, cab (D790-1) activates a hold circuit, which activates the control unit's control logic.	-	<i>Cab control unit, description</i> , page 11:17

Pos	Explanation	Signal description	Reference
6	Control unit, cab (D790-1) activates a redundant voltage feed to other control units. Control unit, cab (D790-1) has 4 outputs for redundant voltage feed while other control units have two inputs for redundant voltage feed. In the event of a malfunction of one voltage feed the control unit is supplied by the other feed.	U _{K11:7} = 24 V U _{K11:8} = 24 V U _{K11:9} = 24 V U _{K11:10} = 24 V	<i>Cab control unit, description, page 11:17</i>
7	Control unit, cab (D790-1) supplies voltage to the control logic of the other control units via the redundant voltage feed.	U _{K2:7} = 24 V U _{K2:8} = 24 V	<i>Control unit, frame front, description, page 11:18</i> D7: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.8 <i>CAN/POWER, menu 8</i>
8		U _{K2:7} = 24 V U _{K2:8} = 24 V	<i>Control unit, frame rear, description, page 11:19</i> D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.10 <i>CAN/POWER, menu 10</i>
9		U _{K2:7} = 24 V U _{K2:8} = 24 V	<i>Control unit, attachment, description, page 11:20</i> D10: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.16 <i>CAN/POWER, menu 16</i>
10		U _{K2:7} = 24 V U _{K2:8} = 24 V	<i>Control unit KID, description, page 11:24</i> D11: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.14 <i>CAN/POWER, menu 14</i>

11.5.1.3 Ignition voltage (15)

Ignition voltage (15), function description

Condition	Reference value	Reference
Battery disconnecter	In position 1	<i>Battery disconnecter, description, page 11:3</i>
Redundant voltage feed	Activated	<i>Redundant voltage feed of control units, function description, page 11:7</i>
Redundant CAN bus	Communication established	<i>Redundant CAN bus, description, page 11:34</i>



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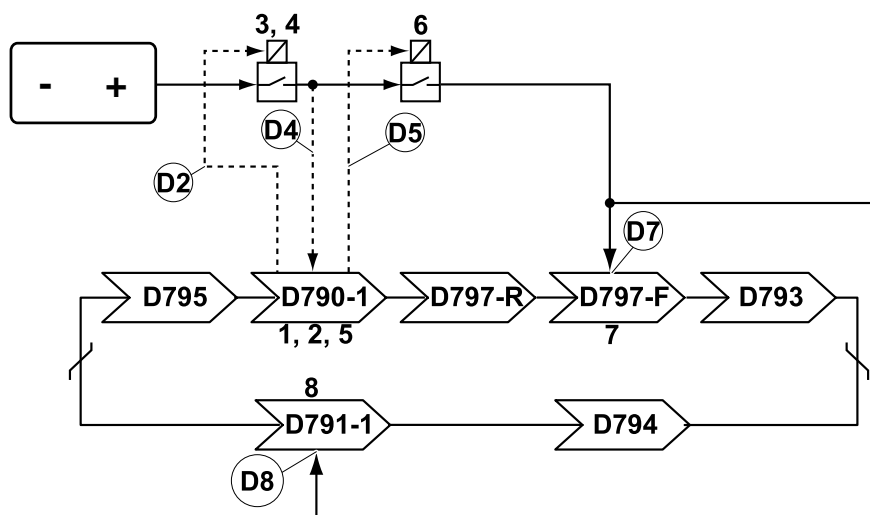
Pos	Explanation	Signal description	Reference
1	Warning light comes on and sends a voltage signal to the Control unit, cab (D790-1).	U = 24 V	Section 9 <i>Frame, body, cab and accessories</i> , group 9.6.7 <i>Flashing hazard lights</i> D1: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.2.8 <i>LIGHTS</i> , menu 8
2	Start key is turned to position I and sends a voltage signal to Control unit, cab (D790-1).	U = 24 V	Section 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instruments</i> D2: Diagnostic menu, see section 8 <i>Control 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 the frame electronic box and Relay, ignition voltage K315-2.	U = 24 V	<i>Cab control unit, description, page 11:17</i> D3: Diagnostic menu, see section 8 <i>Control 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 the cab electronic box and in the frame electronic box.	U = 24 V	-
5	The fuses feed voltage to control units, relays, solenoid valves and other electronic components.	U = 24 V	-
6	Relay, ignition voltage K315-2 supplies voltage to Control unit, engine (D794).	U = 24 V	<i>Control unit, engine, description (engine alternative Yuchai YC6M360-30)</i> , page 11:22

Pos	Explanation	Signal description	Reference
7	The drive-train's CAN-bus establishes communication.	Checked by control system, error shown with error code.	<i>CAN bus drive-train, description</i> , page 11:36
8	Ignition voltage to Control unit, cab (D790-1).	U _{K1:2} = 24 V U _{K1:3} = 24 V U _{K1:4} = 24 V	<i>Cab control unit, description</i> , page 11:17 D8: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.6 <i>CAN/POWER</i> , menu 6
9	Ignition voltage to Control unit, frame rear (D797-R).	U _{K2:1} = 24 V U _{K2:9} = 24 V	<i>Control unit, frame rear, description</i> , page 11:19 D9: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.10 <i>CAN/POWER</i> , menu 10
10	Ignition voltage to Control unit, frame front (D797-F).	U _{K2:1} = 24 V U _{K2:9} = 24 V U _{K2:10} = 24 V	<i>Control unit, frame front, description</i> , page 11:18 D10: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.8 <i>CAN/POWER</i> , menu 8
11	Ignition voltage to Control unit, transmission (D793).	U _{A1} = 24 V	<i>Control unit, transmission, description</i> , page 11:21 D12: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.15 <i>CAN/POWER</i> , menu 15

11.5.1.4 Emergency stop switch voltage

Emergency stop switch voltage (15E), function description

Condition	Reference value	Reference
Redundant voltage feed	Activated	<i>Redundant voltage feed of control units, function description</i> , page 11:7
Ignition voltage	Activated	<i>Ignition voltage (15), function description</i> , page 11:9
Control breaker	Not activated	Section 9 <i>Frame, body, cab and accessories</i> , group 9.1 <i>Controls and instruments</i>

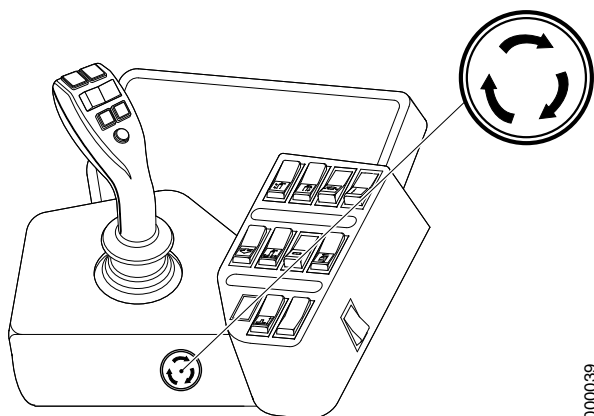


Pos	Explanation	Signal description	Reference
1	Ignition voltage is activated by the Control unit, cab (D790-1).	Checked by control system, error shown with error code.	<i>Ignition voltage (15), function description</i> , page 11:9
2	Control unit, cab (D790-1) supplies voltage to Relay, emergency stop switch voltage (K3009-1) in the frame electronic box.	$U_{K3009-1/86} = 24\text{ V}$	<i>Cab control unit, description</i> , page 11:17 D2: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.5 <i>CAN/POWER</i> , menu 5
3	Relay, emergency stop switch voltage (K3009-1) supplies voltage to Relay, emergency stop switch voltage (K3009-2) in the frame electronic box.	$U_{K3009-2/87} = 24\text{ V}$	<i>Electronic box frame, description</i> , page 11:15 D3: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.5 <i>CAN/POWER</i> , menu 5
4	Relay, emergency stop switch voltage (K3009-1) also sends a voltage signal to the Control unit, cab (D790-1), which verifies that Relay, emergency stop switch voltage (K3009-1) is active but Relay, emergency stop switch voltage (K3009-2) is inactive. This verifies that the emergency stop switch is working.	$U_{K3009-1/87} = 24\text{ V}$ $U_{K3009-2/87} = 0\text{ V}$	<i>Electronic box frame, description</i> , page 11:15 D4: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.5 <i>CAN/POWER</i> , menu 5
5	Control unit, cab (D790-1) activates Relay, emergency stop switch voltage (K3009-2) in the electronic box.	$U_{K3009-2/86} = 24\text{ V}$	<i>Cab control unit, description</i> , page 11:17 D5: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.5 <i>CAN/POWER</i> , menu 5
6	Relay, emergency stop switch voltage K3009-2 supplies voltage to the emergency stop switch circuit.	$U_{K3009-2/87} = 24\text{ V}$	<i>Electronic box frame, description</i> , page 11:15

Pos	Explanation	Signal description	Reference
7	The control units are supplied with emergency stop switch voltage as long as emergency stop switch is not depressed. Control unit, attachment (D791-1) is only supplied emergency stop switch voltage, thus all attachment functions stop if the emergency stop switch is activated.	Emergency stop switch in home position: $U_{K2:6}$ = 24 V	<i>Control unit, frame front, description</i> , page 11:18 D7: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.8 <i>CAN/POWER</i> , menu 8
8	If the emergency stop switch is depressed, ignition voltage to Control unit, cab (D790-1) is cut off, thereby cutting off control current to Relay, emergency stop switch voltage (K3009-1) and Relay, emergency stop switch voltage (K3009-2). The power supply to the control units is cut off and the functions cease. As an extra safety measure, Control unit, cab (D790-1) also transmits the status of the emergency stop switch the CAN bus. In this way functions are also cut off at the signal level.	Emergency stop switch in home position: $U_{K2:1}$ = 24 V Emergency stop switch in home position: $U_{K2:9}$ = 24 V Emergency stop switch in home position: $U_{K2:10}$ = 24 V Emergency stop switch in home position: $U_{K2:11}$ = 24 V	<i>Control unit, attachment, description</i> , page 11:20 D12: Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.16 <i>CAN/POWER</i> , menu 16

Emergency stop switch, checking

- 1 Start the machine and active any load handling function.
- 2 Activate lift.
- 3 Press in the emergency stop switch and check that the lifting movement stops.
- 4 Reset the emergency stop switch (turn in the direction of the arrows) and check that the lift function is working again.



Control breaker

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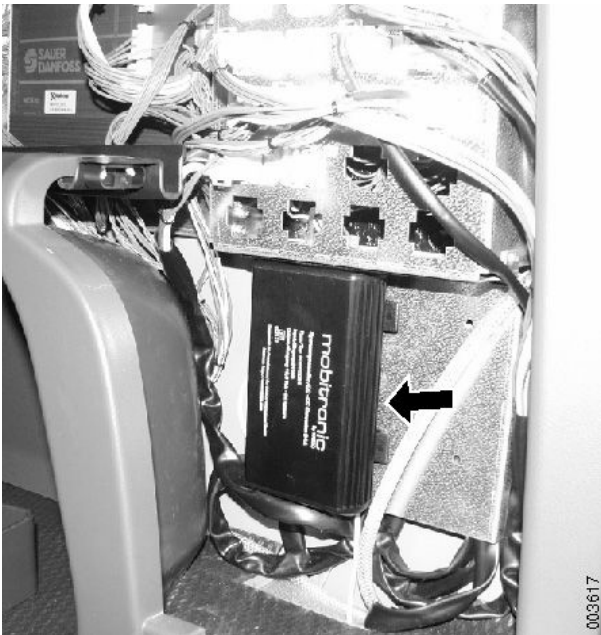
11.5.1.5 Voltage converter

Voltage converter, description



The voltage converter is located under a protective casing to the left behind the driver's seat.

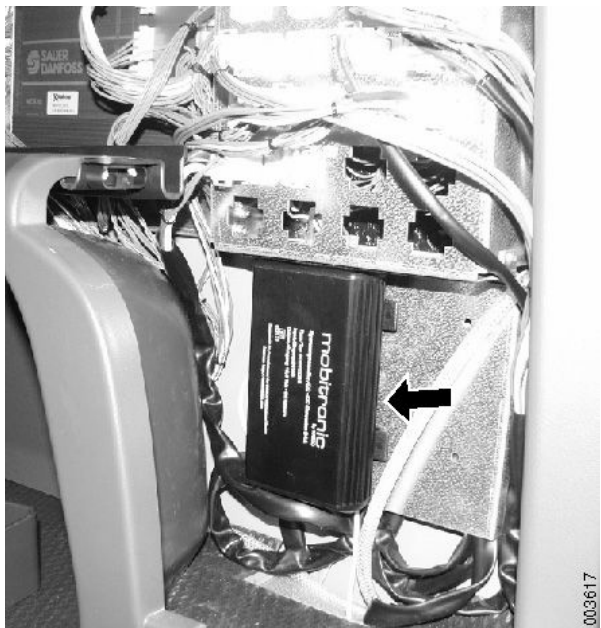
The voltage converter converts 24 volt to 12 volt. 12 V voltage is available for accessories by means of a connector X067 in the cab electronic box. (Contains 15, 30-voltage, ground and 12V.)



Voltage converter, replacement



- 1 Machine in service position, see section *B Safety*.
- 2 Remove the covers behind the driver's seat.
- 3 Detach the electrical cables from the converter.
- 4 Remove the voltage converter.
- 5 Fit in the reverse order.



The voltage converter is located diagonally behind the driver's seat.

11.5.2 Electronic box

11.5.2.1 Electronic box, cab

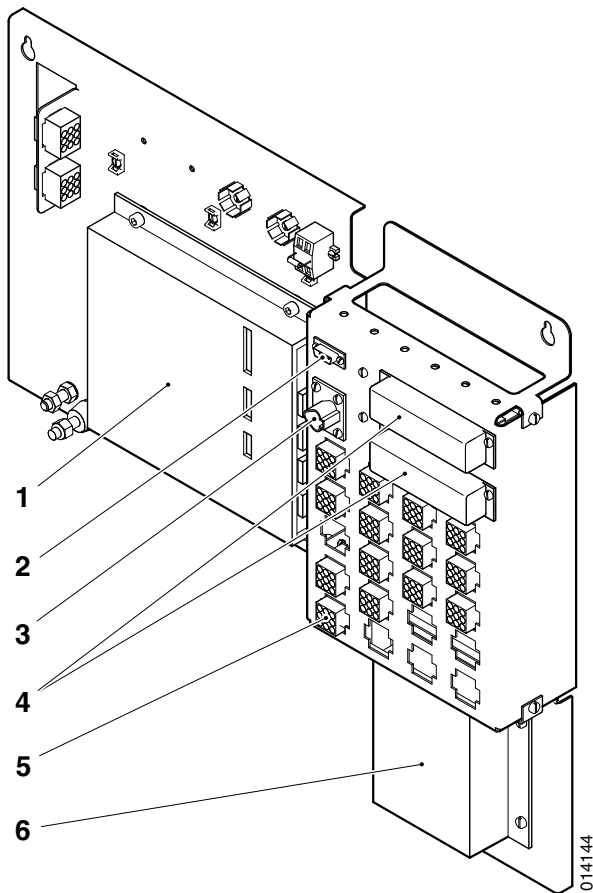
Electronic box, cab, description

The electronic box is mounted on the rear wall of the cab, on the left. Located there are:

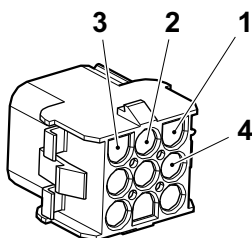
- Control unit, cab (D790-1)
- Circuit fuses
- Buzzer for alarm if, for example, the operator leaves the machine without the parking brake being applied
- Connectors
- Relays
- 
- Voltage converter 24 V to 12 V
- Customer accessory connector. Output voltage 24 V, max. 10 A. Connector 2-pin Universal mate-n-lock. For part number see Spare parts catalogue.

NOTE

This connector is not fitted on the machine if the machine is equipped with voltage converter.



1. Control unit, cab (D790-1)
2. Outlet for control unit programming
3. Outlet for CAN bus drive-train
4. Fuse holder
5. Customer accessory connector (X067) 24V/10A and 12V/20A
6. Voltage converter 



Customer accessory connector (X067)

The connector is designed for customer accessories and contains connections for 24 V. On machines with voltage converter 24 V to 12 V there is also a connection for 12 V .

Pin 1. 24 V, ignition voltage, 10 A

Pin 2. 24 V, battery voltage, 10 A

Pin 3. Ground

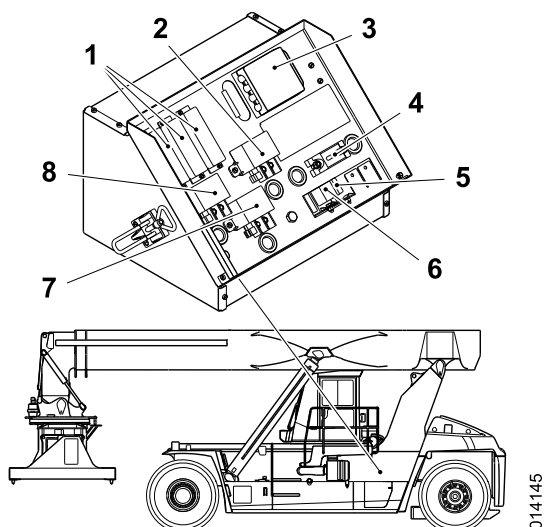
Pin 4. 12 V, ignition voltage, 20 A 

11.5.2.2 Electronic box frame

Electronic box frame, description

The electronic box is fitted on the side of the machine. Also located there are:

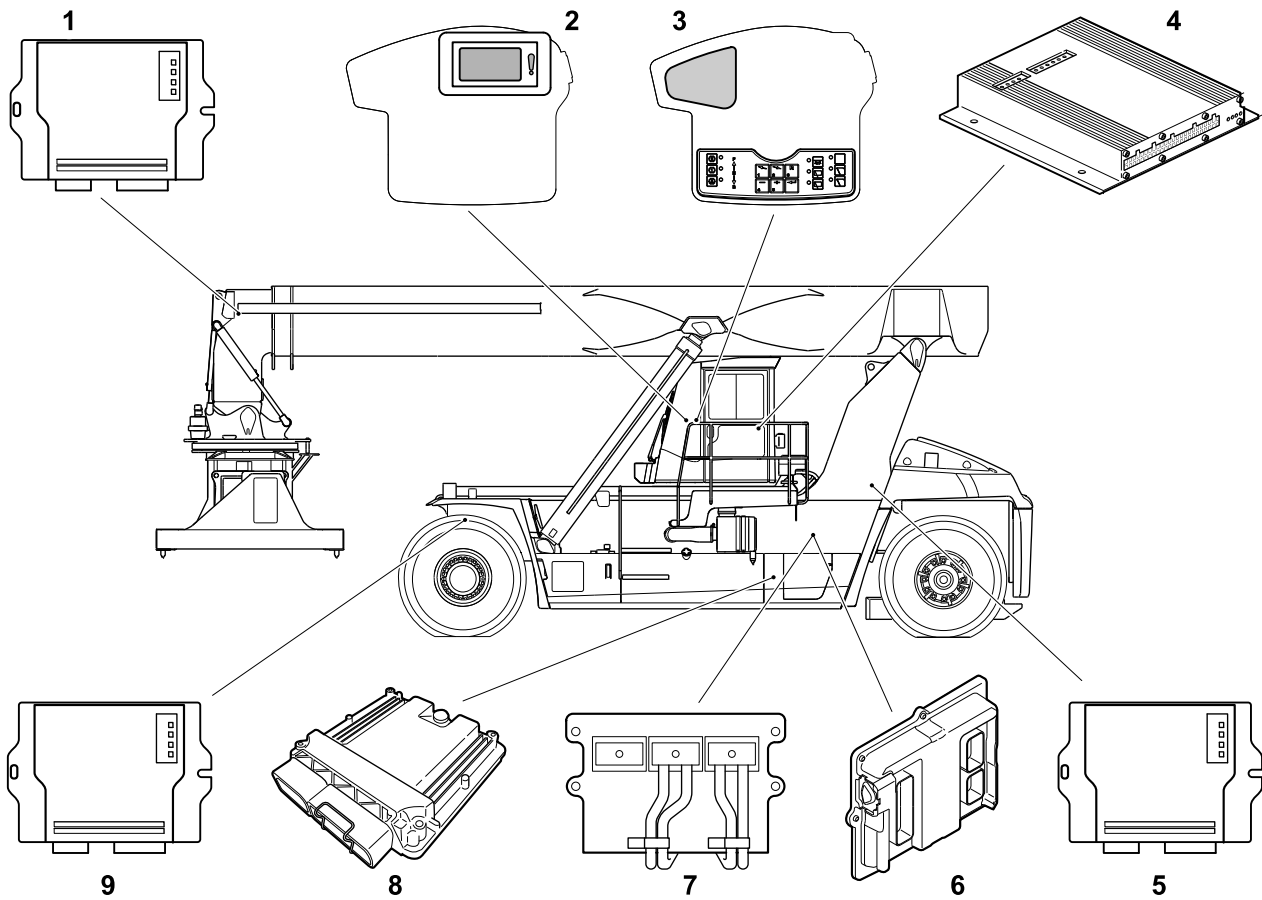
- Circuit fuses
- Outlet for programming Control unit, transmission (D793)
- Main fuses
- Control unit, transmission (D793)
- Power relays for voltage feed to the machine's functions.



1. Circuit fuses
2. Power relay (K315-1)
3. Main fuses
4. Main fuse
5. Circuit fuse transmission (F51-3)
6. Relay (K315-2)
7. Power relay (K3009-1)
8. Power relay (K3009-2)
9. Diagnostic socket engine (engine alternative Yuchai YC6M360-30) (not positioned in illustration, loose in electronic box frame)

11.5.3 Control units

Control units, location



- | | |
|---|---|
| 1. Control unit, attachment (D791-1) | 7. Control unit, engine (D794) (engine alternative Cummins QSM11)  |
| 2. Control unit, KID (D795) | 8. Control unit, transmission (D793) |
| 3. Control unit KIT (D790-2) | 9. Control unit, frame front (D797-F) |
| 4. Control unit, cab (D790-1) | |
| 5. Control unit, frame rear (D797-R) | |
| 6. Control unit, engine (D794) (engine alternative Yuchai YC6M360-30) | |

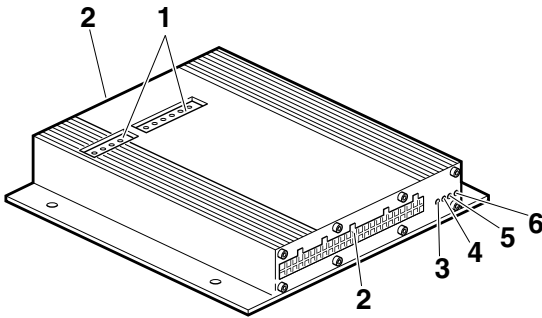
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11.5.3.1 Control unit, cab

Cab control unit, description

Control unit, cab (D790-1) is the central control unit of the control system. Control unit, cab (D790-1) sends activation signals to other units, and controls and monitors their functions. It administrates work in the control unit network. The control unit controls the redundant voltage feed and handles communication via a redundant CAN bus and gateway for CAN bus drive-train. Control unit, cab (D790-1) also processes all input signals from cab controls and transmits these signals on the CAN bus.

Control unit, cab has four indicator lights that indicate the control unit's function (see illustration).

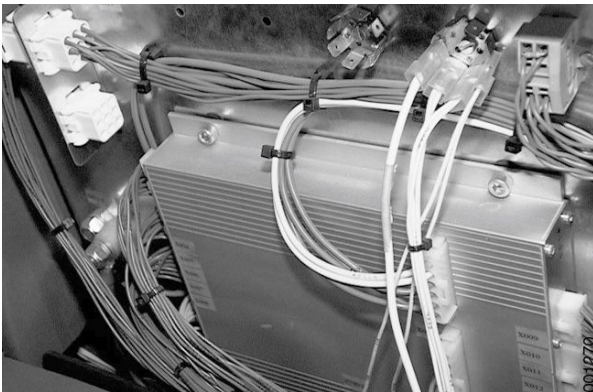


1. Connection terminals - fan, working lights, windscreen wiper
2. Connection terminals, other
3. Light 1, battery voltage
4. Light 2, redundant voltage feed, redundant CAN bus and power supply
5. Light 3, communication
6. Light 4, error indication

Lamp 1	Green light on when there is battery voltage to the unit. The light is physically controlled by voltage feed to the control unit.
Lamp 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 voltage.
Lamp 3	Long single flash yellow during communication with Control unit, display (D795). This is a basic condition of fault tracing. Short single flash yellow during communication with Control unit, engine (D794) and Control unit, transmission (D793). Double flash yellow (short and long flash) during communication with the display and engine or transmission.
Lamp 4	Red light in the event of active error.

Control unit cab, replacement

- 1 Machine in service position.
- 2 Remove the cover from the electronic box.
- 3 Detach the connectors from Control unit, cab (D790-1).
- 4 Replace the control unit.
- 5 Check that the new control unit corresponds with the machine's forklift number (Z-number).
- 6 Calibrate the new control unit. See section 8 *Control system*, group 8.5.2.3 *Calibrate DRIVE-TRAIN*.
- 7 Set the fresh air damper at fully closed and fully open, wait a few seconds in each position so that the damper has time to go to the end position.

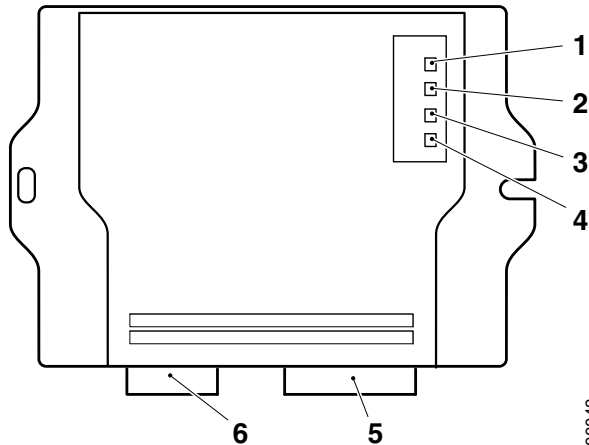


11.5.3.2 Control unit, frame front

Control unit, frame front, description

Control unit, frame front (D797-F) processes 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).



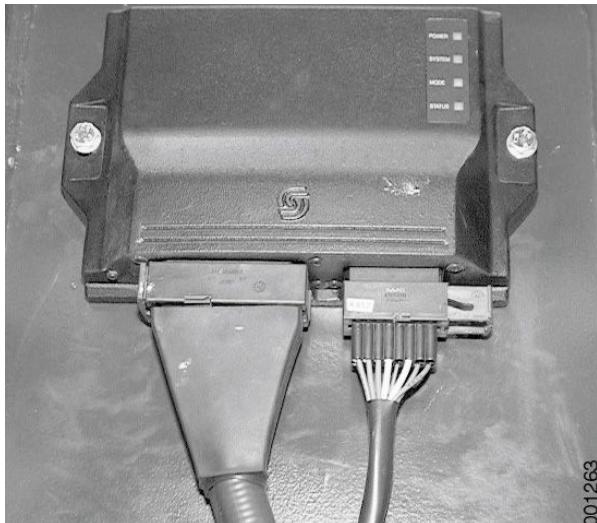
1. Light 1, battery voltage
2. Light 2, redundant voltage feed and power supply
3. Light 3, communication
4. Light 4, error indication
5. Control signals (inputs and outputs)
6. Power supply (redundant voltage feed for control units, redundant CAN bus) and input data

000043

Lamp 1	Green light on when there is battery voltage to the unit. The light is physically controlled by voltage feed to the control unit.
Lamp 2	Flashes green when one or more of the following is missing: redundant voltage feed left, redundant voltage feed right or 15-voltage. Green light when redundant voltage feed left, redundant voltage feed right and 15-voltage are supplied voltage.
Lamp 3	Single yellow flash during communication with display (KID) or Control unit, cab (D790-1). Double yellow flash during communication with display and Control unit, cab (D790-1).
Lamp 4	Red light in the event of active error.

Control unit, frame front, replacement

- 1 Machine in service position.
- 2 Disconnect the cable harness from Control unit, frame front (D797-F).
- 3 Replace the control unit.
- 4 Check that the new control unit corresponds with the machine's forklift number (Z-number).
- 5 Calibrate the new control unit. See section 8 *Control system*, group 8.5.2.1 *Calibrate SCALE* (pressure sensor).
- 6 Verify lowering speed, see section 7 *Load handling*, group 7.2 *Lifting/lowering*. In the event of deviations contact Cargotec.



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DANGER

The lowering speed must be correct. If lowering speed is too high there is a risk of rollover.

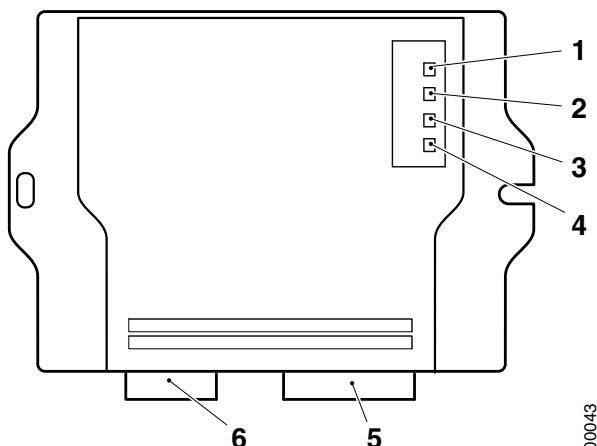
The machine must absolutely not be operated before lowering speed is verified.

11.5.3.3 Control unit, frame rear

Control unit, frame rear, description

Control unit, frame rear (D797-R) processes input data from sensors and sends control signals to relays and solenoid valves for functions in the machine's rear half.

The control unit has four indicator lights that indicate the control unit's function (see illustration).

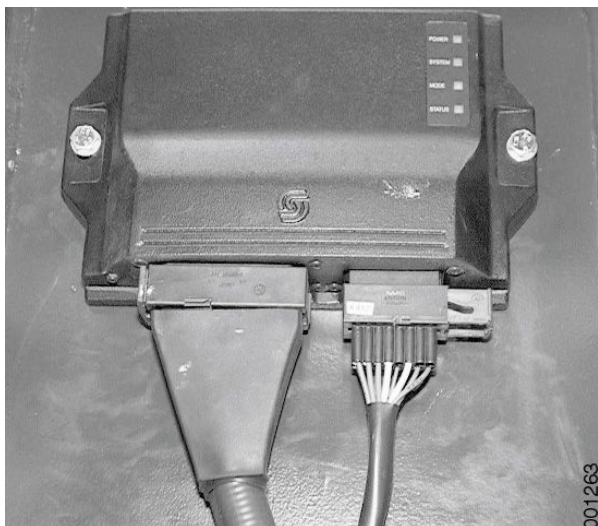


1. Light 1, battery voltage
2. Light 2, redundant voltage feed and power supply
3. Light 3, communication
4. Light 4, error indication
5. Control signals (inputs and outputs)
6. Power supply (redundant voltage feed for control units, redundant CAN bus) and input data

Lamp 1	Green light on when there is battery voltage to the unit. The light is physically controlled by voltage feed to the control unit.
Lamp 2	Flashes green when one or more of the following is missing: redundant voltage feed left, redundant voltage feed right or 15-voltage. Green light when redundant voltage feed left, redundant voltage feed right and 15-voltage are supplied voltage.
Lamp 3	Single yellow flash during communication with display (KID) or Control unit, cab (D790-1). Double yellow flash during communication with display and Control unit, cab (D790-1).
Lamp 4	Red light in the event of active error.

Control unit, frame rear, replacement

- 1 Machine in service position.
- 2 Disconnect the cable harness from Control unit, frame rear (D797-R).
- 3 Replace the control unit.
- 4 Check that the new control unit corresponds with the machine's forklift number (Z-number).
- 5 Calibrate the new control unit. See section 8 *Control system*, group 8.5.2.1 *Calibrate SCALE* (length sensor, angle sensor).

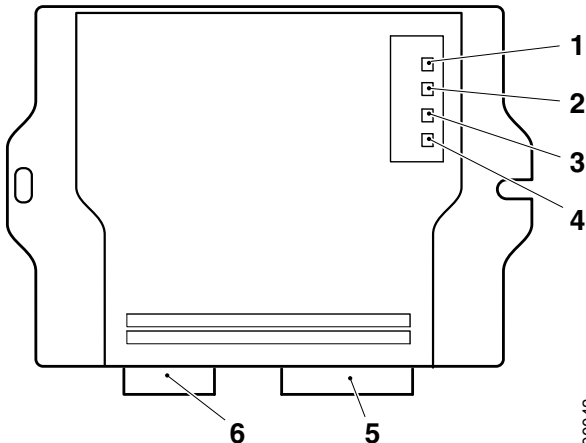


11.5.3.5 Control unit, attachment

Control unit, attachment, description

Control unit, attachment (D791) processes input data from sensors and sends control signals to relays and solenoid valves for functions for the top lift attachment.

The control unit has four indicator lights that indicate the control unit's function (see illustration).

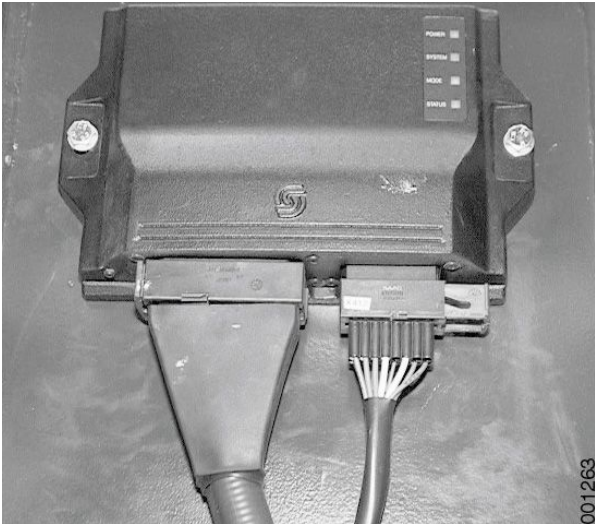


1. Light 1, battery voltage
2. Light 2, redundant voltage feed and power supply
3. Light 3, communication
4. Light 4, error indication
5. Control signals (inputs and outputs)
6. Power supply (redundant voltage feed for control units, redundant CAN bus) and input data

Lamp 1	Green light on when there is battery voltage to the unit. The light is physically controlled by voltage feed to the control unit.
Lamp 2	Flashes green when one or more of the following is missing: redundant voltage feed left, redundant voltage feed right or 15-voltage. Green light when redundant voltage feed left, redundant voltage feed right and 15-voltage are supplied voltage.
Lamp 3	Single yellow flash during communication with display (KID) or Control unit, cab (D790-1). Double yellow flash during communication with display and Control unit, cab (D790-1).
Lamp 4	Red light in the event of active error.

Control unit, attachment, replacement

- 1 Machine in service position.
- 2 Disconnect the cable harness from the control unit.
- 3 Replace the control unit.
- 4 Check that the new control unit corresponds with the machine's forklift number (Z-number).
- 5 The control unit is not calibrated.

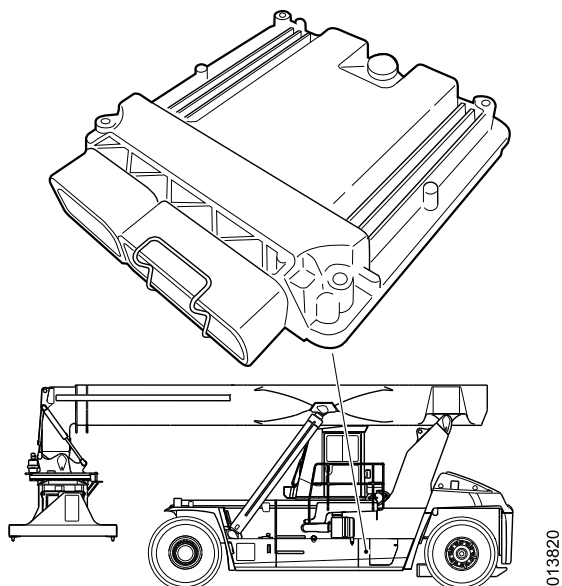


11.5.3.9 Transmission control unit

Control unit, transmission, description

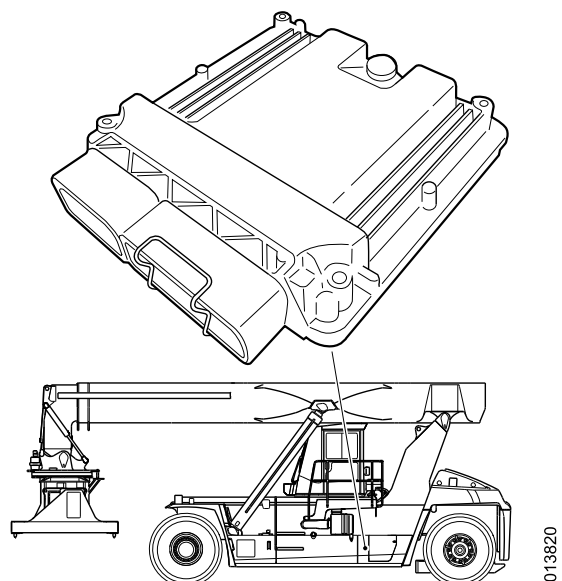
Control unit, transmission TCU (D793) is part of the drive-train control and handles the transmission's function, selection of gear at load and engine speed, etc.

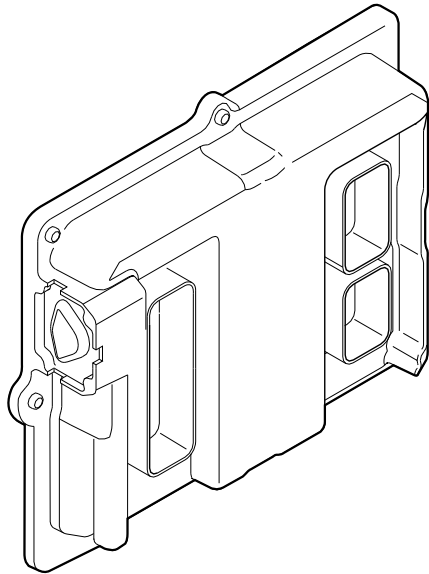
Control unit, transmission TCU (D793) is connected via separate CAN bus communication to the engine, which is connected to Control unit, cab (D790-1). In turn, Control unit, cab (D790-1) sends drive-train information on to other units.



Control unit, transmission, replacement

- 1 Machine in service position.
- 2 Disconnect the cable harness from Control unit, transmission (D793).
- 3 Replace the control unit.
- 4 Check that the new control unit corresponds with the machine's forklift number (Z-number).
- 5 Calibrate the new control unit; see section 8 *Control system*, group 8.5.2.3 *Calibrate DRIVE-TRAIN* and section 2 *Transmission*, group 2.8 *Control system, transmission*.





Engine control unit

11.5.3.10 Engine control unit

Control unit, engine, description (engine alternative Yuchai YC6M360-30)

Control unit, engine (D794) is part of the drive-train control and handles engine function, fuel injection, etc.

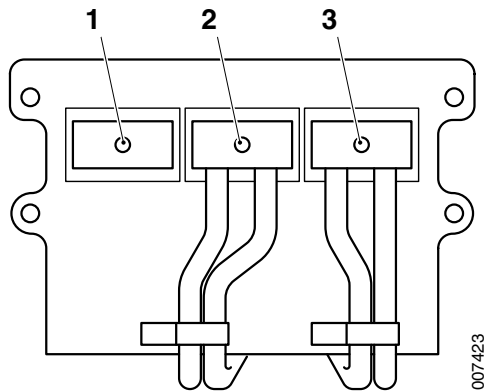
Control unit, engine (D794) is connected via separate CAN bus communication to the transmission, which is connected to Control unit, cab (D790-1). In turn, Control unit, cab (D790-1) sends drive-train information on to other units.

The control unit is fitted on the engine has no function keys or display. All functions are controlled via the CAN bus and an external control system.

The control unit monitors the following values in order to optimise engine performance.

- engine speed
- camshaft 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.



1. Connector OEM
2. Connector Actuator
3. Connector Sensor

Control unit, engine, description (engine alternative Cummins QSM11)



Control unit, engine (D794) is part of the drive-train control and handles engine function, fuel injection, etc.

Control unit, engine (D794) is connected via separate CAN bus communication to the transmission, which is connected to Control unit, cab (D790-1). In turn, Control unit, cab (D790-1) sends drive-train information on to other units.

The control unit is fitted on the engine has no function keys or display. All functions are controlled via the CAN bus and an external control system.

The control unit monitors the following values in order to optimise engine performance.

- engine speed
- 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, replacement

See *supplier documentation, engine*.

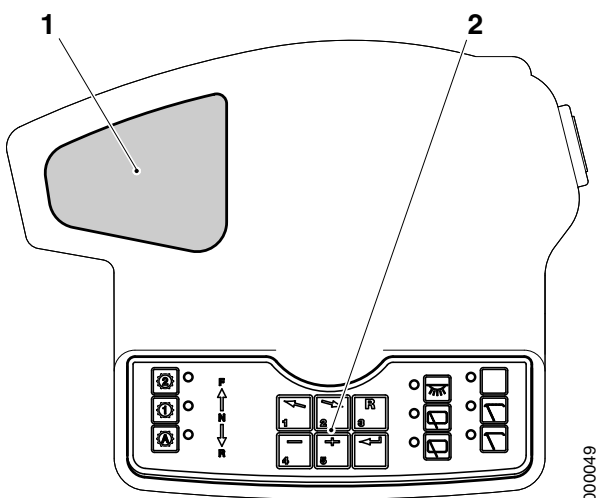
11.5.3.11 Control unit KIT

Control unit KIT, description

Control unit KIT (D790-2) handles functions for the gear selector and multi-function lever, the direction indicator switch and start key positions II and III. It also handles the key panel (B) for the control system and its panel for warning and indicator lights (A).

Control unit KIT (D790-2) has several individual function keys and indicator lights (see illustration).

See the operator's manual for detailed information on warning and indicator lights and function keys.



1. Panel, warning and indicator lights
2. Panel for keys

Control unit KIT, replacement

- 1 Machine in service position.
- 2 Remove the steering wheel and separate the steering wheel panel.
- 3 Detach KIT from the steering wheel panel.
- 4 Detach the connector sockets.
- 5 Remove the warning panel for warning and indicator lights.
- 6 Fit in the reverse order.
- 7 KIT is not calibrated.



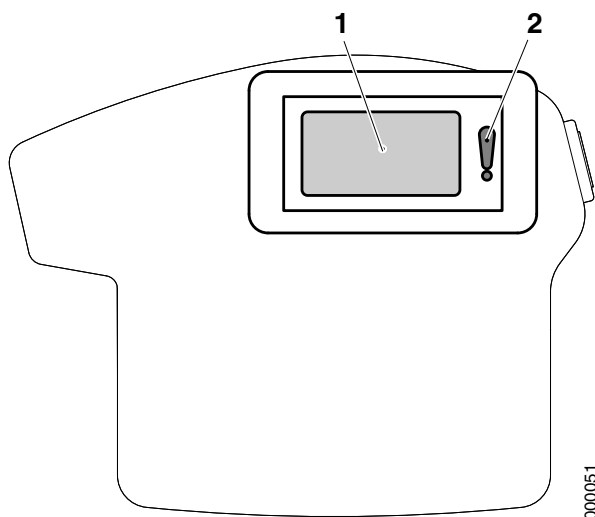
11.5.3.12 Control unit KID

Control unit KID, description

Control unit KID (D795) displays to the operator information sent by the control system, such as speed, in the form of messages, 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 system. The error code and information are shown on the display.

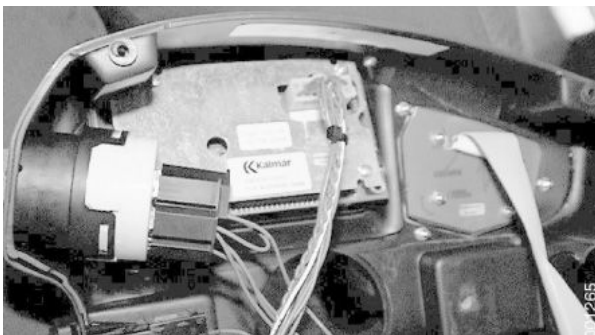
See the operator's manual for detailed information about the display.



1. LCD display
2. Series of diodes that serve as an indicator light for serious malfunction.

Control unit KID, replacement

- 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 the reverse order.
- 6 KID is not calibrated.



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.

Contact	Location	Function
X001	Control unit, cab (D790-1)	Power supply and ground 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)	Air conditioning
X005	Control unit, cab (D790-1)	Switch, option Switch flashing hazard lights (Hazard) Air conditioning Extra sensors Accelerator
X006	Control unit, cab (D790-1)	Instrument lighting dimmer Switch, working lights Switch, option Seat heater Accelerator Brake pedal
X007	Control unit, cab (D790-1)	Control lever
X008	Control unit, cab (D790-1)	Control lever Switch, bypass Emergency stop switch Switch parking brake Switch, option Switch, twistlocks
X009	Control unit, cab (D790-1)	Not used
X010	Control unit, cab (D790-1)	Water valve Seat heat Relay, working lights Hour counter Relay, compressor Power supply relays K315-1, K3009-1, K3009-2 and K315-2 Windscreen washing Windscreen wiper, roof

Contact	Location	Function
X011	Control unit, cab (D790-1)	Ignition key lock Lighting, Control unit, KID (D795) Break contacts (opening switches), cab doors Buzzer Interior lighting Power supply, Control unit, cab (D790-1) Horn Break contact (opening switch), seat Feedback relay K3009-1 Seat heat
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 ground 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, high and low beams
X018	Control unit KIT (D790-2)	Switch, direction indicators
X020	Control unit, KID (D795)	CAN bus RS232 Printer Power supply and ground connection Control unit KID (D795)
X033	Air conditioning	Control, fan Control, temperature Control, air distribution
X034	Air conditioning	Heater fan Water valve
X035	Air conditioning	Valve, air distribution Sensor, air temperature
X036	Air conditioning	Actuator motor, recirculation Sensor, air temperature
X038	Instrument panel, cab	Accelerator Declutch pedal
X039	Electronic box, cab	Hour counter Relay, compressor air-suspension seat Switch flashing hazard lights (Hazard) Break contact (opening switch), cab door Actuator motor, recirculation Fan motor, heating Water valve, ECC
X048	Electronic box, cab	Termination resistor
X049	Electronic box, cab	CAN bus

Contact	Location	Function
X050	Electronic box, cab	D-sub RS232 Control unit, cab (D790-1)
X051	Electronic box, cab	Power supply, Control unit, cab (D790-1) CAN bus
X052	Electronic box, cab	CAN bus Control relays K315-1, K3009-1, K3009-2 and K315-2
X054	Electronic box, cab	Interior lighting Working lights Flashing hazard lights
X055	Electronic box, cab	Windscreen wiper, roof Power, CD player Power, COM radio
X056	Electronic box, cab	Flashing hazard lights Work light boom Working lights, cab
X057	Electronic box, cab	Windscreen wiper, rear Power supply, reversing camera
X058	Electronic box, cab	Motor, windscreen washing Start interlock, engine heater
X059	Electronic box, cab	CAN bus Power supply, control units
X060	Electronic box, cab	CAN bus Interior lighting
X060A	Extension X060	CAN bus Interior lighting
X061	Electronic box, cab	Ground connection, Control unit, KID (D795) Ground connection, Control unit KIT (D790-2) Windscreen wiper, front Motor, recirculation
X061A	Extension X061	Ground connection, Control unit, KID (D795) Ground connection, Control unit KIT (D790-2)
X062	Electronic box, cab	Horn Map lighting Cigarette lighter 12V
X063	Electronic box, cab	Seat heater Compressed-air damped seat
X071-1	Electronic box, cab	Power supply, cab
X071-2	Electronic box, cab	Ground connection, cab
X072	To Right Behind Seat	Current outlet
X073	Right side of instrument panel	Cigarette socket 12V

Contact	Location	Function
X080	Instrument panel, cab	Switch, working lights Switch, high beam Switch, flashing hazard lights Switch, seat heater Switch, seat heater
X081	Instrument panel, cab	Switch, seat heater Switch flashing hazard lights (Hazard) Extra sensors Hour counter
X082	Instrument panel, cab	Break contact (opening switch), cab door left side
X168	Electronic box frame	Power supply, boom and attachment
X200	Boom mounting	CAN bus Redundant power supply, control units
X201	Electronic box frame	Ground connection and power supply, Control unit, transmission (D793)
X202	Boom mounting	Sensor boom length Sensor boom angle Ground connection and power supply, boom sensor Solenoid valve, regeneration extension Solenoid valve, blocking extension Work light boom
X203	Electronic box frame	Termination resistor
X205	Electronic box frame	CAN bus Control unit, transmission (D793)
X206	Boom mounting	Revolving beacon, boom Work light boom
X209A	Control unit, frame front (D797-F)	CAN bus Power supply, control units
X210	Between engine and transmission	Power supply and ground connection Control unit, engine (D794) CAN bus, Control unit, engine (D794)
X211	Control unit, frame front (D797-F)	42-pin connector to Control unit, frame front (D797-F)
X212	Control unit, frame front (D797-F)	Power supply and ground connection, Control unit, frame front (D797-F) CAN bus, Control unit, frame front (D797-F) Temperature oil, brake system Control breaker
X221	Control unit, frame rear (D797-R)	42-pin connector to Control unit, frame rear (D797-R)
X222	Control unit, frame rear (D797-R)	Power supply and ground connection, Control unit, frame rear (D797-R) CAN bus, Control unit, frame rear (D797-R) Temperature hydraulic oil Fuel gauge Control breaker D+ alternator
X246	AC compressor	Power supply, sensor pressure refrigerant
X251	Control unit, transmission (D793), electronic box frame	60-pin connector for Control unit, transmission (D793)

Contact	Location	Function
X253	Transmission	Solenoid valves, transmission Pressure sensor, transmission
X254	Electronic box frame	Power supply and ground connection Control unit, transmission (D793)
X259	Transmission	Temperature sensor, transmission oil to cooler
X260	Electronic box frame	CAN bus, Control unit, transmission (D793)
X261	Electronic box frame	RS232 Control unit, transmission (D793)
X264	Electronic box frame	Solenoid valve, brake transmission
X270	Lamp bracket left front	High and low beams Flashing hazard lights Direction indicators Side marker lights
X271	Lamp bracket right front	High and low beams Flashing hazard lights Direction indicators Side marker lights
X272	Lamp bracket left rear	Back-up lights Tail lights Brake light Direction indicators Side marker lights
X273	Lamp bracket right rear	Back-up lights Tail lights Brake light Direction indicators Side marker lights
X276	Control unit, frame front (D797-F)	Make-contact (closing switch) coolant level Indication preheating active Indication water in fuel
X278	Between engine and transmission	Electromagnetic clutch, compressor Solenoid valve, engagement of hydraulics for top lift Sensor pressure refrigerant Solenoid valve deactivation of hydraulics Relay, starter motor
X279	Engine	Signals, Control unit, engine (D794) CAN bus Drive-train
X281	Electronic box frame	Diagnostic socket engine
X286	Engine	Resistance, indication preheating active Resistance, indication water in fuel
X287	Engine	Power supply and ground connection Control unit, engine (D794)
X301	Boom mounting	Fuse holder power supply and ground connection to boom and attachment
X400	Boom nose	Fuse holder power supply and ground connection to boom and attachment

Contact	Location	Function
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, alignment right side Sensor, twistlocks right side
X403B	Attachment, right side	Sensor, alignment right side Sensor, twistlocks right side
X404	Attachment left side	Sensor, alignment left side Sensor, twistlocks left side
X405	Boom nose	Indicator light locked twistlocks Indicator light unlocked twistlocks Indicator light alignment
X406	Attachment centre section	Not used
X411	Control unit, attachment (D791-1)	42-pin connector for Control unit, attachment (D791-1)
X412	Control unit, attachment (D791-1)	Power supply and ground connection Control unit, attachment (D791-1) CAN bus, Control unit, attachment (D791-1) Control breaker
X428	Boom	Revolving beacon
X759	Engine	Make-contact (closing switch) coolant level
X901	Voltage converter, cab	Voltage converter 24V/12V or only joint
X905	Cab panel	12V socket for Com radio

Signal types, general

The machine's control units use a number of different types of signals to receive signals from sensors and switches and control solenoid valves, lights, etc. The table below describes the different signal types.

Signal type	Explanation	Application area
Analogue input signals		
Rheostat	Resistance input 0–200 Ω . Linear work range with accuracy of 3%.	E.g. fuel level sensor.
Temperature	Rheostat input with non-linear work area. The resistance value is equivalent to temperature and the work range of approx. -40 till 150 °C. There are two different resistance curves, one for Control unit, cab (D790-1) and one for the frame and attachment control units. Accuracy is ± 0.5 in the interval 0-100 °C (sensor's measurement inaccuracy not included). Outside of the interval 0-100 °C, accuracy is ± 2 °C.	E.g. hydraulic oil temperature sensor and air conditioning temperature sensor.
Voltage	An analogue signal 0-5 V. The work range is 0.5 to 4.5 V.	E.g. accelerator pedal and analogue cab controls (operating lever and heater controls).
Analogue outputs		
Current feedback voltage out, PWM	A modulated signal between 0 V and system voltage, i.e. 24 V. The work range is 0 to 2 A. A modulated signal is a digital signal translated to an analogue (continuous) signal adapted for a purpose, such as solenoid valve control. When the slide in a solenoid valve gets hot, resistance drops. This generates a lower current through the valve spool, which can cause the valve's servo pressure to remain constant. An internal ammeter measures current in the circuit and regulates the voltage level in order to maintain the desired current value in the valve spool.	Hydraulics, e.g. lifting/lowering of the boom. Used when the output signal actuates proportional solenoid valves.

Signal type	Explanation	Application area
Voltage out, PNP PWM	A modulated signal between 0 V and system voltage, i.e. 24 V. Requires a grounding point as reference.	E.g. interior lighting and background illumination in switches.
Voltage out, reversed polarity, NPN PWM	A modulated signal between 0 V and system voltage, i.e. 24 V. Requires 24 V as reference.	E.g. cab fan.
Digital input signals		
Digital input signal with pull down and search lighting	Signal in, $U < 5$ V generates logical zero (0) Signal in, $U > 16$ V generates logical one (1) If there is no signal in, the input is grounded.	E.g. input signal from a circuit breaker with search lighting.
Digital input signal with pull down	Signal in, $U < 5$ V generates logical zero (0) Signal in, $U > 12$ V generates logical one (1) If there is no signal in, the input is grounded. Bandwidth 300 Hz, i.e. designed for slow sensors.	E.g. position sensors (inductive sensors) and brake pressure (pressure switches).
Digital outputs		
High side driver, 1.5 A	Logical one (1) generates voltage out, $U \geq 22.5$ V Max. load 1.5 A Open load 0.15 A Max. instantaneous current load, 8 A	E.g. side marker lights, solenoid valves.
High side driver, 5 A	Logical one (1) generates voltage out, $U \geq 22.5$ V Max. load 5 A Open load 0.9 A Max. instantaneous current load, 35 A	E.g. working lights and wiper motors.
High side driver, 10 A	Logical one (1) generates voltage out, $U \geq 22.5$ V Max. load 10 A Open load 1.9 A Max. instantaneous current load, 70 A	E.g. cooling fan. This output is only found on the frame and attachment control units.
H-bridge	Logical one (1) generates voltage out, $U \geq 22.5$ V or grounded output, $U = 0$ V Max. load 0.5 A Open load 0.15 A Max. instantaneous current load, 8 A The H-bridge works with two outputs in a pair. At logical one (1), one output gives voltage while the other output is grounded. At logical zero (0), the outputs switch voltage levels.	E.g. air conditioning water valve (works in both directions).

11.6 Communication

11.6.1 CAN bus

CAN bus, description

Communication between the control units takes place using so-called "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 logical hardware circuits. A simple technology that is highly reliable (low error frequency), which is a requirement for control signals to be able to regulate systems based on varying conditions and requirements.

CAN specifies:

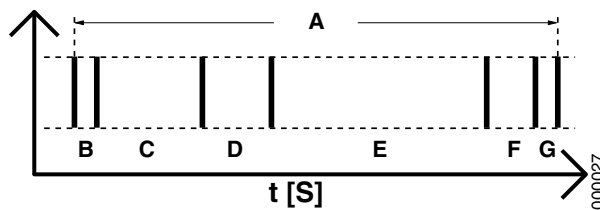
- that the signal traffic is carried by "twisted pair" cables.
- that termination resistors (position 1) are necessary (adapted to cables' impedance) so that the pulse train (position 4) should obtain a sharp signal.
- that the signal value is given as the potential difference between the cables, CAN + and CAN - (position 2 and 3).
- form of signal messages.

Message

There are two types of messages:

- CAN Standard, has identity field of 11 bits
- CAN Extended, has identity field of 29 bits

CAN works in messages sent in frames of 8 bytes (64 bits). A complete message is approx. 100 bits long. The illustration depicts how a message is structured.



Messages are sequential and signal is high (voltage high) or low (voltage low).

- A Length message
- B Start bit
- C Identity field/Priority
- D Control field (length of data segment)
- E Data segment
- F Checksum for error detection
- G Acknowledge bit

Start bit (B)

Indicates that the transmission of a frame, i.e. a message, is now beginning.

Identity field (C)

Indicates what kind of information the message contains, e.g. measurement information on engine speed.

Does not indicate address to control unit. CAN does not work with addressing. All control units receive messages and send them on.

Control field (D)

Indicates how the length of the data segment that follows.

Data segment (E)

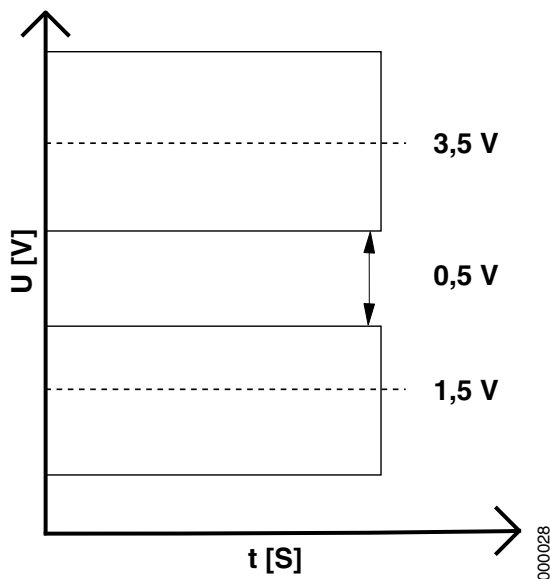
Contains the information to be conveyed to control units in the network.

Checksum for error detection (F)

Calculates a checksum for the message. This makes it possible for the receiving control unit to detect errors in the sent message.

Acknowledge (G)

The transmitting control unit sets a bit to logical one (1) when the message is sent. The first control unit to receive the message sends it on and sets the bit to logical zero (0).



Potential levels CAN + and CAN -

Communication

The CAN network consists of control units and segments. The segment (bus) is a twisted pair cable that leads CAN + and CAN - signal levels from control unit to control unit.

Each control unit measures the potential difference of its two inputs. The potential difference generates logical zero and logical one. The illustration depicts an approved interval according to the standard for potential levels. CAN + has a recommended value of 3.5 V and CAN - has 1.5 V. As a worst case scenario, the potential difference can be only 0.5 V and still be approved. In practice, a potential difference of 2 V is recommended for reliable communication.

A pulse train can only be observed using an oscilloscope, NOT with a digital multimeter.

When a message is sent, all control units in the network listen. Messages are saved in the control unit and relevant information is processed. The control unit that receives the message first confirms receipt (sets an acknowledge 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 sends the message. Other control units listen and wait until the bus is available. If two messages are to be sent simultaneously then the sending of the message with the lowest priority (highest value in identity field) is concluded. This means that messages do not need to be re-sent in the event of a communication conflict but only in the event of a bus error (erroneous message).

The CAN bus exchanges around 100 messages per second in the network.

Different bus systems can be used e.g. random sending or primary (master) / secondary (slave).

HLP High Layer Protocol

CAN only specifies messages and how communication shall take place, i.e. one protocol. In order to manage the network the CAN protocol needs to be supplemented by a 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 the network
- how bits in the message's data field should be interpreted

11.6.2 Redundant CAN bus

Redundant CAN bus, description

The redundant CAN bus handles communication between all of the machine's control units except Control unit, transmission (D793) and Control unit, engine (D794). These have a separate CAN bus; see *CAN bus drive-train, description*, page 11:36.

Redundant CAN bus means that the control units are connected into a network that communicates via a CAN bus (see *CAN bus, description*, page 11:32) and that there are double communication routes on the network. The network is divided into control units and segments (segments are the cables between the control units). The number of active segments depends on the number of control units the machine has, which depends on the machine's equipment level (options).

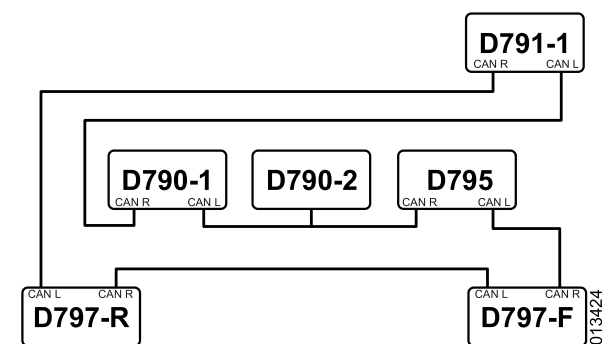
The network is built on the CAN kingdom principle, which means that one control unit is central and is the master unit. In this case, it is Control unit, cab (D790-1). Other control units in the network are secondary (slaves) and handle special areas, e.g. cab components.

The control units have two CAN bus connections - CAN L (left) and CAN R (right). The control units are connected to one another in series in a loop.

The redundant CAN bus can handle the loss of a segment. The link is analysed upon start-up. If a segment has a malfunction, messages are sent via another route.

If several segments are lost, one or more control units lose communication and work independently, often with significantly limited functionality.

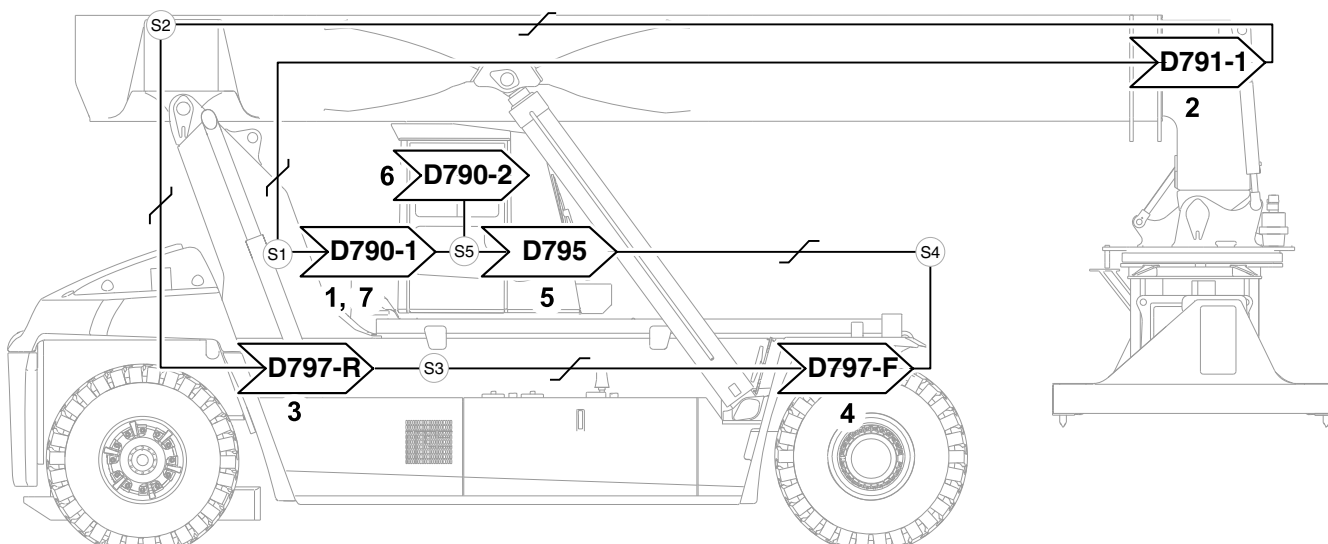
CAN bus faults are indicated with an error code and a warning in the display. If several CAN bus segments are faulty, the system only shows an error code for the first faulty out segment.



Outline view, redundant CAN bus

Connection of redundant CAN bus

Condition	Reference value	Reference
Battery disconnecter	In position 1	<i>Battery disconnecter, description, page 11:3</i>
Redundant voltage feed	Activated.	<i>Redundant voltage feed of control units, function description , page 11:7</i>



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Pos	Explanation	Signal description	Reference
1	Control unit, cab (D790-1) establishes redundant CAN bus communication by sending a request on the CAN bus via CAN R.	Checked by control system, error shown with error code.	<i>Cab control unit, description, page 11:17</i> Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.1 <i>CAN/POWER</i> , menu 1 and 8.4.1.2 <i>CAN/POWER</i> , menu 2
2	Control unit, attachment (D791-1) sends a response back on the CAN bus via CAN L and sends the request on via CAN R. Termination resistors in the control nodes ensure communication segment by segment.	A clicking sound is audible when then termination resistor is activated.	<i>Control unit, attachment, description, page 11:20</i> Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.1 <i>CAN/POWER</i> , menu 1 and 8.4.1.2 <i>CAN/POWER</i> , menu 2
3	Control unit, frame rear (D797-R) sends a response back on the CAN bus via CAN L and sends the request on via CAN R. Termination resistors in the control nodes ensure communication segment by segment.	A clicking sound is audible when then termination resistor is activated.	<i>Control unit, frame rear, description, page 11:19</i> Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.1 <i>CAN/POWER</i> , menu 1 and 8.4.1.2 <i>CAN/POWER</i> , menu 2
4	Control unit, frame front (D797-F) sends a response back on the CAN bus via CAN L and sends the request on via CAN R. Termination resistors in the control nodes ensure communication segment by segment.	A clicking sound is audible when then termination resistor is activated.	<i>Control unit, frame front, description, page 11:18</i> Diagnostic menu, see section 8 <i>Control 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 KID (D795) sends a response back on the CAN bus via CAN L and sends the request on via CAN R. Termination resistors in the control nodes ensure communication segment by segment.	A clicking sound is audible when then termination resistor is activated.	<i>Control unit KID, description, page 11:24</i> Diagnostic menu, see section 8 <i>Control system</i> , group 8.4.1.1 <i>CAN/POWER</i> , menu 1 and 8.4.1.2 <i>CAN/POWER</i> , menu 2

Pos	Explanation	Signal description	Reference
6	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 clicking sound is audible when then termination resistor is activated.	<i>Control unit KIT, description, page 11:23</i>
7	If all control units have responded, then Control unit, cab (D790-1) deactivates the segment to Control unit, attachment (D791-1). If a control unit has not responded, then Control unit, cab (D790-1) uses both CAN L and CAN R to keep communication open and analyses which segment is faulty.	Checked by control system, error shown with error code.	Diagnostic menu, see section 8 <i>Control 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 drive-train

CAN bus drive-train, description

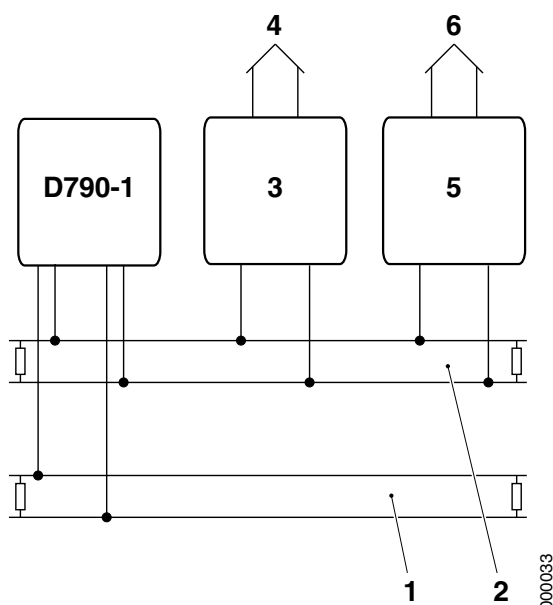
The drive-train CAN bus is based on the SAE J1939 standard where selected messages are used to control engine and transmission.

SAE J1939 is a standard from SAE (Society of Automotive Engineers) for data communication in vehicles. The standard regulates hardware interface, bit times and message composition.

Control units for engine and transmission come from the respective transmission and engine supplier. The control units use the same standard of communication and therefore the messages for each engine are constructed using the same structure.

Communication with Control unit, engine (D794) and Control unit, transmission (D793) are separate from the redundant CAN bus.

The signals can be checked via the diagnostic menu. See section 8 *Control system*, group 8.4.1.3 *CAN/POWER, menu 3*.



1. Redundant CAN bus
2. CAN bus drive-train
3. Engine control unit
4. Engine
5. Transmission control unit
6. Transmission

11.6.4 Communication between PC and machine

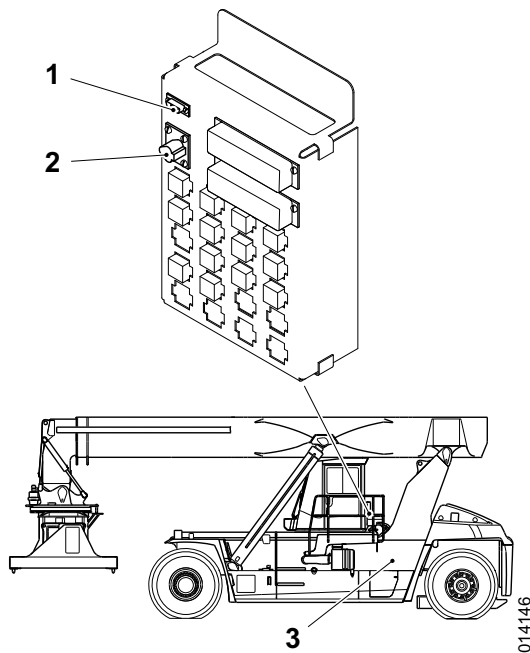
Communication between PC and machine, description

The machine has three sockets for communication between control units and PC. Two are fitted in electronic box cab and one is in electronic box frame. The diagnostic socket for the engine is loose in electronic box frame.

Sockets for programming control units in electronic box cab (position 1) are used for programming the control units in the cab, on the frame and on the attachment.

Sockets for CAN bus drive-train in electronic box cab (position 2) are used for communicating with the engine and transmission via CAN bus.

For further details on communication between computer and machine, contact Cargotec.



1. Diagnostic socket, machine
2. Diagnostic socket CAN bus drive-train
3. Diagnostic socket engine (loose in electronic box)

Contents D Error codes

Error codes	D:3
Engine.....	D:8
Error codes engine, general.....	D:8
Error codes engine (engine alternative Yuchai YC6M360-30).....	D:9
Error codes engine (engine alternative Cummins QSM11).....	D:43
Transmission.....	D:52
Error codes transmission	D:52
Control system.....	D:87
Error codes machine	D:87

D Error codes

Error codes, explanation

The error codes are explained in table form for Engine, Transmission as well as Control system. They are sorted according to error code number.

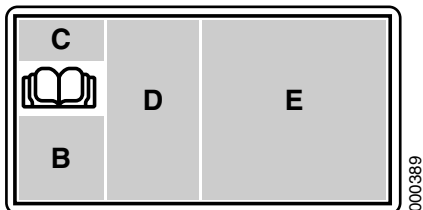
The error code table has the following information:

- Code, error code\qs number, shown in field C on display.
- Description, explanation of the error code and when it\qs 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 rectify the problem, read signal value or check the function.

In addition to the explanation of the display figure, the description of the diagnostic menus contains reference to circuit diagrams that are found in section *E Schematics* and reference to function group for further information about functions and components.

- Function group is a reference to which function group the error code is associated. This field is used to search for more information as necessary. The function group can be used to find different types of information.

Sections 0-12 contain a description of the function and its components, component location and work instructions for different tasks.



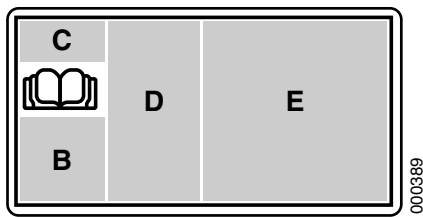
B. Error code level (symbol)

C. Error code number

D. Error cause (symbol)

E. Function (symbol)

Error code menu, description



The control and monitoring system's display is divided into four fields where the information is shown (see figure to the left).

- Field B: Error code level is shown with a symbol.
- Field C: Shows error code.
- Field D: Shows type of error.
- Field E: Indicates which function is affected by error code.
- Book symbol means that information is available in the operator's manual.

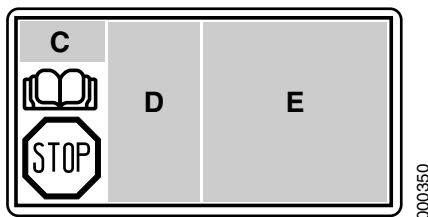
Field B: Error code level

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 jeopardise the operator's safety or cause machine failure. The error code must be attended to immediately. Stop working with the machine and contact service immediately.

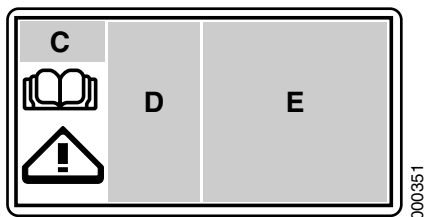
The error code is shown automatically on the display.



- Warning

Indicates malfunction in machine that should be taken care of as soon as possible. After the finished work shift with the machine, contact service as soon as possible.

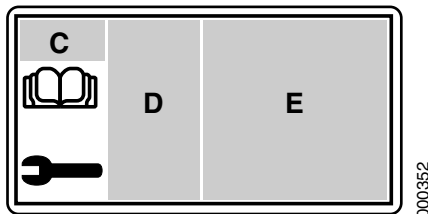
The error code is shown automatically on the display.

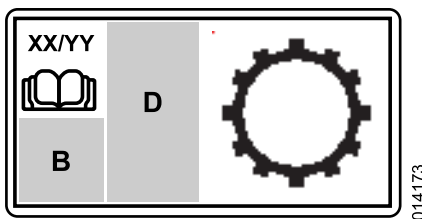
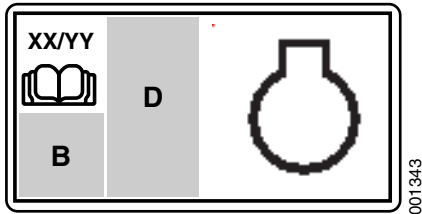
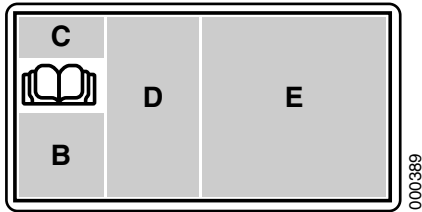


- Information

Information to the operator that something should be rectified, e.g. broken bulb. Take action to rectify the cause of the error code as soon as possible. See section 6 *Inspection and maintenance* in the operator's manual.

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:

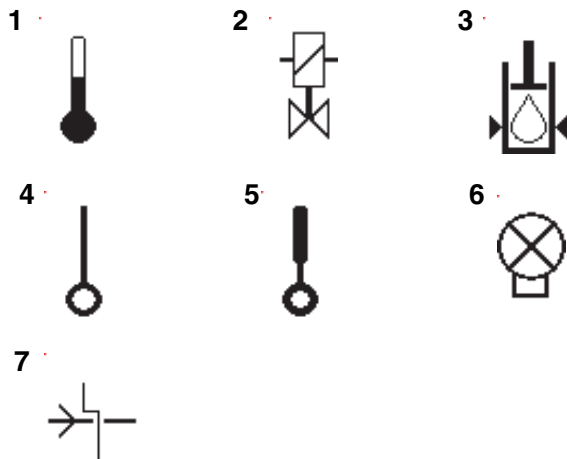
- Machine:
Shown with error code number XXX on display.
- Engine:
Shown with error code number XX/YY on display.

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.

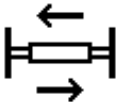
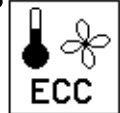
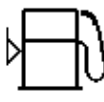
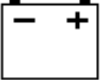
Field D: Type of error



- Temperature too high/too low.
- Incorrect signal to solenoid valve.
- Incorrect hydraulic pressure.
- Incorrect sensor signal.
- Incorrect signal from control.
- Incorrect signal to bulb.
- Incorrect signal, for example, open circuit.

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Field E: Affected function

1		2		3		1. Attachment
4		5		6		2. Rotation of attachment
7		8		9		3. Side shift, attachment
10		11		12		4. Extension (spreading) attachment
13		14		15		5. Twistlocks
16		17		18		6. Boom up/down
19		20		21		7. Pressure sensor lift cylinder (overload system, OP)
22		23				8. Overload system inoperative
						9. Boom in/out
						10. Brake system
						11. Hydraulic functions
						12. Steering
						13. Engine
						14. Transmission
						15. Control unit
						16. Hardware-related error
						17. Cab
						18. Air conditioning
						19. Fuel system
						20. Headlights
						21. Windscreen wipers
						22. Battery voltage
						23. Bulb for lighting

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Reading out error code

NOTE

In the event of an error code, perform the actions recommended in the error code table to identify the fault.

Error codes are stored as active and inactive. Active errors are shown in the error code menu.

Always use error code menus for reading error codes, otherwise there is a risk of missing error codes.

- 1 Turn the start key to position I.



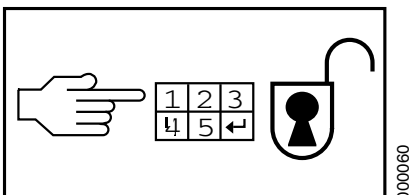
WARNING

Risk of machine damage.

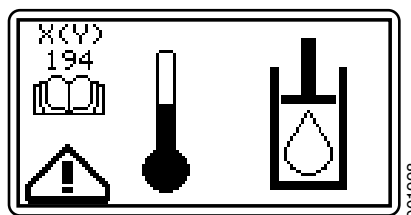
In the event of error codes of level "WARNING" and "STOP", serious machine damage may result if the engine is started.

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.



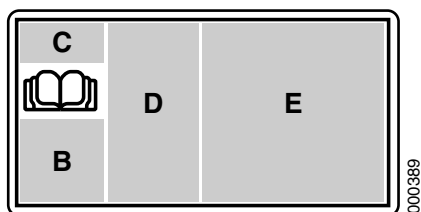
- 3 The safety menu is shown. Hold Enter depressed for at least two seconds.



- 4 The error code list is shown on the display. An active error code is shown on display where field C shows error code number together with X(Y). X shows sequence number for displayed error code and (Y) shows total number of active error codes.

Scroll between error codes with key 1 and 2 (arrow function).

Error codes disappear from the list when the cause has been remedied.



- 5 Note error code number (field C) to avoid forgetting.
 - 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
 - The function affected by the error is 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 the remedial action, check that no active error codes remain for the function in question.

Engine

Error codes engine, general

When contacting engine suppliers, use the supplier code.

- Display indicates error code as shown in the machine, in accordance with SAE J1939 in SPN/FMI
- The supplier code indicates the error code in accordance with the engine manufacturer's specification.

Table Specifications FMI

FMI	Description	SAE-text
0	Too high value.	Data valid, but higher than normal operating range.
1	Too low value.	Data valid, but lower than normal operating range.
2	Incorrect data.	Intermittent or incorrect data.
3	Electrical problem.	Abnormally high voltage or short-circuit to higher voltage.
4	Electrical problem.	Abnormally low voltage or short-circuit to lower voltage.
5	Electrical problem.	Abnormally low current or open circuit.
6	Electrical problem.	Abnormally high current or short-circuit to ground.
7	Mechanical problem.	Incorrect response from mechanical system.
8	Mechanical problem or electrical problem.	Abnormal frequency.
9	Communication error.	Abnormal update rate.
10	Mechanical problem or electrical problem.	Abnormally wide variations.
11	Unknown malfunction.	Non-identifiable malfunction.
12	Component error.	Incorrect unit or component.
13	Incorrect calibration.	Values outside calibration values.
14	Unknown malfunction.	Special instructions.
15	Unknown malfunction.	Reserved for future use.

Error codes engine (engine alternative Yuchai YC6M360-30)

Table Error codes Yuchai YC6M360-30

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
29/2	P2135	Signal from accelerator pedal, signal 2 and 1 do not correspond.	Reduced engine power.	Check the cable harness at the control unit.	D794/1:7 9 D794/1:8 0	-
29/3	P0223	Accelerator pedal, short circuit to voltage.	Reduced engine power.	Check the cable harness at the control unit.	D794/1:8 0	-
29/4	P0222	Accelerator pedal, short circuit to ground.	Reduced engine power.	Check the cable harness at the control unit.	D794/1:8 0	-
84/0	P0501	Machine speed too high.	Engine speed is limited.	Ease off throttle or select higher gear.	-	-
84/2	P0501	Speed signal unreasonable. Machine speed does not correspond with values from fuel injection and engine speed.	Engine speed is limited.	Check the engine speed sensor. Check the speed sensor on the transmission.	D794/1:7 1	ENGINE, menu 1
84/11	P0510	Speed signal wrong. Internal error Control unit, engine.	Engine speed is limited.	Check the engine speed sensor. Check the speed sensor on the transmission.	-	-
84/12	P0500	Speed signal wrong.	Engine speed is limited.	Check the engine speed sensor. Check the speed sensor on the transmission.	-	ENGINE, menu 1
91/2	P2135	Signal from accelerator pedal, signal 1 and 2 do not correspond.	Reduced engine power.	Check the cable harness at the control unit.	D794/1:7 9 D794/1:8 0	-
91/3	P0123	Accelerator pedal, short circuit to voltage.	Reduced engine power.	Check the cable harness at the control unit.	D794/1:7 9	-
91/4	P0122	Accelerator pedal, short circuit to ground.	Reduced engine power.	Check the cable harness at the control unit.	D794/1:7 9	-
91/7	P2299	Signal from accelerator pedal and brake pedal not consistent.	No limitation.	Check the cable harness at the control unit.	D794/1:7 9 D794/1:8 0	-
95/2	P1017	Sensor pressure fuel filter, unreasonable signal.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/1:8 1	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
95/3	P1015	Sensor pressure fuel filter, signal high.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/1:8 1	-
95/4	P1016	Sensor pressure fuel filter, signal low.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/1:8 1	-
95/7	P1018	Fuel filter clogged.	No limitation.	Change the fuel filter.	-	-
97/3	P2267	Water-in-fuel sensor (B760), short circuit to voltage.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/ 1:43 – B760/1	ENGINE, menu 10
97/4	P2266	Water-in-fuel sensor (B760), short circuit to ground.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/ 1:43 – B760/1	ENGINE, menu 10
97/11	P2269	Water in fuel.	No limitation.	Change the fuel prefilter.	D794/ 1:43 – B760/1	ENGINE, menu 10
98/2	P250B	Sensor engine oil level, unreasonable signal.	No limitation.	Check the cable harness at the control unit.	-	-
98/3	P250D	Sensor engine oil level, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
98/4	P250C	Sensor engine oil level, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
98/12	P250A	Sensor engine oil level, incorrect signal via CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/P- OWER, menu 3
100/2	P0521	Sensor engine oil pressure, unreasonable signal.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor. Check the oil level in the engine.	-	ENGINE, menu 6

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
100/3	P0523	Sensor engine oil pressure, short circuit to voltage.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	-	ENGINE, menu 6
100/4	P0522	Sensor engine oil pressure, short circuit to ground.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	-	ENGINE, menu 6
100/12	P0520	Sensor engine oil pressure, incorrect signal via CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/P-OWER, menu 3
100/17	P0524	Low engine oil pressure.	Reduced engine power.	Check the oil level in the engine. Change oil filter. Check the system pressure valves and the safety valve in the lubrication system. Check the sensor.	-	ENGINE, menu 6
102/2	P0236	Sensor boost pressure and sensor air pressure, unreasonable signal combination.	Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensors.	D794/2:3 2 – 36	ENGINE, menu 6
102/3	P0238	Sensor boost pressure, short circuit to voltage.	Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:3 4	ENGINE, menu 6
102/4	P0237	Sensor boost pressure, short circuit to ground.	Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:3 4	ENGINE, menu 6
102/12	P0235	Sensor boost pressure, incorrect signal via CAN bus.	Reduced engine power.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/P-OWER, menu 3

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
105/3	P0098	Sensor intake temperature, incorrect signal. Short circuit to voltage.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:3 6	ENGINE, menu 7
105/4	P0097	Sensor intake temperature, short circuit to ground.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:3 6	ENGINE, menu 7
105/12	P0099	Sensor intake temperature, incorrect signal via CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/POWER, menu 3
108/2	P2227	Sensor air pressure and sensor boost pressure, unreasonable signal combination.	Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensors.	D794/2:3 2 – 2:36	ENGINE, menu 6
108/3	P2229	Sensor air pressure, short circuit to voltage.	Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensor.	-	-
108/4	P2228	Sensor air pressure, short circuit to ground.	Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensor.	-	-
108/12	P0000	Sensor air pressure, incorrect signal via CAN bus.	Reduced engine power.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/POWER, menu 3
110/2	P0116	Coolant temperature sensor, the temperature is unreasonable in relation to the oil temperature.	Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:1 5	ENGINE, menu 7
110/3	P0118	Sensor coolant temperature, short circuit to voltage.	Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:1 5	ENGINE, menu 7

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
110/4	P0117	Sensor coolant temperature, short circuit to ground.	Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:1 5	ENGINE, menu 7
110/12	P0115	Sensor coolant temperature, incorrect signal via CAN bus.	Reduced engine power.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/POWER, menu 3
110/15	P0217	Coolant temperature too high	No limitation.	Check the coolant level. Check that radiator is clean. Check the thermostat. Check the cap on the expansion tank. Check if there is air in coolant system. Check the cable harness between control unit and sensor. Check the sensor.	D794/2:1 5	-
111/2	P2557	Sensor coolant level, unreasonable signal combination.	No limitation.	Check the cable harness at the control unit.	-	ENGINE, menu 10
111/3	P2559	Sensor coolant level, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	ENGINE, menu 10
111/4	P2558	Sensor coolant level, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	ENGINE, menu 10
111/12	P2556	Sensor coolant level, open circuit.	No limitation.	Check the cable harness at the control unit.	-	ENGINE, menu 10
132/3	P0101	Mass air flow sensor, signal deviation too high.	No limitation.	Check the cable harness at the control unit.	-	-
132/3	P0103	Mass air flow sensor, air flow too high.	No limitation.	Check the cable harness at the control unit.	-	-
132/4	P0101	Mass air flow sensor, signal deviation too low.	No limitation.	Check the cable harness at the control unit.	-	-
132/4	P0102	Mass air flow sensor, air flow too low.	No limitation.	Check the cable harness at the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
157/3	P0193	Sensor fuel pressure, short circuit to voltage.	Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:1 4	-
157/4	P0192	Sensor fuel pressure, short circuit to ground.	Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:1 4	-
157/15	P0191	Sensor fuel pressure, signal deviation too high.	Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:1 4	-
157/17	P0191	Sensor fuel pressure, signal deviation too low.	Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:1 4	-
158/12	P2533	Ignition key lock, open circuit.	No limitation.	Check the cable harness at the control unit.	D794/1:4 0	-
168/3	P0563	High battery voltage.	No limitation.	Check the voltage feed. If equipment for assisted start is connected, disconnect it.	D794/1:2	-
168/4	P0562	Low battery voltage.	The engine may be difficult to start.	Check and charge the batteries. Check the cable harness to the control unit. Check alternator, battery and cable harness between battery and alternator.	D794/1:2	-
171/3	P0073	Sensor outdoor temperature, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
171/4	P0072	Sensor outdoor temperature, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
171/12	P0071	Sensor outdoor temperature, incorrect signal via CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/POWER, menu 3

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
172/3	P0113	Sensor intake temperature, high signal.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:3 6	ENGINE, menu 7
172/4	P0112	Sensor intake temperature, low signal.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:3 6	ENGINE, menu 7
174/3	P0183	Sensor fuel temperature, short circuit to voltage.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	-	-
174/4	P0182	Sensor fuel temperature, short circuit to ground.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	-	-
175/3	P0198	Sensor engine oil temperature, short circuit to voltage.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	-	ENGINE, menu 7
175/4	P0197	Sensor engine oil temperature, short circuit to ground.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	-	ENGINE, menu 7
175/12	P0195	Sensor engine oil temperature, incorrect signal via CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/POWER, menu 3
175/17	P0196	High oil temperature.	No limitation.	Check the oil level. Check coolant temperature and level.	-	ENGINE, menu 7
190/7	P0016	Sensor camshaft and sensor crankshaft, unreasonable signal combination.	No limitation.	Check the cable harness between control unit and sensors. Check the sensors.	D794/2:0 9 D794/2:2 3	-
190/11	P0336	Sensor rotation speed crankshaft, irregular signal.	The engine is extremely difficult to start and runs unevenly or stops. Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:2 3	ENGINE, menu 2

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
190/12	P0008	Sensor camshaft rotation speed, signal error.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:09	-
190/12	P0335	Sensor rotation speed crankshaft, no signal.	The engine is extremely difficult to start and runs unevenly or stops. Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:23	-
520/11	UD13A	CAN bus, communication error.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:34 D794/1:35	CAN/POWER, menu 3
520/12	UD13B					
533/15	P0219	Engine speed too high.	No limitation.	Check the fuel pressure. Check the cable harness between control unit and sensors. Check sensor camshaft rotation speed and sensor crankshaft.	D794/2:09 D794/2:23	Engine, menu 2
596/2	P0564	Cruise control input, unreasonable signal.	No limitation.	Check the cable harness at the control unit.	D794/1:31 D794/1:64 D794/1:74 D794/1:46	-
597/2	P0504	The signal from the brake pedal does not correspond with the accelerator pedal.	No limitation.	Check the cable harness at the control unit.	-	-
597/12	P0571	Brake pedal, incorrect signal via CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:34 D794/1:35	CAN/POWER, menu 3
598/2	P0704	Sensor clutch, unreasonable signal.	No limitation.	Check the cable harness at the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
598/12	P0704	Sensor clutch, incorrect signal via CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/P-OWER, menu 3
624/2	P1626	Drive circuit lamp 1, overheating.	No limitation.	Check the cable harness at the control unit.	-	-
624/2	P162A	Drive circuit lamp 2, overheating.	No limitation.	Check the cable harness at the control unit.	-	-
624/2	P162E	Drive circuit lamp 3, overheated.	No limitation.	Check the cable harness at the control unit.	-	-
624/2	P161C	Drive circuit system lamp, overheated.	No limitation.	Check the cable harness at the control unit.	-	-
624/2	P1632	Drive circuit warning lamp, overheated.	No limitation.	Check the cable harness at the control unit.	-	-
624/3	P1623	Drive circuit lamp 1, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
624/3	P1627	Drive circuit lamp 2, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
624/3	P162B	Drive circuit lamp 3, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
624/3	P1619	Drive circuit system lamp, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
624/3	P162F	Drive circuit warning lamp, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
624/4	P1624	Drive circuit lamp 1, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
624/4	P1628	Drive circuit lamp 2, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
624/4	P162C	Drive circuit lamp 3, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
624/4	P161A	Drive circuit system lamp, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
624/4	P1630	Drive circuit warning lamp, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
624/12	P1625	Drive circuit lamp 1, open circuit.	No limitation.	Check the cable harness at the control unit.	-	-
624/12	P1629	Drive circuit lamp 2, open circuit.	No limitation.	Check the cable harness at the control unit.	-	-
624/12	P162D	Drive circuit lamp 3, open circuit.	No limitation.	Check the cable harness at the control unit.	-	-
624/12	P161B	Drive circuit system lamp, open circuit.	No limitation.	Check the cable harness at the control unit.	-	-
624/12	P1631	Drive circuit warning lamp, open circuit.	No limitation.	Check the cable harness at the control unit.	-	-
630/2	P062F	Internal error engine control unit.	No limitation.	Contact Yuchai service.	-	-
630/4	P062F					
630/12	P062F					
636/11	P0341	Sensor rotation speed camshaft, irregular signal.	The engine takes longer to start than normal. The engine is running normally once it has started.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:09	-
636/12	P0340	Sensor rotation speed camshaft, no signal.	The engine takes longer to start than normal. The engine is running normally once it has started.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:09	-
639/12	UC029	CAN bus (A), electrical problem.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:34 D794/1:35	CAN/POWER, menu 3
645/3	P1511	Sensor machine speed, incorrect signal form.	Engine speed is limited.	Check the cable harness between control unit and sensor. Check the sensor.	D794/1:71	ENGINE, menu 2
645/4	P1512	Sensor machine speed, incorrect signal form.	Engine speed is limited.	Check the cable harness between control unit and sensor. Check the sensor.	D794/1:71	ENGINE, menu 2
645/12	P1513	Sensor machine speed, incorrect signal form.	Engine speed is limited.	Check the cable harness between control unit and sensor. Check the sensor.	D794/1:71	ENGINE, menu 2

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
651/3	P0262	Injector cylinder 1, short circuit to ground.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 4 D794/3:1 3	-
651/8	P0261	Injector cylinder 1, short circuit between cables.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 4 D794/3:1 3	-
651/11	P0263	Injector cylinder 1, installation-dependent error.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 4 D794/3:1 3	-
651/11	P0263	Injector cylinder 1, indefinable error.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 4 D794/3:1 3	-
651/11	P1213	Injector cylinder 1, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 4 D794/3:1 3	-
651/11	P1214	Injector cylinder 1, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 4 D794/3:1 3	-
651/11	P1215	Injector cylinder 1, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 4 D794/3:1 3	-
651/12	P0201	Injector cylinder 1, open circuit.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 4 D794/3:1 3	-
652/3	P0265	Injector cylinder 2, short circuit to ground.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 6 D794/3:11	-
652/8	P0264	Injector cylinder 2, short circuit between cables.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 6 D794/3:11	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
652/11	P0266	Injector cylinder 2, installation-dependent error.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 6 D794/3:11	-
652/11	P0266	Injector cylinder 2, indefinable error.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 6 D794/3:11	-
652/11	P1216	Injector cylinder 2, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 6 D794/3:11	-
652/11	P1217	Injector cylinder 2, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 6 D794/3:11	-
652/11	P1218	Injector cylinder 2, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 6 D794/3:11	-
652/12	P0202	Injector cylinder 2, open circuit.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 6 D794/3:11	-
653/3	P0268	Injector cylinder 3, short circuit to ground.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 5 D794/3:1 2	-
653/8	P0267	Injector cylinder 3, short circuit between cables.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 5 D794/3:1 2	-
653/11	P0269	Injector cylinder 3, installation-dependent error.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 5 D794/3:1 2	-
653/11	P0269	Injector cylinder 3, indefinable error.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 5 D794/3:1 2	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
653/11	P1219	Injector cylinder 3, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 5 D794/3:1 2	-
653/11	P121A	Injector cylinder 3, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 5 D794/3:1 2	-
653/11	P121B	Injector cylinder 3, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 5 D794/3:1 2	-
653/12	P0203	Injector cylinder 3, open circuit.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 5 D794/3:1 2	-
654/3	P0271	Injector cylinder 4, short circuit to ground.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 3 D794/3:1 4	-
654/8	P0270	Injector cylinder 4, short circuit between cables.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 3 D794/3:1 4	-
654/11	P0272	Injector cylinder 4, installation-dependent error.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 3 D794/3:1 4	-
654/11	P0272	Injector cylinder 4, indefinable error.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 3 D794/3:1 4	-
654/11	P121C	Injector cylinder 4, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 3 D794/3:1 4	-
654/11	P121D	Injector cylinder 4, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 3 D794/3:1 4	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
654/11	P121E	Injector cylinder 4, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 3 D794/3:1 4	-
654/12	P0204	Injector cylinder 4, open circuit.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 3 D794/3:1 4	-
655/3	P0274	Injector cylinder 5, short circuit to ground.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 1 D794/3:1 6	-
655/8	P0273	Injector cylinder 5, short circuit between cables.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 1 D794/3:1 6	-
655/11	P0275	Injector cylinder 5, installation-dependent error.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 1 D794/3:1 6	-
655/11	P0275	Injector cylinder 5, indefinable error.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 1 D794/3:1 6	-
655/11	P121F	Injector cylinder 5, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 1 D794/3:1 6	-
655/11	P1220	Injector cylinder 5, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 1 D794/3:1 6	-
655/11	P1221	Injector cylinder 5, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 1 D794/3:1 6	-
655/12	P0205	Injector cylinder 5, open circuit.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 1 D794/3:1 6	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
656/3	P0277	Injector cylinder 6, short circuit to ground.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 2 D794/3:1 5	-
656/8	P0276	Injector cylinder 6, short circuit between cables.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 2 D794/3:1 5	-
656/11	P0278	Injector cylinder 6, installation-dependent error.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 2 D794/3:1 5	-
656/11	P0278	Injector cylinder 6, indefinable error.	Engine only runs on 3 cylinders and has reduced power.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 2 D794/3:1 5	-
656/11	P1222	Injector cylinder 6, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 2 D794/3:1 5	-
656/11	P1223	Injector cylinder 6, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 2 D794/3:1 5	-
656/11	P1224	Injector cylinder 6, installation-dependent error.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 2 D794/3:1 5	-
656/12	P0206	Injector cylinder 6, open circuit.	No limitation.	Check the cable harness between control unit and injector. Check the injector.	D794/3:0 2 D794/3:1 5	-
676/7	P0540	Relay, preheating (K312), signal error.	Preheating not working.	Check the cable harness between control unit and component. Check the component.	D794/1:55 – K312/86 D794/1:59 – K312/85	ENGINE, menu 5
677/3	P0617 P1638	Relay starter motor, short circuit to voltage or activated too long.	No limitation.	Check the cable harness at the control unit.	D794/1:3 7 D794/1:5 1	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
677/4	P0616 P1639	Relay starter motor, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	D794/1:3 7 D794/1:5 1	-
677/5	P163A	Relay starter motor, open circuit.	No limitation.	Check the cable harness at the control unit.	D794/1:3 7 D794/1:5 1	-
729/3	P0541	Relay preheating (K312), short circuit to ground.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/ 1:55 – K312/86 D794/ 1:59 – K312/85	ENGINE, menu 5
729/3	P0542	Relay preheating (K312), short circuit to voltage.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/ 1:55 – K312/86 D794/ 1:59 – K312/85	ENGINE, menu 5
729/3	P1020	Relay preheating (K312), high signal.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/ 1:55 – K312/86 D794/ 1:59 – K312/85	ENGINE, menu 5
729/4	P1021	Relay preheating (K312), active too short time.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/ 1:55 – K312/86 D794/ 1:59 – K312/85	ENGINE, menu 5
730/3	P1022	Relay preheating (K312), high signal.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/ 1:55 – K312/86 D794/ 1:59 – K312/85	ENGINE, menu 5
730/4	P1023	Relay preheating (K312), low signal.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/ 1:55 – K312/86 D794/ 1:59 – K312/85	ENGINE, menu 5
898/11	UD10E	CAN bus, communication error.	No limitation.	Use diagnostic menu to check communication.	D794/1:3 4	CAN/P-OWER, menu 3
898/12	UD10F			Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 5	

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
970/3	P1617	Voltage error at shut-off, high battery voltage.	Reduced engine power.	Check the cable harness at the control unit. Check the component.	D794/1:0 2	-
970/4	P1618	Voltage error at shut-off, low battery voltage.	Reduced engine power.	Check the cable harness at the control unit. Check the component.	D794/1:0 2	-
970/12	P1616	Voltage error at shut-off, monitoring switched off.	Reduced engine power.	Check the cable harness at the control unit. Check the component.	D794/1:0 2	-
985/2	P2519	AC compressor, incorrect CAN message.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4	CAN/P- OWER, menu 3
985/12	P2519				D794/1:3 5	
1041/7	P2530	Ignition key lock, incorrect signal.	No limitation.	Check the cable harness at the control unit.	D794/1:6 1	-
1041/8	P2530	Switch remote start engine, fixed in activated position.	No limitation.	Check the cable harness at the control unit.	D794/1:6 1	-
1071/2	P0483	Drive circuit cooling fan, overheated.	No limitation.	Check the cable harness at the control unit.	D794/1:1 3 D794/1:5 8	-
1071/3	P0692	Drive circuit cooling fan, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	D794/1:1 3 D794/1:5 8	-
1071/3	P0694	Drive circuit cooling fan 2, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
1071/4	P0691	Drive circuit cooling fan, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	D794/1:1 3 D794/1:5 8	-
1071/4	P0693	Drive circuit cooling fan 2, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
1071/12	P0480	Drive circuit cooling fan, open circuit.	No limitation.	Check the cable harness at the control unit.	D794/1:1 3 D794/1:5 8	-
1072/3	P0080	Drive circuit brake valve, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
1072/4	P0079	Drive circuit brake valve, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
1072/255	P1633	Drive circuit brake valve, open circuit.	No limitation.	Check the cable harness at the control unit.	-	-
1072/255	P1634	Drive circuit brake valve, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	D794/3:08	-
1074/2	P0476	Drive circuit exhaust brake, overheated.	No limitation.	Check the cable harness at the control unit.	D794/3:08	-
1074/3	P0478	Drive circuit exhaust brake, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	D794/3:08	-
1074/4	P0477	Drive circuit exhaust brake, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	D794/3:08	-
1074/12	P0476	Drive circuit exhaust brake, open circuit.	No limitation.	Check the cable harness at the control unit.	D794/3:08	-
1079/3	P0643	Voltage feed 1 sensor engine, high signal.	Reduced engine power.	Check the cable harness at the control unit.	-	-
1079/4	P0642	Voltage feed 1 sensor engine, low signal.	No limitation.	Check the cable harness at the control unit.	-	-
1080/3	P0653	Voltage feed 2 sensor engine, high signal.	Reduced engine power.	Check the cable harness at the control unit.	-	-
1080/4	P0652	Voltage feed 2 sensor engine, low signal.	No limitation.	Check the cable harness at the control unit.	-	-
1081/2	P1638	Drive circuit indicator light preheating, overheated.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/1:38 – D797-F/K1:26	ENGINE, menu 10
1081/3	P1635	Drive circuit indicator light preheating, short circuit to voltage.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/1:38 – D797-F/K1:26	ENGINE, menu 10
1081/4	P1636	Drive circuit indicator light preheating, short circuit to ground.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/1:38 – D797-F/K1:26	ENGINE, menu 10

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
1081/12	P1637	Drive circuit indicator light preheating, open circuit.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/1:3 8 – D797-F/K1:26	ENGINE, menu 10
1108/16	P1613	Engine speed too high.	No limitation.	Check the cable harness between control unit and the components. Check sensor camshaft rotation speed and sensor crankshaft. Check the fuel pressure.	D794/2:0 9 D794/2:2 3	ENGINE, menu 2
1192/2	P0046	Valve boost pressure control, overheating.	No limitation.	Check the cable harness at the control unit.	D794/2:0 1	-
1192/3	P0048	Valve boost pressure control, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	D794/2:0 1	-
1192/3	P1000	Valve boost pressure control, signal too high.	No limitation.	Check the cable harness at the control unit.	D794/2:0 1	-
1192/4	P0047	Valve boost pressure control, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	D794/2:0 1	-
1192/4	P1001	Valve boost pressure control, signal too low.	No limitation.	Check the cable harness at the control unit.	D794/2:0 1	-
1192/12	P0045	Valve boost pressure control, open circuit.	No limitation.	Check the cable harness at the control unit.	D794/2:0 1	-
1192/12	P1002	Valve boost pressure control, incorrect signal.	No limitation.	Check the cable harness at the control unit.	D794/2:0 1	-
1213/2	P0650	Drive circuit warning lamp engine fault, overheated.	No limitation.	Check the cable harness between control unit and component.	-	-
1213/3	P0650	Drive circuit warning lamp engine fault, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
1213/4	P0650	Drive circuit warning lamp engine fault, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
1213/12	P0650	Drive circuit warning lamp engine fault, open circuit.	No limitation.	Check the cable harness at the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
1231/12	UC038	CAN bus (C), electrical problem.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/P-OWER, menu 3
1235/12	UC047					
1322/3	P0300	Misfiring on multiple cylinders.	Reduced engine power.	Contact Yuchai service.	-	-
1323/3	P0301	Misfiring cylinder 1.	Reduced engine power.	Contact Yuchai service.	-	-
1324/3	P0302	Misfiring cylinder 2.	Reduced engine power.	Contact Yuchai service.	-	-
1325/3	P0303	Misfiring cylinder 3.	Reduced engine power.	Contact Yuchai service.	-	-
1326/3	P0304	Misfiring cylinder 4.	Reduced engine power.	Contact Yuchai service.	-	-
1327/3	P0305	Misfiring cylinder 5.	Reduced engine power.	Contact Yuchai service.	-	-
1328/3	P0306	Misfiring cylinder 6.	Reduced engine power.	Contact Yuchai service.	-	-
1351/2	P0645	Drive circuit AC compressor, overheated.	No limitation.	Check the cable harness at the control unit.	D794/2:11	-
1351/3	P0647	Drive circuit AC compressor, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	D794/2:11	-
1351/4	P0646	Drive circuit AC compressor, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	D794/2:11	-
1351/12	P0645	Drive circuit AC compressor, open circuit.	No limitation.	Check the cable harness at the control unit.	D794/2:11	-
1485/3	P0687	Main relay 2, electrical problem.	No limitation.	Check the cable harness at the control unit.	-	-
1485/4	P0686	Main relay 2, electrical problem.	No limitation.	Check the cable harness at the control unit.	-	-
1624/3	P2158	Sensor machine speed, speed too high.	Engine speed is limited.	Check the cable harness at the control unit.	D794/1:7 1	-
1624/4	P2160	Sensor machine speed, speed too low.	Engine speed is limited.	Check the cable harness at the control unit.	D794/1:7 1	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
1624/12	P2157	Sensor machine speed, speed message via CAN bus incorrect.	Engine speed is limited.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/POWER, menu 3
1624/255	P2159	Sensor machine speed, unreasonable speed.	Engine speed is limited.	Check the cable harness at the control unit.	D794/1:7 1	-
1639/3	P0526	Sensor fan speed, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	D794/1:6 8 D794/1:6 9	-
1639/4	P0527	Sensor fan speed, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	D794/1:6 8 D794/1:6 9	-
2634/3	P160E	Main relay, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
2634/4	P160F	Main relay, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
2791/2	P0403	Drive circuit EGR valve, overheating.	No limitation.	Check the cable harness at the control unit.	-	-
2791/3	P0490	Drive circuit EGR valve, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
2791/4	P0489	Drive circuit EGR valve, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
2791/5	P0404	Drive circuit EGR valve, open circuit.	No limitation.	Check the cable harness at the control unit.	-	-
520192/2	P063B	Voltage feed speed sensor, incorrect signal (ADC).	The engine is only running at idle.	Check the cable harness between control unit and sensor. Check the sensor.	-	-
520192/3	P060B	Voltage feed speed sensor, signal too high (ADC).	The engine is only running at idle.	Check the cable harness between control unit and sensor. Check the sensor.	-	-
520192/4	P061B	Voltage feed speed sensor, signal too low (ADC).	The engine is only running at idle.	Check the cable harness between control unit and sensor. Check the sensor.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
520192 /11	P062B	Voltage feed speed sensor, incorrect test impulse(ADC).	The engine is only running at idle.	Check the cable harness between control unit and sensor. Check the sensor.	-	-
520193/3	P0103	Mass air flow sensor, air flow too high.	No limitation.	Check the cable harness at the control unit.	-	-
520193/4	P0102	Mass air flow sensor, air flow too low,	No limitation.	Check the cable harness at the control unit.	-	-
520194/2	P0649	Warning lamp speed limitation, overheated.	No limitation.	Check the cable harness at the control unit.	-	-
520194/3	P0649	Warning lamp speed limitation, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
520194/4	P0649	Warning lamp speed limitation, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
520194/5	P0649	Warning lamp speed limitation, open circuit.	No limitation.	Check the cable harness at the control unit.	-	-
520195 /15	P0402	EGR control, signal too high.	No limitation.	Check the cable harness at the control unit.	-	-
520196 /17	P0401	EGR control, signal too low.	No limitation.	Check the cable harness at the control unit.	-	-
520197/3	P022C	Bypass valve cold start, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
520197/4	P022B	Bypass valve cold start, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
520197 /12	P022A	Bypass valve cold start, open circuit.	No limitation.	Check the cable harness at the control unit.	-	-
520198/2	P0116	Sensor coolant temperature, unreasonable signal.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:1 5	ENGINE, menu 7
520198/2	P0116	Sensor coolant temperature, unreasonable signal.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:1 5	ENGINE, menu 7
520199/2	P0856	DCS, unreasonable signal.	No limitation.	Check the cable harness at the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
520200 /20	P161F	Incorrect compression test.	No limitation.	contact Yuchai service.	-	-
520201/3	P1505	Sensor outdoor temperature (BET), signal too high.	No limitation.	Check the cable harness at the control unit.	-	-
520201/4	P1506	Sensor outdoor temperature (BET), signal too low.	No limitation.	Check the cable harness at the control unit.	-	-
520202/3	P1507	Sensor outdoor temperature (ClgZn), signal too high.	No limitation.	Check the cable harness at the control unit.	-	-
520202/4	P1508	Sensor outdoor temperature (ClgZn), signal too low.	No limitation.	Check the cable harness at the control unit.	-	-
520203/3	P1509	Sensor intake temperature, signal too high.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:3 6	-
520203/4	P150A	Sensor intake temperature, signal too low.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:3 6	-
520204/2	P1635	Switch exhaust brake, unreasonable signal.	No limitation.	Check the cable harness at the control unit.	D794/2:2 9	-
520205/3	P245D	EGR valve, short circuit to voltage or overheated.	No limitation.	Check the cable harness at the control unit.	-	-
520205/4	P245C	EGR valve, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
520205 /12	P245A	EGR valve, open circuit.	No limitation.	Check the cable harness at the control unit.	-	-
520206/2	P0470	Exhaust back pressure sensor, unreasonable signal.	No limitation.	Check the cable harness at the control unit.	-	-
520206/3	P0473	Sensor exhaust back pressure, signal too high.	No limitation.	Check the cable harness at the control unit.	-	-
520206/4	P0472	Sensor exhaust back pressure, signal too low.	No limitation.	Check the cable harness at the control unit.	-	-
520207/3	P1008	Relay heating coil fuel filter, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	D794/2:0 4 D794/2:0 5	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
520207/4	P1009	Relay heating coil fuel filter, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	D794/2:0 4 D794/2:0 5	-
520208/2	P0409	Sensor airflow EGR valve, unreasonable signal.	No limitation.	Check the cable harness at the control unit.	-	-
520208/3	P0406	Sensor airflow EGR valve, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
520208/4	P0405	Sensor airflow EGR valve, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
520208/12	P0409	Sensor airflow EGR valve, open circuit.	No limitation.	Check the cable harness at the control unit.	-	-
520209/2	P040B	Sensor exhaust temperature, unreasonable signal.	No limitation.	Check the cable harness at the control unit.	-	-
520209/3	P040D	Sensor exhaust temperature, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
520209/4	P040C	Sensor exhaust temperature, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
520209/12	P040A	Sensor exhaust temperature, open circuit.	No limitation.	Check the cable harness at the control unit.	-	-
520210/3 or/255	UC158	Communication error, display.	No limitation.	Check the cable harness at the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
520211 /12	P0000	Communication error, CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/POWER, menu 3
520212/3	UD100					
520213 /12	UC103					
520214 /12	UC113					
520215/3	UD101					
520216/3	UC156					
520217/3	UD103					
520218/3	UD10C					
520218/4	UD10D					
520218 /12	UD104					
520219/3	UD110					
520219 /12	UD111					
520220/3	UD112					
520220 /12	UD113					
520222 /14	P0607	Internal error engine control unit.	Engine switched off: engine cannot be started. Engine running: engine misfires.	Contact Yuchai service.	-	-
520222 /14	P0607					
520222 /14	P0607					
520223 /20	P160C	Fuel injection, test mode.	No limitation.	Contact Yuchai service.	-	-
520224/3	P150B	Sensor air humidity, signal too high.	No limitation.	Check the cable harness at the control unit.	-	-
520224/4	P150C	Sensor air humidity, signal too low.	No limitation.	Check the cable harness at the control unit.	-	-
520225 /11	P1302	Injection error, software error.	No limitation.	Check the cable harness at the control unit.	-	-
520225 /15	P1301	Injection error, uneven amount of fuel between the cylinders.	No limitation.	Check the cable harness at the control unit.	-	-
520225 /16	P1300	Injection error, uneven output between the cylinders.	No limitation.	Check the cable harness at the control unit.	-	-
520226 /12	P1225	Pressure fault on multiple injectors.	The engine is switched off.	Check the injectors.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
520227/2	P154C	Multi-function lever, unreasonable position.	No limitation.	Check the cable harness at the control unit.	D794/1:6 2	-
520227/3	P154A	Multi-function lever, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	D794/1:6 2	-
520227/4	23/04	Multi-function lever, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	D794/1:6 2	-
520228 /15	P1614	Sensor engine speed, unreasonable signal	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:2 3	ENGINE, menu 2
520229 /15	P2263	Intake pressure difference too high.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	-	-
520230 /17	P2263	Intake pressure difference too low.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	-	-
520231/2	P062A	Feed pump, overheated.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/23: 09 D794/23: 10	-
520231/3	P0629	Feed pump, short circuit to voltage.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/23: 09 D794/23: 10	-
520231/4	P0628	Feed pump, short circuit to ground.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/23: 09 D794/23: 10	-
520231 /12	P0627	Feed pump, open circuit.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/23: 09 D794/23: 10	-
520232/ 255	P1615	Test mode.	No limitation.	Contact Yuchai service.	-	-
520233 /20	P1621					

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
520234/2	P0488	Throttle, overheated.	No limitation.	Check the cable harness at the control unit.	D794/1:7 9 D794/1:8 0	-
520234/3	P2142	Throttle, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	D794/1:7 9 D794/1:8 0	-
520234/4	P2141	Throttle, short circuit to ground.	The engine is running at idle.	Check the cable harness at the control unit.	D794/1:7 9 D794/1:8 0	-
520234/12	P0487	Throttle, open circuit.	No limitation.	Check the cable harness at the control unit.	D794/1:7 9 D794/1:8 0	-
520235/3	P1636	Reference voltage 12 V, signal too high.	No limitation.	Check the cable harness at the control unit.	-	-
520235/4	P1637	Reference voltage 12 V, signal too high.	No limitation.	Check the cable harness at the control unit.	-	-
520236/2	P1007	Software error engine control unit (FMTC).	No limitation.	Contact Yuchai service	-	-
520237/3	UD114	Communication error, CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/P-OWER, menu 3
520238/12	UD115					
520239/2	P161E	Internal error engine control unit.	No limitation.	Contact Yuchai service.	-	-
520239/11	P161D					
523218/12	UC104	Communication error, CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/P-OWER, menu 3
523222/12	UC157					

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
523350/3	P1203	Injector bank 1, short circuit between cables.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:0 4 D794/3:1 3 D794/3:0 6 D794/3:11 D794/3:0 5 D794/3:1 2	-
523350/4	P1204	Injector bank 1, short circuit to ground.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:0 4 D794/3:1 3 D794/3:0 6 D794/3:11 D794/3:0 5 D794/3:1 2	-
523350 /11	P1205	Injector bank 1, installation-dependent error.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:0 4 D794/3:1 3 D794/3:0 6 D794/3:11 D794/3:0 5 D794/3:1 2	-
523350 /11	P1206	Injector bank 1, electrical problem.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:0 4 D794/3:1 3 D794/3:0 6 D794/3:11 D794/3:0 5 D794/3:1 2	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
523351 /11	P1207	Injector bank 1, installation-dependent error.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:04 D794/3:13 D794/3:06 D794/3:11 D794/3:05 D794/3:12	-
523351 /11	P1208	Injector bank 1, installation-dependent error.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:04 D794/3:13 D794/3:06 D794/3:11 D794/3:05 D794/3:12	-
523351 /11	P120A	Injector bank 1, installation-dependent error.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:04 D794/3:13 D794/3:06 D794/3:11 D794/3:05 D794/3:12	-
523351 /12	P1209	Injector bank 1, open circuit.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:04 D794/3:13 D794/3:06 D794/3:11 D794/3:05 D794/3:12	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
523352/3	P120B	Injector bank 2, short circuit between cables.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:03 D794/3:14 D794/3:01 D794/3:16 D794/3:02 D794/3:15	-
523352/4	P120C	Injector bank 2, short circuit to ground.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:03 D794/3:14 D794/3:01 D794/3:16 D794/3:02 D794/3:15	-
523352/11	P120D	Injector bank 2, installation-dependent error.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:03 D794/3:14 D794/3:01 D794/3:16 D794/3:02 D794/3:15	-
523352/11	P120E	Injector bank 2, electrical problem.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:03 D794/3:14 D794/3:01 D794/3:16 D794/3:02 D794/3:15	

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
523353 /11	P120F	Injector bank 2, installation-dependent error.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:03 D794/3:14 D794/3:01 D794/3:16 D794/3:02 D794/3:15	-
523353 /11	P1210	Injector bank 2, installation-dependent error.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:03 D794/3:14 D794/3:01 D794/3:16 D794/3:02 D794/3:15	-
523353 /11	P1212	Injector bank 2, installation-dependent error.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:03 D794/3:14 D794/3:01 D794/3:16 D794/3:02 D794/3:15	-
523352 /12	P1211	Injector bank 2, open circuit.	The engine is only running on three cylinders.	Check the cable harness between control unit and the components. Check the injectors.	D794/3:03 D794/3:14 D794/3:01 D794/3:16 D794/3:02 D794/3:15	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
523354/2	P062B	Internal error engine control unit.	The engine is switched off.	Contact Yuchai service.	-	-
523354/3	P062B					
523354/4	P062B					
523354/12	P062B					
523355/2	P062B					
523355/3	P062B					
523355/4	P062B					
523355/12	P062B					
523420/2	P060C					
523470/0	P100E	Valve fuel pressure control, leakage.	Reduced engine power.	Check the component.	D794/2:14	-
523470/7	P1010	Valve fuel pressure control, does not open.	Reduced engine power.	Check the component.	D794/2:14	-
523470/11	P100F	Valve fuel pressure control, fuel pressure too high.	Reduced engine power.	Check the component.	D794/2:14	-
523500/12	UC001	Communication error, CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:34 D794/1:35	CAN/POWER, menu 3
523550/2	P0607					
523600/12	P0607	Internal error engine control unit.	No limitation.	Contact Yuchai service.	-	-
523601/3	P0699	Voltage feed 3 sensor, short circuit to voltage.	Reduced engine power.	Check the cable harness at the control unit.		-
523601/4	P0698	Voltage feed 3 sensor, short circuit to ground.	The engine takes longer to start than normal. The engine is running normally once it has started.	Check the cable harness at the control unit.		-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
523604 /12	UD1102	Communication error, CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/POWER, menu 3
523605 /11	UD1104					
523605 /12	UD1105					
523606 /11	UD1106					
523606 /12	UD1107					
523607 /11	UD1108					
523608 /11	UD110A					
523608 /12	UD110B					
523612/3	P1607	Internal error engine control unit.	No limitation.	Contact Yuchai service.	-	-
523612/4	P1608	Internal error engine control unit.				
523613/2	P1014	Unreasonable fuel pressure.	Reduced engine power.	Check the cable harness between control unit and sensor. Check the sensor.	D794/2:1 4	-
523613/3	P0088	Fuel pressure too high.	Reduced engine power.	Check the fuel pressure. Check the fuel pump. Check the sensor.	D794/2:1 4	-
523613/4	P0087	Fuel pressure too low.	Reduced engine power.	Check the fuel pressure. Check the fuel pump. Check the fuel filters. Check the sensor.	D794/2:1 4	-
523613/5	P1019	Fuel pressure too high.	Reduced engine power.	Check the fuel pressure. Check the fuel pump. Check the fuel filters. Check the sensor.	D794/2:1 4	-
523613/7	P1018	Fuel pressure too low.	Reduced engine power.	Check the fuel pressure. Check the fuel pump. Check the fuel filters. Check the sensor.	D794/2:1 4	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Display	Supplier code					
523613 /15	P1012	Fuel pressure too high.	Reduced engine power.	Check the fuel pressure. Check the fuel pump. Check the fuel filters. Check the sensor.	D794/2:1 4	-
523613 /16	P1011	Fuel pressure too high.	Reduced engine power.	Check the component.	D794/2:1 4	-
523613 /17	P1013	Fuel pressure too low.	Reduced engine power.	Check the fuel pressure. Check the fuel pump. Check the fuel filters. Check the sensor.	D794/2:1 4	-
523613 /18	P101A	Fuel pressure too high.	Reduced engine power.	Check the fuel pressure. Check the fuel pump. Check the fuel filters. Check the sensor.	D794/2:1 4	-
523615/2	P0252	Fuel metering valve, overheated power stage.	No limitation.	Check the cable harness at the control unit.	-	-
523615/3	P0254	Valve fuel metering, short circuit to voltage.	No limitation.	Check the cable harness at the control unit.	-	-
523615/4	P0253	Valve fuel metering, short circuit to ground.	No limitation.	Check the cable harness at the control unit.	-	-
523615/5	P0251	Valve fuel metering, open circuit.	No limitation.	Check the cable harness at the control unit.	-	-
523615 /16	P025C	Fuel metering valve, status signal too low.	No limitation.	Check the cable harness at the control unit.	-	-
523615 /18	P025D	Fuel metering valve, status signal too high.	No limitation.	Check the cable harness at the control unit.	-	-
523617 /11	P060A	Communication error, CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	D794/1:3 4 D794/1:3 5	CAN/P-OWER, menu 3

Error codes engine (engine alternative Cummins QSM11)

Table Error codes Cummins QSM11

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	J1587					
84/2	PID084/2	Electrical error, speed sensor, invalid data.	Engine speed limited to maximum speed without gear.	Check the cable harness between control unit and component. Check the sensor.	-	-
84/10	PID084/10	Electrical error, speed sensor, signal manipulation detected.	Engine speed limited to maximum speed without gear.	Check the cable harness between control unit and component. Check the sensor.	-	-
91/3	PID091/3	Electrical error, accelerator pedal, cable short circuit to voltage.	The engine does not respond to throttle application.	Check the cable harness between control unit and component. Check the component.	-	-
91/4	PID091/4	Electrical error, accelerator pedal, cable short circuit to ground.	The engine does not respond to throttle application.	Check the cable harness between control unit and component. Check the component.	-	-
91/8	PID091/8	Electrical error, accelerator pedal, frequency too low.	The engine does not respond to throttle application.	Check the cable harness between control unit and component. Check the component.	-	-
91/8	PID091/8	Electrical error, accelerator pedal, frequency too high.	The engine does not respond to throttle application.	Check the cable harness between control unit and component. Check the component.	-	-
91/19	SID091/2	Communication error with Control unit, cab (D790-1), electrical error, accelerator pedal.	Engine only running at idle.	Use diagnostic menu to find incorrect segment.	-	CAN/P-OWER, menu 3
97/3	PID097/3	Electrical error, water-in-fuel sensor, cable short circuit to voltage.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/Sensor:09	-
97/4	PID097/4	Electrical error, water-in-fuel sensor, cable short circuit to ground.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/Sensor:09	-
97/15	PID097/15	Water in fuel.	Risk of white exhaust smoke and reduced engine output.	Drain water from the fuel filter.	-	-
100/1	PID100/1	Low engine oil pressure.	Engine output is reduced gradually. The engine is switched off after 30 seconds.	Check the oil level in the engine; fill if necessary.	-	ENGINE, menu 6
100/2	PID100/2	Sensor, oil pressure, data error.	No warning of low engine oil pressure.	Check the sensor.	D794/Sensor:44	ENGINE, menu 6

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	J1587					
100/3	PID100/3	Sensor oil pressure cable short-circuited to voltage.	No warning of low engine oil pressure.	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:44	ENGINE, menu 6
100/4	PID100/4	Sensor oil pressure, open circuit or short circuit to ground.	No warning of low engine oil pressure.	Check the cable harness between control unit and component. Check the sensor.	D794/Black:14	ENGINE, menu 6
100/18	PID100/1	Low engine oil pressure.	No limitation.	Check the oil level in the engine; fill if necessary. Check the sensor.	-	ENGINE, menu 6
102/2	PID102/2	Sensor boost pressure indicates high boost pressure, but other engine data indicates that pressure should be normal.	Reduced engine power.	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:39	ENGINE, menu 7
102/3	PID102/3	Sensor, boost pressure, cable short-circuited to voltage.	Reduced engine power.	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:39	ENGINE, menu 7
102/4	PID102/4	Sensor boost pressure, cable short circuit to ground or open circuit.	Reduced engine power.	Check cable harness between control unit and component. Check the boost pressure sensor.	D794/Black:3	ENGINE, menu 7
103/16	PID103/0	Over-rev protection, turbo.	Reduced engine power.	Check the component.	-	-
105/0	PID105/0	Intake air too hot.	Engine output is reduced gradually. The engine is switched off after 30 seconds.	Check the coolant level in the engine; fill if necessary. Check that the charge air cooler is clean, clean if necessary. Check that the fan belts are intact. Check the intake air temperature sensor.	-	ENGINE, menu 7
105/3	PID105/3	Sensor charge air temperature, cable short-circuited to voltage or open circuit.	Risk of white exhaust smoke. No warning of high coolant temperature.	Check cable harness between control unit and component. Check that the charge air temperature sensor is correctly installed and connected. Check the charge air temperature sensor.	D794/Sensor:38	ENGINE, menu 7

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	J1587					
105/4	PID105/4	Sensor charge air temperature, cable short circuit to ground or open circuit.	Risk of white exhaust smoke. No warning of high coolant temperature.	Check the cable harness between control unit and component. Check that the sensor is correctly installed and connected. Check the sensor.	D794/Sensor:38	ENGINE, menu 7
108/2	PID108/2	Electrical error, air pressure sensor, data error.	Reduced engine power.	Check the sensor.	-	-
108/3	PID108/3	Electrical error, air pressure sensor, cable short circuit to voltage.	Reduced engine power.	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:06	-
108/4	PID108/4	Electrical error, air pressure sensor, cable short circuit to ground.	Reduced engine power.	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:06	-
110/0	PID110/0	High coolant temperature.	Engine output is reduced gradually. The engine is switched off after 30 seconds.	Check the coolant level. Check that radiator is clean. Check if there is air in coolant system. Check the cap on the expansion tank. Check the sensor. Check the thermostat.	-	ENGINE, menu 7
110/3	PID110/3	Sensor coolant temperature, cable short-circuited to voltage or open circuit.	No indication of engine temperature.	Check the cable harness between control unit and component.	D794/Sensor:02	ENGINE, menu 7
110/4	PID110/4	Sensor coolant temperature, cable short circuit to ground.	No indication of engine temperature.	Check the cable harness between control unit and component. Check that the sensor is connected correctly. Check the sensor.	D794/Sensor:02	ENGINE, menu 7
111/1	PID111/1	Low coolant level.	Engine output is reduced gradually. The engine is switched off after 30 seconds.	Check the coolant level; fill if necessary. Check the sensor.	-	-
111/2	PID111/2	Electrical error, sensor coolant level, data error.	No warning of low coolant level.	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:09	-
166/2	PID116/2	Output imbalance between cylinders.	Rough idle.	Check the fuel quality. The error code could be generated if the fuel system has been opened, allowing air to enter the system. Troubleshoot the engine.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	J1587					
167/1	PID167/1	Low battery voltage.	Warning active until voltage is correct.	Check batteries and alternator.	D794/OE-M:7, 8, 17, 18, 28	-
167/16	PID167/0	Low battery voltage.	Warning active until voltage is correct.	Check fuses. Check batteries and alternator.	D794/OE-M:7, 8, 17, 18, 28	-
167/18	PID167/1	High battery voltage.	Warning active until voltage is correct. The engine runs at raised idle in order to increase voltage.	Check batteries and alternator.	D794/OE-M:7, 8, 17, 18, 28	-
168/16	PID168/0	High voltage feed to control unit.	No limitation.	Check fuses. Check batteries and alternator.	D794/OE-M:7, 8, 17, 18, 28	-
168/18	PID168/1	Low voltage feed to control unit.	Rough idle.	Check fuses. Check batteries and alternator.	D794/OE-M:7, 8, 17, 18, 28	-
175/0	PID175/0	High engine oil temperature.	Engine output is reduced gradually. The engine is switched off after 30 seconds.	Check the coolant and oil level in the engine; fill if necessary. Check that the oil cooler is clean, clean if necessary. Check that the fan belts are intact. Check the sensor.	-	ENGINE, menu 7
175/3	PID175/3	Sensor, oil temperature, cable short-circuited to voltage or open circuit.	No indication of engine oil temperature.	Check the cable harness between control unit and component. Check that the sensor is connected correctly.	D794/Sensor:42	ENGINE, menu 7
175/4	PID175/4	Sensor oil temperature, cable short circuit to ground.	No indication of engine oil temperature.	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:42	ENGINE, menu 7
188/4	SID032/4	Electrical error, wastegate solenoid valve 1 short circuit to ground.	Reduced engine power.	Check the cable harness between control unit and component. Check the solenoid valve.	D794/Actuator:24	
190/0	PID190/0	Engine speed too high.	Fuel supply restricted until engine speed is below permitted value.	Ease off the throttle or select higher gear.	-	-
190/2	PID190/2	Electrical error, sensor rotation speed/ignition mode; no signal from any sensors.	The engine stops and cannot be restarted.	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:47, 50	-
190/10	PID190/10	Electrical error, sensor rotation speed/ignition mode, one of two signals missing.	No limitation.	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:47, 50	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	J1587					
191/16	PID191/0	Speed limitation activated.	Speed is reduced.	Reduce throttle application.	-	-
191/18	PID191/1	Speed warning for low speed.	Engine only running at idle.	Increase throttle application.	-	-
251/2	PID251/2	Internal error Control unit, engine.	-	-	-	-
441/3	PID441/3	Extra temperature sensor, short circuit to ground.	No warning of high temperature, Control unit, engine (D794).	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:12	
441/4	PID441/4	Extra temperature sensor, short circuit to voltage.	No warning of high temperature, Control unit, engine (D794).	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:12	
558/2	SID230/2	Electrical error, sensor accelerator pedal, idle contact, data error.	No limitation.	Check cable between control unit and component. Check component.	D794/OE-M:03, 13	-
558/4	SID230/4	Electrical error, sensor accelerator pedal, idle contact, cable short circuit to ground.	The engine does not respond to throttle application.	Check cable between control unit and component. Check component.	D794/OE-M:03, 13	-
558/13	SID230/13	Electrical error, sensor accelerator pedal, idle contact, calibration error.	Engine only running at idle.	Check cable between control unit and component. Check component.	D794/OE-M:13	-
608/2	SID250/2	Communication error with Control unit, engine (D794).	No limitation.	Check the control unit.	D794/OE-M:26, 27, 36, 37, 46	
608/9	SID250/9	Communication error with Control unit, engine (D794).	No limitation.	Check the control unit.	D794/OE-M:26, 27, 36, 37, 46	
620/3 1080/3	SID232/3	Electrical error, reference voltage to sensor short circuit to voltage.	Reduced engine power. No warning of low oil pressure or low coolant level.	Check the cable harness between control unit and component. Check the control unit.	D794/Sensor:18, 25, 45	-
620/4 1081/4	SID232/4	Electrical error, reference voltage to sensor short circuit to ground.	Reduced engine power. No warning of low oil pressure or low coolant level.	Check the cable harness between control unit and component. Check the component.	D794/Sensor:18, 25, 45	-
626/11	SID237/11	Electrical error to control of relay preheating.	Preheating not working. Risk of white smoke.	Check the cable harness between control unit and component. Check the component.	D794/Actuator:34	ENGINE, menu 5
627/2	SID251/2	Voltage feed to control unit disappears but ignition not off.	Reduced engine power. Engine difficult to start or dies.	Check fuses. Check batteries and alternator.	D794/OE-M:7, 8, 17, 18, 28	-
629/12	SID254/12	Internal error Control unit, engine.	The engine does not start.	Check the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	J1587					
629/12	SID254/12	Internal error Control unit, engine.	No limitation.	Check the control unit.	-	-
630/2	SID253/2	Software error Control unit, engine (D794).	Reduced engine power. Engine difficult to start or dies.	Reprogram the software in Control unit, engine (D794).	-	-
632/3	SID017/3	Electrical error, fuel cut-off solenoid valve, cable short circuit to voltage.	No limitation.	Check the cable harness between control unit and component. Check the solenoid valve.	D794/Actuator:33	-
632/4	SID017/4	Electrical error, fuel cut-off solenoid valve, cable short circuit to ground.	The engine is switched off.	Check the cable harness between control unit and component. Check the solenoid valve.	D794/Actuator:33	-
639/2	SID231/2	Communication error with Control unit, engine (D794).	Functions via CAN bus not working.	Use diagnostic menu to find incorrect segment.	-	CAN/POWER, menu 2
639/9	SID231/9	Communication error with Control unit, engine (D794).	Functions via CAN bus not working.	Use diagnostic menu to find incorrect segment.	-	CAN/POWER, menu 2
639/9	SID231/9	Communication error with Control unit, engine (D794), timeout error.	Functions via CAN bus not working.	Use diagnostic menu to find incorrect segment.	-	CAN/POWER, menu 2
639/13	SID231/13	Communication error with Control unit, engine (D794), configuration error.	Functions via CAN bus not working.	Use diagnostic menu to find incorrect segment.	-	CAN/POWER, menu 2
644/2	SID030/2	Electrical error, accelerator pedal, signal not within valid interval.	The engine is switched off.	Check the cable harness between control unit and component. Check the component.	-	-
647/4	SID033/4	Electrical error, fan connection, cable short circuit to ground.	Cooling fan runs constantly.	Check the cable harness between control unit and component. Check the component.	D794/Actuator:10, Actuator:9	-
651/5	SID001/5	Electrical error, injector cylinder 1, open circuit on cable.	Engine only runs on 5 cylinders, sounds rough and has reduced power.	Check the cable harness between control unit and component. Check the injector.	D794/Actuator:10, Actuator:9	-
651/6	SID001/7	Electrical error, injector cylinder 1, cable short circuit to ground.	Engine only runs on 5 cylinders, sounds rough and has reduced power.	Check the cable harness between control unit and component. Check the injector.	D794/Actuator:10, Actuator:9	-
652/5	SID002/5	Electrical error, injector cylinder 2, open circuit on cable.	Engine only runs on 5 cylinders, sounds rough and has reduced power.	Check the cable harness between control unit and component. Check the injector.	D794/Actuator:7, 8	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	J1587					
652/6	SID002/6	Electrical error, injector cylinder 2, cable short circuit to ground.	Engine only runs on 5 cylinders, sounds rough and has reduced power.	Check the cable harness between control unit and component. Check the injector.	D794/Actuator:7, 8	-
653/5	SID003/5	Electrical error, injector cylinder 3, open circuit on cable.	Engine only runs on 5 cylinders, sounds rough and has reduced power.	Check the cable harness between control unit and component. Check the injector.	D794/Actuator:6, 16	-
653/6	SID003/6	Electrical error, injector cylinder 3, cable short circuit to ground.	Engine only 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	SID004/5	Electrical error, injector cylinder 4, open circuit on cable.	Engine only runs on 5 cylinders, sounds rough and has reduced power.	Check the cable harness between control unit and component. Check the injector.	D794/Actuator:26, 36	-
654/6	SID004/6	Electrical error, injector cylinder 4, cable short circuit to ground.	Engine only runs on 5 cylinders, sounds rough and has reduced power.	Check the cable harness between control unit and component. Check the injector.	D794/Actuator:26, 36	-
655/5	SID005/5	Electrical error, injector cylinder 5, open circuit on cable.	Engine only runs on 5 cylinders, sounds rough and has reduced power.	Check the cable harness between control unit and component. Check the injector.	D794/Actuator:3, 4	-
655/6	SID005/6	Electrical error, injector cylinder 5, cable short circuit to ground.	Engine only 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	SID006/5	Electrical error, injector cylinder 6, open circuit on cable.	Engine only 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	SID006/6	Electrical error, injector cylinder 6, cable short circuit to ground.	Engine only runs on 5 cylinders, sounds rough and has reduced power.	Check the cable harness between control unit and component. Check the injector.	D794/Actuator:1, 2	-
702/3	SID040/3 PID154/3	Electrical error, auxiliary output 2, cable short circuit to voltage.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/Actuator:14	-
703/3	SID051/3	Electrical error, auxiliary output 2, cable short circuit to voltage.	No limitation.	Check the cable harness between control unit and component. Check the component.	D794/Actuator:45	-
974/3	SID029/3	Electrical error, extra accelerator pedal, cable short circuit to voltage.	The engine does not respond to throttle application.	Check the cable harness between control unit and component. Check the component.	D794/OE-M:21	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	J1587					
974/4	SID029/4	Electrical error, extra accelerator pedal, cable short circuit to ground.	The engine does not respond to throttle application.	Check the cable harness between control unit and component. Check the component.	D794/OE-M:21	-
974/19	SID029/2	Communication error with Control unit, cab (D790-1), electrical error, accelerator pedal.	The engine does not respond to throttle application.	Use diagnostic menu to find incorrect segment.	-	CAN/P-OWER, menu 2
1043/3	PID221/3	Electrical error, accelerator pedal reference voltage, cable short circuit to voltage.	Engine only running at idle.	Check the cable harness between control unit and component. Check the component.	D794/OE-M:48	-
1043/4	PID221/4	Electrical error, accelerator pedal reference voltage, cable short circuit to ground.	Engine only running at idle.	Check the cable harness between control unit and component. Check the component.	D794/OE-M:48	-
1072/11	SID070/1 1	Electrical error, solenoid valve engine brake 2.	Engine brake 1 cannot be activated.	Check the cable harness between control unit and component. Check the solenoid valve.	D794/Actuator: 44	-
1073/11	SID029/1 1	Electrical error, solenoid valve engine brake 2.	Engine brake 2 cannot be activated.	Check the cable harness between control unit and component. Check the solenoid valve.	D794/Actuator:44	-
1079/3	SID232/3	Electrical error, reference voltage to sensor short circuit to voltage.	Reduced engine power.	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:17, 37	-
1079/4	SID232/4	Electrical error, reference voltage to sensor short circuit to ground.	Reduced engine power.	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:17, 37	-
1188/3	SID032/3	Electrical error, solenoid valve wastegate 1 short circuit to voltage.	Reduced engine power.	Check the cable harness between control unit and component. Check the solenoid valve.	D794/Actuator:24	-
1189/3	SID088/3	Electrical error, solenoid valve wastegate 2 short circuit to voltage.	Reduced engine power.	Check the cable harness between control unit and component. Check the solenoid valve.	D794/Actuator:23	-
1189/4	SID88/4	Electrical error, wastegate solenoid valve 2 short circuit to ground.	Reduced engine power.	Check the cable harness between control unit and component. Check the solenoid valve.	D794/Actuator:23	-
1265/4	SID085/4	Electrical error, oil-burn solenoid valve, cable short circuit to ground.	No limitation.	Check the cable harness between control unit and component. Check the solenoid valve.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	J1587					
1319/2	PID102/2	Electrical error, boost pressure sensor.	Reduced engine power.	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:9	-
1380/1	PID017/1	Low oil level engine.	No limitation.	Check the oil level in the engine; fill if necessary.	-	-
1383/31	SID151/1 1	Engine switched off other than with start key, causing load.	No limitation.	Switch of the engine with the start key.	-	-
1384/31	SID029/1 4	Engine switched off other than with start key, causing load.	No limitation.	Switch of the engine with the start key.	-	-
1387/3	PID223/3	Electrical error, extra pressure sensor, cable short circuit to voltage.	No pressure guard (customer-specific option).	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:19	-
1387/4	PID223/4	Electrical error, extra pressure sensor, cable short circuit to ground.	No pressure guard (customer-specific option).	Check the cable harness between control unit and component. Check the sensor.	D794/Sensor:19	-
1484/31	SID216/1 1	Error codes in other control units.	No limitation.	Check error codes for other machine control units, particularly the Control unit, cab (D790-1) and Control unit, transmission (D793).	-	-

Transmission

Error codes transmission

Control unit transmission can generate two states with reduced functionality to protect the transmission in the event of serious malfunctions:

Limp home

In this condition only gear 1-2 in each direction can be used. If the error occurs in a higher gear then downshifting to gear 1 or 2 must take place manually.

Shut down

In this mode the transmission is permanently in neutral as there is no oil pressure to enable gear selection.

Table Error codes Dana HR36000

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
00/31	520192 /31	Digital input 0, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/59	-
01/31	520193 /31	Digital input 1, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/58	-
02/31	520194 /31	Digital input 2, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/57	-
03/31	520195 /31	Digital input 3, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/56	-
04/31	520196 /31	Digital input 4, active error. The transmission control unit activates Shut down or Limp home depending on speed.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/55	-
05/31	520197 /31	Digital input 5, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/54	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
06/31	520198/31	Digital input 6, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/53	-
07/31	520199/31	Digital input 7, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/52	-
16/03	520208/3	Analogue input 0, short circuit to voltage.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/24 D793/25	-
16/04	520208/4	Analogue input 0, short circuit to ground.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/24 D793/25	-
16/16	520208/16	Analogue input 0, the value is above highest normal value.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/24 D793/25	-
16/18	520208/18	Analogue input 0, the value is below lowest normal value.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/24 D793/25	-
16/31	520208/31	Analogue input 0, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/24 D793/25	-
17/03	520209/3	Sensor oil temperature transmission (B766), short circuit to voltage.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and sensor. Check the sensor.	D793/26 – B766/1 D793/27 – B766/2	TRANSM, menu 10
17/04	520209/4	Sensor oil temperature transmission (B766), short circuit to ground.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D793/26 – B766/1 D793/27 – B766/2	TRANSM, menu 10

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
17/18	520209 /18	Sensor oil pressure transmission (B766), value is below lowest calibrated value.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D793/26 – B766/1 D793/27 – B766/2	TRANSM, menu 10
17/16	520209 /16	Sensor oil pressure transmission (B766), value is above highest calibrated value.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D793/26 – B766/1 D793/27 – B766/2	TRANSM, menu 10
17/13	520209 /13	Sensor oil temperature transmission (B766), calibration incorrect	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D793/26 – B766/1 D793/27 – B766/2	TRANSM, menu 10
17/31	520209 /31	Sensor oil temperature transmission (B766), active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and sensor. Check the sensor.	D793/26 – B766/1 D793/27 – B766/2	TRANSM, menu 10
18/03	520210/3	Sensor oil pressure (D765), short circuit to voltage.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D793/28 – B765/A D793/29 – B765/B	TRANSM, menu 10
18/04	520210/4	Sensor oil pressure (D765), short circuit to ground.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D793/28 – B765/A D793/29 – B765/B	TRANSM, menu 10
18/16	520210 /16	Sensor oil pressure (B765), value is above highest normal value.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D793/28 – B765/A D793/29 – B765/B	TRANSM, menu 10
18/18	520210 /18	Sensor oil pressure (B765), value is below lowest normal value.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D793/28 – B765/A D793/29 – B765/B	TRANSM, menu 10
18/13	520210 /13	Sensor oil pressure (B765), incorrectly calibrated.	No limitation.	Check the cable harness between control unit and sensor. Check the sensor.	D793/28 – B765/A D793/29 – B765/B	TRANSM, menu 10
18/31	520210 /31	Sensor oil pressure (B765), active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and sensor. Check the sensor.	D793/28 – B765/A D793/29 – B765/B	TRANSM, menu 10

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
19/03	520211/3	Analogue input 3, short circuit to voltage.	No limitation.	Check the cable harness to the control unit.	D793/13 D793/14	-
19/04	520211/4	Analogue input 3, short circuit to ground.	No limitation.	Check the cable harness to the control unit.	D793/13 D793/14	-
19/16	520211/16	Analogue input 3, the value is above highest normal value.	No limitation.	Check the cable harness to the control unit.	D793/13 D793/14	-
19/18	520211/18	Analogue input 3, the value is below lowest normal value.	No limitation.	Check the cable harness to the control unit.	D793/13 - D793/14	-
19/13	520211/13	Analogue input 3, incorrectly calibrated	No limitation.	Check the cable harness to the control unit.	D793/13 D793/14	-
19/31	520211/31	Analogue input 3, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/13 D793/14	-
26/05	520218/5	Speed input 0, short circuit to voltage.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/09 D793/10	-
26/06	520218/6	Speed input 0, short circuit to ground.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/09 D793/10	-
26/10	520218/10	Speed input 0, value outside limit values.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/09 D793/10	-
26/31	520218/31	Speed input 0, active error. The transmission control unit activates Shut down or Limp home depending on speed.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/09 D793/10	-
27/05	520219/5	Sensor turbine speed (B751), short circuit to voltage.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and sensor. Check the sensor.	D793/11 – B751/2 D793/12 – B751/1	TRANSM, menu

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
27/06	520219/6	Sensor turbine speed (B751), short circuit to ground.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and sensor. Check the sensor.	D793/11 – B751/2 D793/12 – B751/1	TRANSM, menu
27/10	520219/10	Sensor turbine speed (B751), value outside limit values.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and sensor. Check the sensor.	D793/11 – B751/2 D793/12 – B751/1	TRANSM, menu
27/31	520219/31	Sensor turbine speed (B751), active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and sensor. Check the sensor.	D793/11 – B751/2 D793/12 – B751/1	TRANSM, menu
32/03	5520224/3	Solenoid valve clutch forward (Y630), short circuit to voltage.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/33 – Y630/1 D793/34 – Y630/2	TRANSM, menu
32/04	520224/4	Solenoid valve clutch forward (Y630), short circuit to ground.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/33 – Y630/1 D793/34 – Y630/2	TRANSM, menu
32/05	520224/5	Solenoid valve clutch forward (Y630), open circuit or short circuit to battery.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/33 – Y630/1 D793/34 – Y630/2	TRANSM, menu
32/31	520224/31	Solenoid valve clutch forward (Y630), active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/33 – Y630/1 D793/34 – Y630/2	TRANSM, menu
33/03	520225/3	Solenoid valve clutch reverse (Y631), short circuit to voltage.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/31 – Y631/1 D793/32 – Y631/2	TRANSM, menu
33/04	520225/4	Solenoid valve clutch reverse (Y631), short circuit to ground.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/31 – Y631/1 D793/32 – Y631/2	TRANSM, menu

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
33/05	520225/5	Solenoid valve clutch reverse (Y631), open circuit or short circuit to battery.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/31 – Y631/1 D793/32 – Y631/2	TRANSM, menu
33/31	520225/31	Solenoid valve clutch reverse (Y631), active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/31 – Y631/1 D793/32 – Y631/2	TRANSM, menu
34/03	520226/3	Solenoid valve clutch gear 1 (Y6067-1), short circuit to voltage.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/48 – Y6067-1/1 D793/49 – Y6067-2/2	TRANSM, menu
34/04	520226/4	Solenoid valve clutch gear 1 (Y6067-1), short circuit to ground.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/48 – Y6067-1/1 D793/49 – Y6067-2/2	TRANSM, menu
34/05	520226/5	Solenoid valve clutch gear 1 (Y6067-1), open circuit or short circuit to battery.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/48 – Y6067-1/1 D793/49 – Y6067-2/2	TRANSM, menu
34/31	520226/31	Solenoid valve clutch gear 1 (Y6067-1), active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/48 – Y6067-1/1 D793/49 – Y6067-2/2	TRANSM, menu
35/03	520227/3	Solenoid valve clutch gear 2 (Y6069), short circuit to voltage.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/18 – Y6069/1 D793/19 – Y6069/2	TRANSM, menu
35/05	520227/5	Solenoid valve clutch gear 2 (Y6069), open circuit or short circuit to battery voltage.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/18 – Y6069/1 D793/19 – Y6069/2	TRANSM, menu
35/31	520227/31	Solenoid valve clutch gear 2 (Y6069), active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/18 – Y6069/1 D793/19 – Y6069/2	TRANSM, menu

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
36/03	520228/3	Solenoid valve clutch gear 3 (Y6067-3), short circuit to voltage.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/46 – Y6067-3/1 D793/47 – Y6067-3/2	TRANSM, menu
36/04	520228/4	Solenoid valve clutch gear 3 (Y6067-3), short circuit to ground.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/46 – Y6067-3/1 D793/47 – Y6067-3/2	TRANSM, menu
36/05	520228/5	Solenoid valve clutch gear 3 (Y6067-3), open circuit or short circuit to battery.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/46 – Y6067-3/1 D793/47 – Y6067-3/2	TRANSM, menu
36/31	520228/31	Solenoid valve clutch gear 3 (Y6067-3), active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between control unit and solenoid valve. Check the solenoid valve.	D793/46 – Y6067-3/1 D793/47 – Y6067-3/2	TRANSM, menu
37/03	520229/3	Digital output 05, short circuit to voltage.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/17 D793/18	-
37/04	520229/4	Digital output 05, short circuit to ground.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/17 D793/18	-
37/05	520229/5	Digital output 05, open circuit or short circuit to battery.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/17 D793/18	-
37/31	520229/31	Digital output 05, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/17 D793/18	-
38/03	520230/3	Digital output 06, short circuit to voltage.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/35 D793/50	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
38/04	520230/4	Digital output 06, short circuit to ground.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/35 D793/50	-
38/05	520230/5	Digital output 06, open circuit or short circuit to battery.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/35 D793/50	-
38/31	520230/31	Digital output 06, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/35 D793/50	-
39/03	520231/3	Digital output 07, short circuit to voltage.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/01 D793/02	-
39/04	520231/4	Digital output 07, short circuit to ground.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/01 D793/02	-
39/05	520231/5	Digital output 07, open circuit or short circuit to battery.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/01 D793/02	-
39/06	520231/6	Digital output 07, short circuit to ground.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/01 D793/02	-
39/31	520231/31	Digital output 07, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/01 D793/02	-
40/03	520232/3	Digital output 08, short circuit to voltage.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/03 D793/04	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
40/04	520232/4	Digital output 08, short circuit to ground.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/03 D793/04	-
40/05	520232/5	Digital output 08, open circuit or short circuit to battery.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/03 D793/04	-
40/06	520232/6	Digital output 08, short circuit to ground.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	D793/03 D793/04	-
40/31	520230/31	Digital output 08, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/03 D793/04	-
48/09	520240/9	Incorrect declutch signal via the CAN bus.	Declutch of transmission with declutch pedal does not work.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
48/19	520240/19	Incorrect declutch signal via the CAN bus.	Declutch of transmission with declutch pedal does not work.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
48/31	520240/31	Incorrect declutch signal via the CAN bus.	Declutch of transmission with declutch pedal does not work.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
49/09	520241/9	Incorrect gear programme selection via the CAN bus.	Transmission control unit does not allow change of gear range, however, operation of machine is possible.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
49/19	520241/19	Incorrect gear programme selection via the CAN bus.	Transmission control unit does not allow change of gear range, however, operation of machine is possible.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
49/31	520241/31	Incorrect gear programme selection via the CAN bus.	Transmission control unit does not allow change of gear range, however, operation of machine is possible.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
50/09	520242/9	Incorrect kickdown signal via the CAN bus.	Kickdown does not work.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
50/19	520242/19	Incorrect kickdown signal via the CAN bus.	Kickdown does not work.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
50/31	520242/31	Incorrect kickdown signal via the CAN bus.	Kickdown does not work.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
51/09	520243/9	Incorrect neutral position signal via the CAN bus.	The transmission is locked in neutral position.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
51/19	520243 /19	Incorrect neutral position signal via the CAN bus.	The transmission is locked in neutral position.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
51/31	520243 /31	Incorrect neutral position signal via the CAN bus.	The transmission is locked in neutral position.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
52/02	520244/2	Incorrect idle signal from accelerator pedal via CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
52/09	520244/9	Incorrect idle signal from accelerator pedal via CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
52/19	520244 /19	Incorrect idle signal from accelerator pedal via CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
52/31	520244 /31	Incorrect idle signal from accelerator pedal via CAN bus.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
53/02	520245/2	Incorrect full throttle signal from accelerator pedal via CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
53/09	520245/9	Incorrect full throttle signal from accelerator pedal via CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
53/19	520245/19	Incorrect full throttle signal from accelerator pedal via CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
53/31	520245/31	Incorrect full throttle signal from accelerator pedal via CAN bus.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
57/09	520249/9	Incorrect parking brake signal via the CAN bus.	The transmission is locked in neutral position.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
57/19	520249/19	Incorrect parking brake signal via the CAN bus.	The transmission is locked in neutral position.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
57/31	520249/31	Incorrect parking brake signal via the CAN bus.	The transmission is locked in neutral position.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
58/09	520250/9	Incorrect load signal via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
58/19	520250 /19	Incorrect load signal via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
58/31	520250 /31	Incorrect load signal via the CAN bus.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
59/09	520251/9	Incorrect signal for disengagement 4WD/2WD via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
59/19	520251 /19	Incorrect signal for disengagement 4WD/2WD via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
59/31	520251 /31	Incorrect signal for disengagement 4WD/2WD via the CAN bus.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
60/09	520252/9	Incorrect high/low gear signal via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
60/19	520252 /19	Incorrect high/low gear signal via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
60/31	250252 /31	Incorrect high/low gear signal via the CAN bus.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
61/09	520253/9	Incorrect extra neutral position signal via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
61/19	520253 /19	Incorrect extra neutral position signal via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
61/31	520253 /31	Incorrect extra neutral position signal via the CAN bus.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
62/01	520254/1	Low oil pressure transmission.	Risk of slipping clutches.	Check the transmission oil level. Check the sensor.	-	-
62/09	520254/9	Incorrect oil pressure signal via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
62/19	520254 /19	Incorrect oil pressure signal via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
62/31	520254/31	Oil pressure signal, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
63/09	520255/9	Incorrect brake signal via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
63/19	520255/19	Incorrect brake signal via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
63/31	520255/31	Brake signal, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
64/09	520256/9	Incorrect signal for operator-in-seat via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
64/19	520256/19	Incorrect signal for operator-in-seat via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
64/31	520256/31	Signal operator-in-seat, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
65/09	520257/9	Incorrect signal for seat direction via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
65/19	520257/19	Incorrect signal for seat direction via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
65/31	520257/31	Signal for seat direction, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
66/09	520258/9	Incorrect signal for prevent shifting via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
66/19	520258/19	Incorrect signal for prevent shifting via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
66/31	520258/31	Signal prevent shifting, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
68/00	520260/0	High transmission oil temperature.	Control unit indicates the error to make operator aware of the warning's level.	Check the transmission oil cooler, clean if necessary. Check the thermostat in the transmission oil cooler.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
68/09	520260/9	Incorrect transmission oil temperature via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
68/19	520260/19	Incorrect transmission oil temperature via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
68/31	520260/31	Transmission oil temperature, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
69/09	520261/9	Incorrect signal for lock-up function via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
69/19	520261/19	Incorrect signal for lock-up function via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
68/31	520261/31	Signal lock-up function active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
70/09	520262/9	Incorrect signal for exhaust brake via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
70/19	520262 /19	Incorrect signal for exhaust brake via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
70/31	520262 /31	Exhaust brake signal, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
71/09	520263/9	Incorrect signal for retarder via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
71/19	520263 /19	Incorrect signal for retarder via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
71/31	520263 /31	Signal retarder, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
72/09	520264/9	Incorrect signal for raised idle via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
72/19	520264 /19	Incorrect signal for raised idle via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
72/31	520264 /31	Signal raised idle, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
84/02	520276/2	Incorrect gear position limitation.	No limitation.	Check the cable harness to the control unit.	-	-
84/09	520276/9	Incorrect gear position limitation via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
84/19	520276 /19	Incorrect gear position limitation via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
84/31	520276 /31	Signal gear position limitation, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
85/09	520277/9	Incorrect signal for customer function 1 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
85/19	520277 /19	Incorrect signal for customer function 1 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
85/31	520277/31	Signal customer function 1, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
86/09	520278/9	Incorrect signal for customer function 2 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
86/19	520278/19	Incorrect signal for customer function 2 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
86/31	520278/31	Signal customer function 2, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
87/09	520279/9	Incorrect signal for customer function 3 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
87/19	520279/19	Incorrect signal for customer function 3 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
87/31	520279/31	Signal customer function 3, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
88/09	520280/9	Incorrect signal for customer function 4 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
88/19	520280/19	Incorrect signal for customer function 4 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
88/31	520280/31	Signal customer function 4, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
89/09	520281/9	Incorrect signal for customer function 5 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
89/19	520281/19	Incorrect signal for customer function 5 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
89/31	520281/31	Signal customer function 5, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
90/09	520282/9	Incorrect signal for customer function 6 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
90/19	520282 /19	Incorrect signal for customer function 6 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
90/31	520282 /31	Signal customer function 6, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
91/09	520283/9	Incorrect signal for customer function 7 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
91/19	520283 /19	Incorrect signal for customer function 7 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
91/31	520283 /31	Signal customer function 7, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
92/09	520284/9	Incorrect signal for customer function 8 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
92/19	520284 /19	Incorrect signal for customer function 8 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
92/31	520284 /31	Signal customer function 8, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
93/09	520285/9	Incorrect signal for customer function 9 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
93/19	520285 /19	Incorrect signal for customer function 9 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
93/31	520285 /31	Signal customer function 9, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
94/09	520286/9	Incorrect signal for customer function 10 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
94/19	520286 /19	Incorrect signal for customer function 10 via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
94/31	520286 /31	Signal customer function 10, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
95/02	520287/2	Incorrect signal from gear selector.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness to the control unit.	-	-
95/09	520287/9	Incorrect signal for gear selection via the CAN bus.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
95/19	520287/19	Incorrect signal for gear selection via the CAN bus.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
95/31	520287/31	Signal gear selection, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
96/02	520288/02	Incorrect signal from accelerator pedal.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
96/09	520288/09	Incorrect accelerator pedal signal via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
96/19	520288/19	Incorrect accelerator pedal signal via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
96/31	520288 /31	Signal accelerator pedal, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
97/02	520289/2	Incorrect signal from brake pedal.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
97/09	520289/9	Incorrect brake signal via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
97/19	520289 /19	Incorrect brake signal via the CAN bus.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
97/31	520289 /31	Signal brake pedal, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
98/00	520290/0	Transmission oil temperature too high sump.	Transmission locked in neutral position (Shut down).	Check the transmission oil cooler, clean if necessary. Check the thermostat in the transmission oil cooler.	-	-
98/02	520290/2	Incorrect signal from sensor for transmission oil temperature sump.	Transmission locked in neutral position (Shut down).	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
98/16	520290 /16	High transmission oil temperature sump.	No limitation.	Check the transmission oil cooler, clean if necessary. Check the thermostat in the transmission oil cooler.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
98/31	520290/31	Signal transmission oil temperature sump, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
99/00	520291/0	Transmission oil temperature too high, radiator.	Transmission locked in neutral position (Shut down).	Check the transmission oil cooler, clean if necessary. Check the thermostat in the transmission oil cooler.	-	-
99/02	520291/2	Incorrect signal from sensor for transmission oil temperature radiator.	Transmission locked in neutral position (Shut down).	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
99/16	520291/16	High transmission oil temperature radiator.	No limitation.	Check the transmission oil cooler, clean if necessary. Check the thermostat in the transmission oil cooler.	-	-
99/31	520291/31	Signal transmission oil temperature cooler, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
101/01	520293/1	Oil pressure too low, transmission.	Risk of slipping clutches	Check the transmission oil level Check the sensor.	-	-
101/02	520293/2	Incorrect signal oil pressure transmission.	Transmission in locked neutral position (Shut down).	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
101/31	520293/31	Signal oil pressure transmission, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
102/00	520294/0	Clutch pressure, clutch forward, too high.	No limitation.	Check the transmission oil level Check the sensor. Check the hydraulics in the transmission.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
102/02	520294/2	Incorrect signal clutch pressure, clutch forward.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
102/16	520294/16	High clutch pressure, clutch forward.	No limitation.	Check the transmission oil level Check the sensor. Check the hydraulics in the transmission.	-	-
102/31	520294/31	Signal clutch pressure, clutch forward, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
103/00	520295/0	Clutch pressure, clutch reverse, too high.	No limitation.	Check the transmission oil level Check the sensor. Check the hydraulics in the transmission.	-	-
103/02	520294/2	Incorrect signal clutch pressure, clutch reverse.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
103/16	520295/16	High clutch pressure, clutch reverse.	No limitation.	Check the transmission oil level Check the sensor. Check the hydraulics in the transmission.	-	-
103/31	520295/31	Signal clutch pressure, clutch reverse, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
104/00	520296/0	Clutch pressure, clutch forward high gear, too high.	No limitation.	Check the transmission oil level Check the sensor. Check the hydraulics in the transmission.	-	-
104/02	520296/2	Incorrect signal clutch pressure, clutch forward, high gear.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
104/16	520296 /16	High clutch pressure, clutch forward high gear.	No limitation.	Check the transmission oil level Check the sensor. Check the hydraulics in the transmission.	-	-
104/31	520296 /31	Signal clutch pressure, clutch forward high gear, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
105/00	520297/0	Clutch pressure, clutch gear 1, too high.	No limitation.	Check the transmission oil level Check the sensor. Check the hydraulics in the transmission.	-	-
105/02	520297/2	Incorrect signal clutch pressure, clutch gear 1.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
105/16	520297 /16	High clutch pressure, clutch gear 1.	No limitation.	Check the transmission oil level Check the sensor. Check the hydraulics in the transmission.	-	-
105/31	520297 /31	Signal clutch pressure, clutch gear 1, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
106/00	520298/0	Clutch pressure, clutch gear 2, too high.	No limitation.	Check the transmission oil level Check the sensor. Check the hydraulics in the transmission.	-	-
106/02	520298/2	Incorrect signal clutch pressure, clutch gear 2.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
106/16	520298 /16	High clutch pressure, clutch gear 2.	No limitation.	Check the transmission oil level Check the sensor. Check the hydraulics in the transmission.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
106/31	520298 /31	Signal clutch pressure, clutch gear 2, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
107/00	520299/0	Clutch pressure, clutch gear 3, too high.	No limitation.	Check the transmission oil level Check the sensor. Check the hydraulics in the transmission.	-	-
107/02	520299/2	Incorrect signal clutch pressure, clutch gear 3.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
107/16	520299 /16	High clutch pressure, clutch gear 3.	No limitation.	Check the transmission oil level Check the sensor. Check the hydraulics in the transmission.	-	-
107/31	520299 /31	Signal clutch pressure, clutch gear 3, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
108/00	520300/0	Clutch pressure, clutch gear 4, too high.	No limitation.	Check the transmission oil level Check the sensor. Check the hydraulics in the transmission.	-	-
108/02	520300/2	Incorrect signal clutch pressure, clutch gear 4.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
108/16	520300 /16	High clutch pressure, clutch gear 4.	No limitation.	Check the transmission oil level Check the sensor. Check the hydraulics in the transmission.	-	-
108/31	520300 /31	Signal clutch pressure, clutch gear 4, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
122/02	520314/0	Incorrect signal engine speed.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
122/09	520314/9	Incorrect signal for engine speed via the CAN bus.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
122/19	520314/19	Incorrect signal for engine speed via the CAN bus.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/POWER, menu 3
122/31	520314/31	Signal engine speed, active error.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
123/02	520315/2	Incorrect signal from Sensor, turbine speed.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check the cable harness between the sensor and control unit. Check the sensor.	D793/11 – B751/2 D793/12 – B751/1	-
123/31	520315/31	Signal turbine speed, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	D793/11 – B751/2 D793/12 – B751/1	-
124/02	520316/2	Incorrect signal rotation speed drum.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
124/31	520316/31	Signal rotation speed drum, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
125/02	520317/2	Incorrect signal rotation speed output shaft.	No limitation or Shut down while error is active. For inactive error code, Limp home until ignition is switched off.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
125/31	520317/31	Signal rotation speed output shaft, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
144/00	520336/0	Control unit, transmission (D793), battery voltage too high.	Transmission locked in neutral position (Shut down).	Check the voltage feed. If equipment for assisted start is connected, disconnect it.	D793/45	CAN/POWER, menu 15
144/01	520336/1	Control unit, transmission (D793), battery voltage too low.	Transmission locked in neutral position (Shut down).	Check the cable harness to the control unit. Check alternator, battery and cable harness between battery and alternator.	D793/45	CAN/POWER, menu 15
144/16	520336/16	Control unit, transmission (D793), battery voltage high.	No limitation.	Check the voltage feed. If equipment for assisted start is connected, disconnect it.	D793/45	CAN/POWER, menu 15
144/18	520336/18	Control unit, transmission (D793), battery voltage low.	No limitation.	Check the cable harness to the control unit. Check alternator, battery and cable harness between battery and alternator.	D793/45	CAN/POWER, menu 15
145/00	520337/0	Control unit, transmission (D793), ignition voltage too high.	Transmission locked in neutral position (Shut down).	Check the voltage feed. If equipment for assisted start is connected, disconnect it.	D793/20 D793/60	CAN/POWER, menu 15
145/01	520337/1	Control unit, transmission (D793), ignition voltage too low.	Transmission locked in neutral position (Shut down).	Check the cable harness to the control unit. Check alternator, battery and cable harness between battery and alternator.	D793/20 D793/60	CAN/POWER, menu 15

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
145/16	520337 /16	Control unit, transmission (D793), ignition voltage high.	No limitation.	Check the voltage feed. If equipment for assisted start is connected, disconnect it.	D793/20 D793/60	CAN/P-OWER, menu 15
145/18	520337 /18	Control unit, transmission (D793), ignition voltage low.	No limitation.	Check the cable harness to the control unit. Check alternator, battery and cable harness between battery and alternator.	D793/20 D793/60	CAN/P-OWER, menu 15
154/12	520346 /12	Control unit, transmission (D793), memory error.	Transmission locked in neutral position (Shut down).	Switch off the ignition and the battery voltage, and check if the error remains.	-	-
154/31	520346 /31	Control unit, transmission (D793), memory error.	Transmission locked in neutral position (Shut down).	Switch off the ignition and the battery voltage, and check if the error remains.	-	-
155/31	520347 /31	Control unit, transmission (D793), memory error.	Transmission locked in neutral position (Shut down).	Switch off the ignition and the battery voltage, and check if the error remains.	-	-
156/31	520348 /31	Control unit, transmission (D793), memory error.	Transmission locked in neutral position (Shut down).	Switch off the ignition and the battery voltage, and check if the error remains.	-	-
161/31	520353 /31	Incorrect configuration.	No limitation.	Reprogram the control unit.	-	-
162/31	520354 /31	Incorrect configuration.	No limitation.	Reprogram the control unit.	-	-
163/31	520355 /31	Incorrect configuration.	No limitation.	Reprogram the control unit.	-	-
164/31	520356 /31	Incorrect configuration.	No limitation.	Reprogram the control unit.	-	-
176/31	520368 /31	Output parking brake, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
179/31	520371 /31	Output disengagement 4WD/2WD, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
180/31	520372 /31	Output high/low gear, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
181/31	520373 /31	Output speed limitation, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
182/31	520374 /31	Output signal start interlock neutral position, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
183/31	520375 /31	Output signal warning lamp transmission error, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
184/31	520376 /31	Output signal lock-up, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
185/31	520377 /31	Output gear position, active error.	No limitation.	Check for more error codes and rectify them first. Check the cable harness to the control unit.	-	-
193/09	520385/9	Control unit, cab (D790-1), communication error.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
194/09	520386/9	Control unit, cab (D790-1), communication error.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
195/09	520387/9	Control unit, cab (D790-1), communication error.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
197/09	520389/9	Control unit, cab (D790-1), communication error.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
198/09	520390/9	Control unit, cab (D790-1), communication error.	No limitation.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, transmission (D793).	D793/22 – D790-1/K13:1 D790-1/K13:1 – D793/23	CAN/P-OWER, menu 3
240/XX	520432/XX	Incorrect configuration.	No limitation.	Reprogram Control unit, transmission (D793).	-	-
241/XX	520433/XX	Incorrect configuration.	No limitation.	Reprogram Control unit, transmission (D793).	-	-
242/XX	520434/XX	Incorrect configuration.	No limitation.	Reprogram Control unit, transmission (D793).	-	-
243/XX	520435/XX	Incorrect configuration.	No limitation.	Reprogram Control unit, transmission (D793).	-	-
244/XX	520436/XX	Incorrect configuration.	No limitation.	Reprogram Control unit, transmission (D793).	-	-
245/XX	520437/XX	Incorrect configuration.	No limitation.	Reprogram Control unit, transmission (D793).	-	-
246/XX	520438/XX	Incorrect configuration.	No limitation.	Reprogram Control unit, transmission (D793).	-	-
247/XX	520439/XX	Incorrect configuration.	No limitation.	Reprogram Control unit, transmission (D793).	-	-
248/XX	520440/XX	Incorrect configuration.	No limitation.	Reprogram Control unit, transmission (D793).	-	-

		Description	Limitation	Action	Connections and components	Diagnostic menu
Code	SPN-/FMI					
249/XX	520441/XX	Incorrect configuration.	No limitation.	Reprogram Control unit, transmission (D793).	-	-
250/XX	520442/XX	Incorrect configuration.	No limitation.	Reprogram Control unit, transmission (D793).	-	-
251/XX	520443/XX	Incorrect configuration.	No limitation.	Reprogram Control unit, transmission (D793).	-	-
253/XX	520444/XX	Incorrect configuration.	No limitation.	Reprogram Control unit, transmission (D793).	-	-

Control system

Error codes machine

Table Error codes machine

Cod- e	Description	Limitation	Action	Connec- tions and compo- nents	Diagnos- tic 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/P- OWER, 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/P- OWER, menu 2	11.6.2 Redundant CAN bus
3	Communication error with Control unit, attachment left jack pair (D791-3).	Left side of bottom lift not working.	Use diagnostic menu to find incorrect segment.	D791-3	CAN/P- OWER, menu 2	11.6.2 Redundant CAN bus
4	Communication error with Control unit, attachment right jack pair (D791-4).	Right side of bottom lift not working.	Use diagnostic menu to find incorrect segment.	D791-4	CAN/P- OWER, 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/P- OWER, menu 2	11.6.2 Redundant CAN bus
6	Communication error with Control unit, frame front (D797-F).	Front lighting, lift, extension, brake lights, brake cooling not working.	Use diagnostic menu to find incorrect segment.	D797-F	CAN/P- OWER, menu 2	11.6.2 Redundant CAN bus
7	Communication error with Control unit, frame option (D797-O).	Sliding cab, support jacks, joystick control, mini-wheel, cab lift and cab tilt not working.	Use diagnostic menu to find incorrect segment.	D797-O	CAN/P- OWER, 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/P- OWER, menu 2	11.6.2 Redundant CAN bus
9	Communication error with Control unit, cab option (D790-3).	Mini-wheel or joystick control not working.	Use diagnostic menu to find incorrect segment.	D790-3	CAN/P- OWER, menu 2	11.6.2 Redundant CAN bus
11	Cable harness fault CAN bus segment 1.	No limitation.	Use diagnostic menu to find incorrect segment.	Varies de- pending on machine configura- tion.	CAN/P- OWER, menu 1 and 21	11.6.2 Redundant CAN bus
12	Cable harness fault CAN bus segment 2.	No limitation.	Use diagnostic menu to find incorrect segment.	Varies de- pending on machine configura- tion.	CAN/P- OWER, menu 1 and 21	11.6.2 Redundant CAN bus
13	Cable harness fault CAN bus segment 3.	No limitation.	Use diagnostic menu to find incorrect segment.	Varies de- pending on machine configura- tion.	CAN/P- OWER, menu 1 and 21	11.6.2 Redundant CAN bus

Cod- e	Description	Limitation	Action	Connections and components	Diagnostic menu	Group
14	Cable harness fault CAN bus 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 harness fault CAN bus 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 harness fault CAN bus 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 harness fault CAN bus 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 harness fault CAN bus 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
20	Accelerator pedal (B690) not calibrated.	Poor sensitivity in accelerator pedal.	Calibrate the accelerator pedal. See section 8 <i>Control system</i> , group 8.5.2.3 <i>Calibrate DRIVE-TRAIN</i> .	D790-1/K6:11 – B690	CALIBRATION: 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 the 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 drive-train
22	Communication error with Control unit, engine (D794).	Engine does not respond to commands from the cab.	Use diagnostic menu to check communication. Check the cable harness between Control unit, cab (D790-1) and Control unit, engine (D794).	Yuchai: D790-1/K13:1, K13:2 – D794/1:34, 1:35 Cummins: D790-1/K13:1, K13:2 – D794/46, 37	CAN/POWER, menu 3	11.6.3 CAN bus drive-train
23	The set-up file cannot be read in Control unit, cab (D790-1).	No controls in the cab are working.	Contact Cargotec support.	D790-1	-	11.5.3.1 Control unit, cab
24	Power supply to cab fan below 18 V.	Cab fan not working.	Check fuse F58-5/3.	D790-1/K2:8 – 58-5/3:2	-	9.4.3 Cabin fan

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
25	Interference during software download. Buffer for error codes from Control unit, engine (D794), active error code when downloading.	Error code stored in Control unit, engine (D794).	Switch the ignition off and on. Repeat software download.	D794	ENGINE, menu 8	11.5.3.10 Engine control unit
26						
27						
28						
29						
30						
31	Incorrect power supply to Control unit, cab (D790-1). Voltage below 18 V or above 32 V.	Controls in cab not working.	Check fuse F58-5/1. Check cabling 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/P-OWER, menu 6	11.5.1.3 Ignition voltage (15)
32	Incorrect 5 V reference voltage to analogue cab controls. Voltage below 4.9 V or above 5.1 V.	Analogue controls in cab not working (mini-wheel/steering lever and controls for air conditioning).	Check cabling 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/P-OWER, menu 6	11.5.3.1 Control unit, cab
33	No feedback signal for emergency stop switch voltage from Relay, emergency stop switch voltage (K3009-1).	Control breaker cannot be disengaged. All hydraulic functions are blocked.	Check fuse F58-3/8. Check cabling between the control unit and the component with diagnostic menu.	D790-1/K11:13 – K3009-1/87	CAN/P-OWER, menu 5	11.5.1.4 Emer- gency stop switch volt- age (15E)
34	Incorrect signal from Switch, parking brake (S107), indicates released and applied at same time or nothing at all.	Parking brake cannot be released.	Check cabling 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 stored in Control unit, transmission (D793).	Switch the ignition off and on. Repeat software download.	D793	TRANSM, menu 13	11.5.3.9 Transmis- sion con- trol unit
36						
37						
38						
39						
40						
41	The transistor has been triggered due to short circuit in the circuit for Wiper motor, rear (M650-2).	Wiper rear not working.	Check cabling 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
42	The transistor has been triggered due to short circuit in the circuit for Revolving beacon (H428).	Revolving beacon not working.	Check cabling between the control unit and the component with diagnostic menu. Check the component.	D790-1/K2:5 – H428	LIGHTS, menu 9	9.6.8 Revolving beacon

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
43	The transistor has been triggered due to short circuit in the circuit for Working light, cab left (E404-1L).	Working light, cab left not working.	Check bulb. Check cabling between the control unit and the component with diagnostic menu.	D790-1/K2:6 – E404-1L	LIGHTS, menu 1	9.6.9 Working light, cab
44	The transistor has been triggered due to short circuit in the circuit for Working light, cab right (E404-1R).	Working light, cab right not working.	Check bulb. Check cabling between the control unit and the component with diagnostic menu.	D790-1/K2:7 – E404-1R	LIGHTS, menu 1	9.6.9 Working light, cab
45	The transistor has been triggered due to short circuit in the circuit for Wiper motor, front (M650-1).	Wiper front not working.	Check cabling 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 circuit in the circuit for Fan motor (M657-1).	Cab fan not working.	Check cabling 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 Cabin fan
47	The transistor has been triggered due to short circuit in the circuit for Actuator motor, recirculation (M612).	Recirculation damper for ventilation not working.	Check cabling 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 circuit in the circuit for Water valve (Y673).	Heat in cab cannot be adjusted.	Check cabling 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 circuit in the circuit for Water valve (Y673).	Heat in cab cannot be adjusted.	Check cabling 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
50	The transistor has been triggered due to short circuit in the circuit for Damper motor (Y672).	Air distribution in cab cannot be adjusted.	Check cabling 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 circuit in the circuit for Damper motor (Y672).	Air distribution in cab cannot be adjusted.	Check cabling 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

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
53	The transistor has been triggered due to short circuit in the circuit for Washer motor, roof and rear (M651-2).	Windscreen washer rear and roof not working.	Check cabling 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 circuit or open circuit in the circuit for indicator light Switch, flashing hazard lights (S109).	Flashing hazard lights not working.	Check cabling between the control unit and the component with diagnostic menu. Check the switch.	D790-1/K5:5 – S109/9	LIGHTS, menu 7	9.6.7 Flashing hazard lights
55	The transistor has been triggered due to short circuit in the circuit for background lighting in switches and instruments.	Reduced or no background lighting in instruments and controls.	Check bulbs for background lighting, replace if necessary. Check the cable harness for background lighting.	D7901/K6:1, K 8:15, K 9:2, K 10:5, all inputs of type A Digital in	LIGHTS, menu 13	9.1 Controls and instruments
56	The transistor has been triggered due to short circuit or open circuit in the circuit for LED indication for tilt lock in control lever (S815).	Indication for tilt lock in control lever not illuminated.	Check cabling 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 circuit or open circuit in the circuit for LED indication for levelling lock in control lever (S815).	Indication for levelling lock in control lever not illuminated.	Check cabling between the control unit and the component with diagnostic menu. Check the switch.	D790-1/K7:9 – S815/7	-	7.1.1 Control lever
60	The transistor has been triggered due to short circuit or open circuit in the circuit for Relay, seat heater (K383).	Seat heat not working.	Check cabling 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 Heating coil
61	The transistor has been triggered due to short circuit or open circuit in the circuit for Relay, extra working lights boom (K304).	Extra work lights boom not working.	Check cabling 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 Working lights, boom
62	The transistor has been triggered due to short circuit or open circuit for simulated D+ feed for hour meter (P708) and Relay, compressor air-suspension seat (K358).	Hour meter and air-suspension seat not working.	Check cabling between the control unit and the component with diagnostic menu. Check the component.	D790-1/K10:9 – P708, K358/86	CAN/P-OWER, menu 7	9.3.5 Air suspension

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
63	The transistor has been triggered due to short circuit or open circuit in the circuit for Relay, ignition voltage (K315-1).	No ignition voltage to the machine's Control units.	Check cabling between the control unit and the component with diagnostic menu. Check the component.	D790-1/K10:10 – K315-1/86	CAN/P-OWER, menu 4	11.5.1.3 Ignition voltage (15)
64	The transistor has been triggered due to short circuit or open circuit in circuit for Relay, emergency stop switch voltage (K3009-1).	No emergency stop switch voltage to the machine's Control units.	Check cabling between the control unit and the component with diagnostic menu. Check the component.	D790-1/K10:11 – K3009-1/86	CAN/P-OWER, menu 5	11.5.1.4 Emer- gency stop switch volt- age
65	The transistor has been triggered due to short circuit or open circuit in circuit for Relay, emergency stop switch voltage (K3009-2).	No emergency stop switch voltage to the machine's Control units.	Check cabling between the control unit and the component with diagnostic menu. Check the component.	D790-1/K10:11 – K3009-1/86	CAN/P-OWER, menu 5	11.5.1.4 Emer- gency stop switch volt- age
66	The transistor has been triggered due to short circuit in the circuit for Washer motor, windscreen (M651-1).	Windshield washer not working.	Check cabling 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
67	The transistor has been triggered due to short circuit or open circuit in the circuit for Wiper motor, roof (M650-3).	Wiper roof not working.	Check cabling 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 circuit or open circuit in circuit for Circulation pump, pause heater (M667).	Pause heater not working.	Check cabling between the control unit and the component with diagnostic menu. Check the motor.	D790-1/K10:15 – M667	-	9.4 Heat- ing, venti- lation and air condi- tioning
69	The transistor has been triggered due to short circuit or open circuit in the circuit for Relay, ignition voltage drive-train (K315-2).	No voltage feed to engine and transmission.	Check cabling between the control unit and the component with diagnostic menu. Check the component.	D790-1/K10:16 – K315-2/86	CAN/P-OWER, menu 4	11.5.1.3 Ignition voltage (15)
71	The transistor has been triggered due to short circuit in the circuit for Interior lighting, cab (E434-1).	Interior lighting in cab not working.	Check bulb. Check cabling 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 circuit in the circuit for Horn (H850) or Relay, loud horn (K3016)	Horn/loud horn not working.	Check cabling 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

Cod- e	Description	Limitation	Action	Connec- tions and compo- nents	Diagnos- tic menu	Group
75	Relay, ignition voltage (K315-1) has jammed in position on.	Control unit, cab (D790-1) is still energised and is thereby active.	Check cabling between the control unit and the component with diagnostic menu. Check the component.	-	CAN/P- OWER, 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 the drive belt for the compressor for air conditioning. Check that compressor for air conditioning is activated. Check cabling between the control unit and the component with diagnostic menu.	D797- R/K1:37 – S246	CLIMATE, menu 3	9.4.10 Pressure switch
81	Incorrect signal from Damper motor (Y672). Signal voltage below 0.2 V or above 4.8 V.	Air distribution cannot be adjusted.	Check cabling between the control unit and the component with diagnostic menu. Check the motor.	D790- 1/K4:7 – Y672/9	CLIMATE, menu 4	9.4.6 Fresh air and recir- culation damper
85	Incorrect signal from accelerator pedal (R690). Signal voltage below 0.2 V or above 4.8 V.	Engine speed limited to idle.	Check cabling 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 lifting/lowering. Signal voltage below 0.2 V or above 4.8 V.	Lift and lower not working.	Check cabling 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 Control lever
88	Incorrect signal from Control lever (S815-P2) for extension. Signal voltage below 0.2 V or above 4.8 V.	Extension not working.	Check cabling 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 Control lever
89	Incorrect signal from Control lever (S815-P3) for rotation. Signal voltage below 0.2 V or above 4.8 V.	Rotation not working.	Check cabling 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 Control lever
90	Incorrect signal from Control lever (S815-P4) for tilt. Signal voltage below 0.2 V or above 4.8 V.	Controllable tilt not working.	Check cabling 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 Control lever

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
92	Incorrect signal from Steering lever (R825-1) or Mini-wheel (R825-1). Signal voltage below 0.2 V or above 4.8 V.	Joystick control or mini-wheel not working.	Check cabling between the control unit and the component with diagnostic menu. Check the switch.	D790-1/K9:8 – R825-1/P2	STEERING, menu 1	5.1.2 Mini-wheel 5.1.3 Joystick
93	Incorrect signal from Mini-wheel (R825-2). Signal voltage below 0.2 V or above 4.8 V.	Joystick control or mini-wheel not working.	Check cabling between the control unit and the component with diagnostic menu. Check the switch.	D790-1/K9:9 – R825-2/H2	STEERING, menu 1	5.1.2 Mini steering wheel
94	Incorrect signal from Water valve, cab heating (Y673). Signal voltage below 0.2 V or above 4.8 V.	Cab heat cannot be adjusted.	Check cabling 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). Sensor indicates temperature below -43 °C or above 105 °C.	Air conditioning not working.	Check cabling 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 ambient temperature sensor (B774). Temperature signal above 105 °C.	Air conditioning not working.	Check cabling 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, ambient temperature
98	Incorrect signal from Sensor, outlet fan temperature (B775-2). Sensor indicates temperature below -43 °C or above 105 °C.	Air conditioning not working.	Check cabling 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, refrigerant temperature (B775-3). Sensor indicates temperature below -43 °C or above 105 °C.	Air conditioning not working.	Check cabling 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 reach destination.	-	Check cabling 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 reach destination.	-	Check cabling 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

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
103	Incorrect power supply to Control unit, frame front (D797-F). Voltage below 18 V or above 32 V.	No electric power feed to components.	Check fuse F58-2/1, replace if necessary. Check cabling 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/P-OWER, menu 8	11.5.1.3 Ignition voltage (15)
104	Incorrect emergency stop switch voltage to Control unit, frame front (D797-F).	Functions normally supplied emergency stop switch voltage have no feed. All hydraulic functions are blocked.	Check fuse F58-3/2, replace if necessary. Check cabling between the control unit and the component with diagnostic menu.	D797-F/K2:11 – F58-3/2:1	CAN/P-OWER, menu 8	11.5.1.4 Emer- gency stop switch volt- age
105	Incorrect 5 V reference voltage to pressure sensor. Voltage below 4.9 V or above 5.1 V.	Regeneration lift, weight indicator and overload system not working.	Check cabling 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/P-OWER, menu 9	8.2.1.7 Sensor, hydraulic pressure lift cylinder
106	The transistor has been triggered due to short circuit in the circuit for Cooling fan, brake oil (M674).	Cooling fan brake oil not working.	Check cabling 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 Cooling fan
107	The transistor has been triggered due to short circuit or open circuit in the circuit for High beam lamp, left (E402L).	Left high beam not working.	Check bulb. Check the bulb holder. Check cabling 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 circuit or open circuit in the circuit for High beam lamp, right (E402R).	Right high beam not working.	Check bulb. Check the bulb holder. Check cabling 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 circuit or open circuit in the circuit for Low beam lamp (E400L/E400R).	Low beams not working.	Check bulb. Check the bulb holder. Check cabling 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
111	The transistor has been triggered due to short circuit in the circuit for Solenoid valve, boom up (Y6005).	Lift not working.	Check cabling 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

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
112	The transistor has been triggered due to short circuit in the circuit for Solenoid valve, boom down (Y6004).	Lower not working.	Check cabling 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 circuit in the circuit for Solenoid valve, boom out (Y6006).	Extension out not working.	Check cabling 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 circuit in the circuit for Solenoid valve, boom in (Y6007).	Extension in not working.	Check cabling 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 circuit or open circuit in the circuit for Solenoid valve, blocking lift, left (Y6002).	Lift and lower not working.	Check cabling 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 circuit or open circuit in the circuit for Solenoid valve, blocking lift, right (Y6001).	Lift and lower not working.	Check cabling 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 circuit or open circuit in the circuit for Solenoid valve, regeneration lift, right (Y6051).	Regeneration lift not working.	Check cabling 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
118	The transistor has been triggered due to short circuit or open circuit in the circuit for Solenoid valve, regeneration lift, left (Y6052).	Regeneration lift not working.	Check cabling 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 circuit or open circuit in the circuit for Solenoid valve, parking brake (Y642).	Parking brake cannot be released.	Check cabling 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

Cod- e	Description	Limitation	Action	Connec- tions and compo- nents	Diagnos- tic menu	Group
120	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, direction indicator, left front (H422).	Direction indicator left front not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- F/K1:9 – H422/1	LIGHTS, menu 8	9.6.6 Direction indicators
121	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, direction indicator, right front (H423).	Direction indicator right front not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- F/K1:10 – H423/1	LIGHTS, menu 8	9.6.6 Direction indicators
122	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, running lights, left front (H416-1).	Running light left front not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- F/K1:25 – H416-1/1	LIGHTS, menu 5	9.6.2 Running lights
123	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, running lights, right front (H417-1).	Running light right front not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- F/K1:29 – H417-1/1	LIGHTS, menu 5	9.6.2 Running lights
124	Incorrect 24 V reference voltage to Break contact (opening switch) parking brake (S200), Break contact (opening switch) low brake pressure (S204), Make-contact (closing switch) brake lights (S216) and Break contact (opening switch) declutch (S220-2).	Indicator light parking brake and warning for low brake pressure not switching off. Brake lights and declutch not working. Gear cannot be engaged because the signal for released parking brake is not working.	Check cabling 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/P- OWER, menu 9	4.5.5 Break contact (opening switch) parking brake 4.3.8 Make- contact (closing switch) brake lights 4.3.7 Break contact (opening switch) brake pressure
133	Incorrect signal from Sensor, hydraulic pressure lift cylinder left (B768-L1). Signal voltage below 0.2 V or above 4.8 V.	Overload system not working. All lift functions run at reduced speed. Error code 150 activated.	Check cabling 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

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
134	Incorrect signal from Sensor, hydraulic pressure lift cylinder left (B768-L2). Signal voltage below 0.2 V or above 4.8 V.	Overload system not working. All lift functions run at reduced speed. Error code 150 activated.	Check cabling 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 below 0.2 V or above 4.8 V.	Overload system not working. All lift functions run at reduced speed. Error code 150 activated.	Check cabling 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 below 0.2 V or above 4.8 V.	Overload system not working. All lift functions run at reduced speed. Error code 150 activated.	Check cabling 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
137	Incorrect signal from Solenoid valve, boom up (Y6005). Return current does not correspond with control current.	Lift not working.	Check cabling 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 Control valve lift, lower and extension
138	Incorrect signal from Solenoid valve, boom down (Y6004). Return current does not correspond with control current.	Lower not working.	Check cabling 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 Control valve lift, lower and extension
139	Incorrect signal from Solenoid valve, boom out (Y6006). Return current does not correspond with control current.	Extension out not working.	Check cabling 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 Control valve lift, lower and extension
140	Incorrect signal from Solenoid valve, boom in (Y6007). Return current does not correspond with control current.	Extension in not working.	Check cabling 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 Control valve lift, lower and extension
145	Incorrect signal from Sensor, boom angle (B771). Logical error, the signal does not change when lifting or lowering is activated.	Overload system not working. All lift functions run at reduced speed. Error code 150 activated.	Check sensor arm mounting. Check the sensor. Check cabling between the control unit and the component with diagnostic menu.	-	OP, menu 4	8.2.1.5 Sensor boom angle

Cod- e	Description	Limitation	Action	Connec- tions and compo- nents	Diagnos- tic menu	Group
146	Incorrect signal from Sensor, boom length (B777). Logical error, the signal does not change when extension is activated.	Overload system not working. All lift functions run at reduced speed. Error code 150 activated.	Check the cable to the sensor. Check the sensor. Check cabling between the control unit and the component with diagnostic menu.	-	OP, menu 4	8.2.1.6 Sensor boom length
147	High brake oil temperature.	Reduced braking capacity.	Check that cooling fan is working. Check that the radiator is not 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 (Y762). Signal voltage below 0.2 V or above 4.8 V.	Model year 2009-: Machine speed limited to 5 km/h.	Check the sensor. Check cabling 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 and lower as well as extension not working.	Contact Cargotec support.	-	-	7.2 Lifting/lowering. 7.3 Extension
150	Defective overload protection. This error code cannot be removed with Reset.	Overload system not working. All lift functions operate at 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 reach destination.	-	Check cabling between the control unit and the component with diagnostic menu. Check the control unit.	D797-R/K2:7	CAN/P-OWER, 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 reach destination.	-	Check cabling between the control unit and the component with diagnostic menu. Check the control unit.	D797-R/K2:8	CAN/P-OWER, menu 10	11.5.1.2 Redundant voltage feed of Control units
153	Incorrect power supply to Control unit, frame rear (D797-R). Voltage below 18 V or above 32 V.	-	Check fuse F58-2/3, replace if necessary. Check cabling between the control unit and the component with diagnostic menu.	D797-R/K2:1, K2:9, K2:10 – F58-2/3:1	CAN/P-OWER, menu 10	11.5.1.3 Ignition voltage (15)
154	Incorrect power supply to Control unit, frame rear (D797-R).	-	Check fuse F58-2/3, replace if necessary. Check cabling between the control unit and the component with diagnostic menu.	D797-R/K2:11 – F58-2/3:2	CAN/P-OWER, menu 10	11.5.1.4 Emergency stop switch voltage

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
155	Incorrect 5 V reference voltage to analogue sensors. Voltage below 4.9 V or above 5.1 V.	Overload system and weight indicator not working.	Check cabling between the control unit and the component with diagnostic menu. Check the sensor.	D797- R/K1:8 – B771/1, B777/1	CAN/P- OWER, menu 11	8.2.1.5 Sensor boom angle 8.2.1.6 Sensor, boom length, (analogue sensor)
156	The transistor has been triggered due to short circuit in the circuit for Cooling fan, hydraulic oil (M668).	Cooling fan hydraulic oil not working.	Check cabling 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 circuit or open circuit in the circuit for Lamp, working lights, boom, left (E404-3L).	Work light boom left not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- R/K1:1 – E404-3L	LIGHTS, menu 3	9.6.10 Working lights, boom
158	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, working lights, boom, right (E404-3R).	Work light boom right not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- R/K1:15 – E404-3R	LIGHTS, menu 3	9.6.10 Working lights, boom
159	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, back-up light, left (E405L).	Back-up light left not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- R/K1:28 – E405L	LIGHTS, menu 11	9.6.5 Back-up lights
160	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, back-up light, right (E405R).	Back-up light right not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- R/K1:42 – E405R	LIGHTS, menu 11	9.6.5 Back-up lights
161	The transistor has been triggered due to short circuit or open circuit in the circuit for Sensor, steering axle load (B7221L and B7221R).	Overload system indicates overload.	Check cabling 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

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
162	The transistor has been triggered due to short circuit or open circuit in the circuit for Sensor, position sensor boom length.	Damping in/out/1.5 m not working.	Check cabling 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 (position sensor)
163	The transistor has been triggered due to short circuit or open circuit in the circuit for Solenoid valve, regeneration extension, (Y6046).	Regeneration extension not working.	Check cabling 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 circuit or open circuit in the circuit for Solenoid valve, blocking extension, (Y6050).	Extension not working.	Check cabling 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 circuit or open circuit in circuit for Back-up warning device (H965).	Back-up alarm not working.	Check cabling 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 circuit or open circuit in the circuit for Solenoid valve, top hydraulics (Y6003).	Attachment functions not working.	Check cabling 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 circuit or open circuit in the circuit for Lamp, brake light, left (H411L).	Brake light left not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- R/K1:32 – H411L/1	LIGHTS, menu 11	9.6.4 Brake light
168	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, brake light, right (H411R).	Brake light right not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- R/K1:33 – H411R/1	LIGHTS, menu 11	9.6.4 Brake light
169	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, running lights, left (H416-2).	Running light left rear not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- R/K1:7 – H416-2/1	LIGHTS, menu 5	9.6.2 Running lights

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
170	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, running lights, right (H417-2).	Running light right rear not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- R/K1:9 – H417-2/1	LIGHTS, menu 5	9.6.2 Running lights
171	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, tail light, left (E421L).	Tail light left not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- R/K1:10 – H412L/1	LIGHTS, menu 5	9.6.3 Tail lights
172	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, tail light, right (E421R).	Tail light right not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- R/K1:25 – H412R/1	LIGHTS, menu 5	9.6.3 Tail lights
173	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, direction indicator, left rear (H426).	Direction indicator left rear not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D797- R/K1:29 – H426/1	LIGHTS, menu 8	9.6.6 Direction indicators
174	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, direction indicator, right rear (H426).	Direction indicator right rear not working.	Check bulb. Check the bulb holder. Check cabling 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 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 circuit or open circuit in the circuit for Solenoid valve, pump unloading (Y6062).	Unloading of hydraulic oil pumps at boom not working.	Check cabling 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 below 0.2 V or above 4.8 V.	Overload system not working. All lift functions run at reduced speed. Error code 150 activated.	Check cabling 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

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
184	Incorrect signal from Sensor, boom length (777). Signal voltage below 0.2 V or above 4.8 V.	Overload system not working. All lift functions run at reduced speed. Error code 150 activated.	Check cabling 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 circuit or open circuit in circuit for Electromagnetic clutch on the AC compressor (M677). NOTE! Error code 191 and 192 belong to the same consumer.	Air conditioning not working.	Check cabling 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				D797- R/K1:26 – M645/1		
193	The transistor has been triggered due to short circuit or open circuit in the circuit for Relay, starter motor (K360).	Starter motor not working.	Check cabling 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 the radiator is not clogged. Check the sensor.	D797- R/K2:13 – B776/1	HYD, menu 1	10.6 Temperature control, cleaning and hydraulic oil
198	Incorrect signal from Sensor, hydraulic oil temperature (B776).	Incorrect temperature display.	Check the sensor. Check cabling between the control unit and the component with diagnostic menu.	D797- R/K2:13 – B776/1	HYD, menu 1	10.6.4 Sensor hydraulic oil temperature
199	Incorrect signal from fuel level sensor (B757). Resistance above 180 Ω.	Incorrect display of fuel volume (empty or full).	Check the sensor. Check cabling between the control unit and the component with diagnostic menu.	D797- R/K2:15 – B757	CAB, menu 7	1.2.2 Sensor fuel level
251	Redundant voltage feed left to frame control unit (D791-1) does not reach destination.	-	Check cabling between the control unit and the component with diagnostic menu.	D791- 1/K2:7	CAN/P- OWER, menu 16	11.5.1.2 Redundant voltage feed of Control units
252	Redundant voltage feed left to frame control unit (D791-1) does not reach destination.	-	Check cabling between the control unit and the component with diagnostic menu.	D791- 1/K2:8	CAN/P- OWER, menu 16	11.5.1.2 Redundant voltage feed of Control units

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
253	Incorrect power supply to Control unit, attachment (D791-1). Voltage below 18 V or above 32 V.	Functions normally supplied emergency stop switch voltage have no feed. No attachment functions working.	Check fuse F58-3/1, replace if necessary. Check fuse F52-1, replace if necessary. Check cabling between the control unit and the component with diagnostic menu.	D791-1/K-2:1/9/10 – F52-1 – F58-3/1:1	CAN/P-OWER, menu 16	11.5.1.4 Emer- gency stop switch volt- age
254	Incorrect emergency stop switch voltage to Control unit, attachment (D791-1).	Functions normally supplied emergency stop switch voltage have no feed. No attachment functions working.	Check fuse F58-3/1, replace if necessary. Check fuse F52-1, replace if necessary. Check cabling between the control unit and the component with diagnostic menu.	D791-1/K2:11 – F58-3/1	CAN/P-OWER, menu 16	11.5.1.4 Emer- gency stop switch volt- age
257	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, working lights, attachment right (E406R).	Work light attachment right not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D791-1/K1:1 – E406R	LIGHTS, menu 2	9.6.11 Working lights at- achment
258	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, working lights, attachment left (E406L).	Work light attachment left not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D791-1/K1:15 – E406L	LIGHTS, menu 2	9.6.11 Working lights at- achment
259	The transistor has been triggered due to short circuit or open circuit in the circuit for Buzzer, automatic spreading 20'-40' (H4009).	Automatic spreading 20"-40" not working.	Check cabling 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 (position- ing)
260	The transistor has been triggered due to short circuit or open circuit in the circuit for Lamp, extra working lights, attachment (E404-4L and E404-4R).	Extra work light attachment not working.	Check bulb. Check the bulb holder. Check cabling between the control unit and the component with diagnostic menu.	D791-1/K1:42 – E404-4L, E404-4R	LIGHTS, menu 2	9.6.11 Working lights at- achment
261	The transistor has been triggered due to short circuit in the circuit for Solenoid valve, rotation clockwise (Y6008).	Rotation of attachment not working.	Check cabling 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, attach- ment

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
262	The transistor has been triggered due to short circuit in the circuit for Solenoid valve, rotation anticlockwise (Y6009).	Rotation of attachment not working.	Check cabling 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 circuit in the circuit for Solenoid valve, spreading out (Y6018).	Spreading not working.	Check cabling 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 circuit in the circuit for Solenoid valve, spreading in (Y6019).	Spreading not working.	Check cabling 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 circuit or open circuit in the circuit for Solenoid valve, side shift, right (Y6021).	Side shift of attachment not working.	Check cabling 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 circuit or open circuit in the circuit for Solenoid valve, side shift, left (Y6020).	Side shift of attachment not working.	Check cabling 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 circuit or open circuit in the circuit for Solenoid valve, lock twistlock, (Y6040).	Twistlock not working.	Check cabling 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
268	The transistor has been triggered due to short circuit or open circuit in the circuit for Solenoid valve, open twistlock, (Y6039).	Twistlock not working.	Check cabling 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, attachment
269	The transistor has been triggered due to short circuit or open circuit in the circuit for Solenoid valve, tilt lock 1 (Y6012-1).	Tilt locked, tilt damping and controllable tilt not working.	Check cabling 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

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
270	The transistor has been triggered due to short circuit or open circuit in the circuit for Solenoid valve, tilt lock 2 (Y6012-2).	Tilt locked, tilt damping and controllable tilt not working.	Check cabling 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 circuit or open circuit in circuit for Voltage feed, position sensor attachment.	Twistlocks, rotation stop, and spreading not working.	Check cabling 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 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 (position sensor)
272	The transistor has been triggered due to short circuit or open circuit in the circuit for Indicator light, open twistlocks (H562).	Indicator light, open twistlocks, not working.	Check bulb. Check the bulb holder. Check cabling 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 circuit or open circuit in circuit for Indicator light, alignment (H564).	Indicator light, alignment twistlock, not working.	Check bulb. Check the bulb holder. Check cabling 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 circuit or open circuit in the circuit for Indicator light, locked twistlocks (H563).	Indicator light locked twistlock not working.	Check bulb. Check the bulb holder. Check cabling 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). Return current does not correspond with control current.	Rotation of attachment not working.	Check cabling 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

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
288	Incorrect signal from Solenoid valve, rotation anticlockwise (Y6009). Return current does not correspond with control current.	Rotation of attachment not working.	Check cabling 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, spreading out (Y6018). Return current does not correspond with control current.	Spreading not working.	Check cabling 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
290	Incorrect signal from Solenoid valve, spreading in (Y6019). Return current does not correspond with control current.	Spreading not working.	Check cabling 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 cabling between the control unit and the component with diagnostic menu.	-	ATTACH, menu 7	7.9.1.9 Sensor twistlock
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 cabling between the control unit and the component with diagnostic menu.	-	ATTACH, menu 7	7.9.1.9 Sensor twistlock
300	Sensor, alignment, indicates unreasonable distance.	Twistlock not working.	Check that Sensors, alignment, are clean and correctly adjusted. Check that the contact pin runs smoothly. Check cabling between the control unit and the component with diagnostic menu.	-	ATTACH, menu 6	7.9.1.8 Sensor, alignment
451	Redundant voltage feed left to Control unit KID (D795) does not reach destination.	-	Check cabling between the control unit and the component with diagnostic menu.	795/K1:7	CAN/P-OWER, menu 14	11.5.1.2 Redundant voltage feed of Control units

Cod- e	Description	Limitation	Action	Conne- ctions and compo- nents	Diagnos- tic menu	Group
452	Redundant voltage feed right to Control unit KID (D795) does not reach destination.	-	Check cabling between the control unit and the component with diagnostic menu.	795/K1:8	CAN/P- OWER, menu 14	11.5.1.2 Redundant voltage feed of Control units
460	No messages received on CAN buffer 1.	Incorrect values in operating menus.	Use diagnostic menu to check the CAN bus.	D795/K1: 10, K1:11, K1:12, K1:13	CAN/P- OWER, 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 the CAN bus.	D795/K1:5 , K1:6	CAN/P- OWER, menu 1, 2, 21	11.6.2 Redundant CAN bus
500	Time for service.	-	Check that servicing has been performed. If servicing has been performed following the Cargotec service schedule, reset the service indicator; see section 8 <i>Control system</i> , group 8.2.6 <i>Service indicator</i> .	-	-	8.2.6 Service indicator

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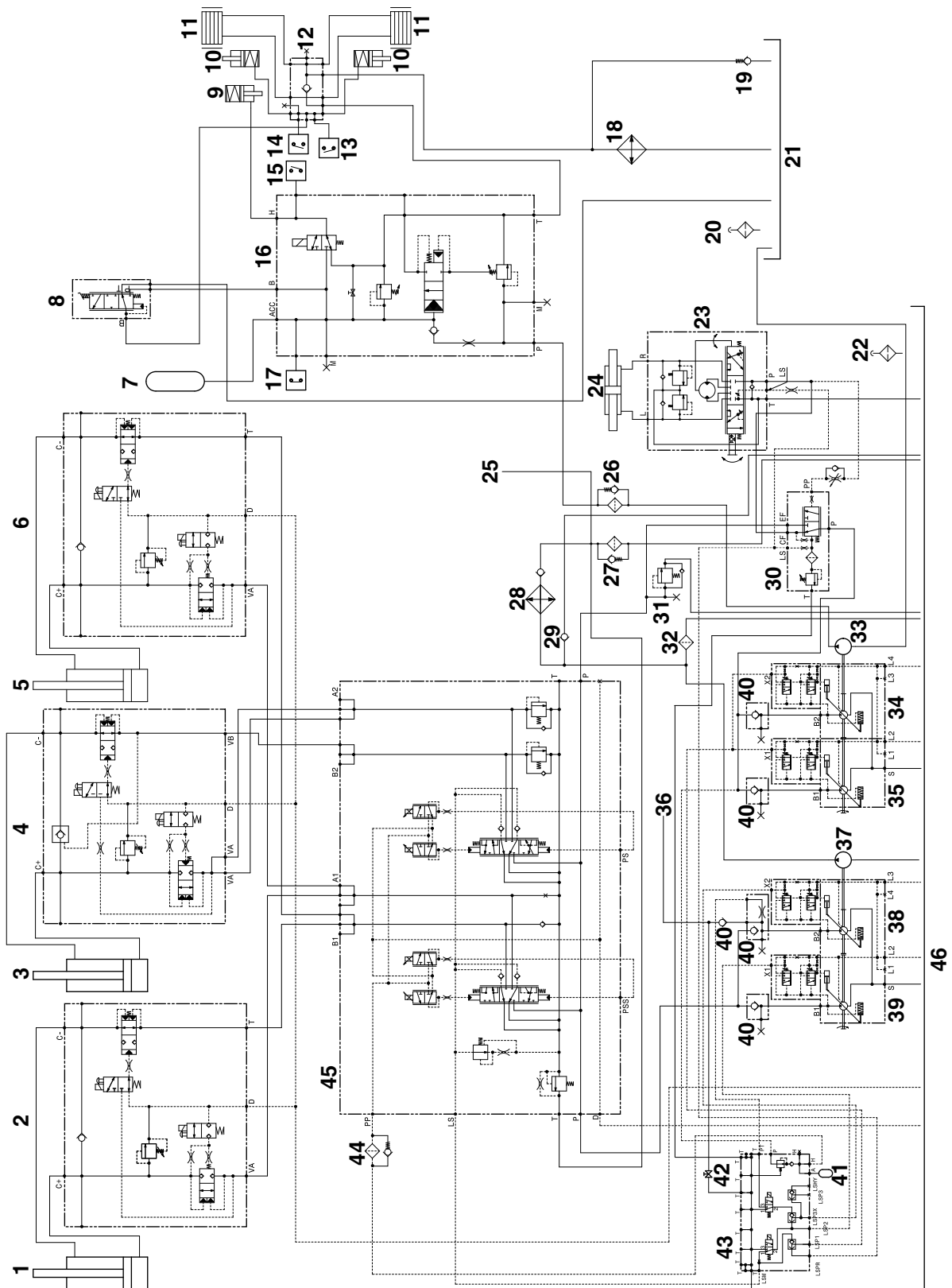
E Schematics

Common hydraulics

Hydraulic diagrams, compilation

Designation	Drawing number
<i>Hydraulic diagram basic machine</i> , page E:4	A40740.0800
<i>Hydraulic diagram top lift</i> , page E:6	A40853.0100

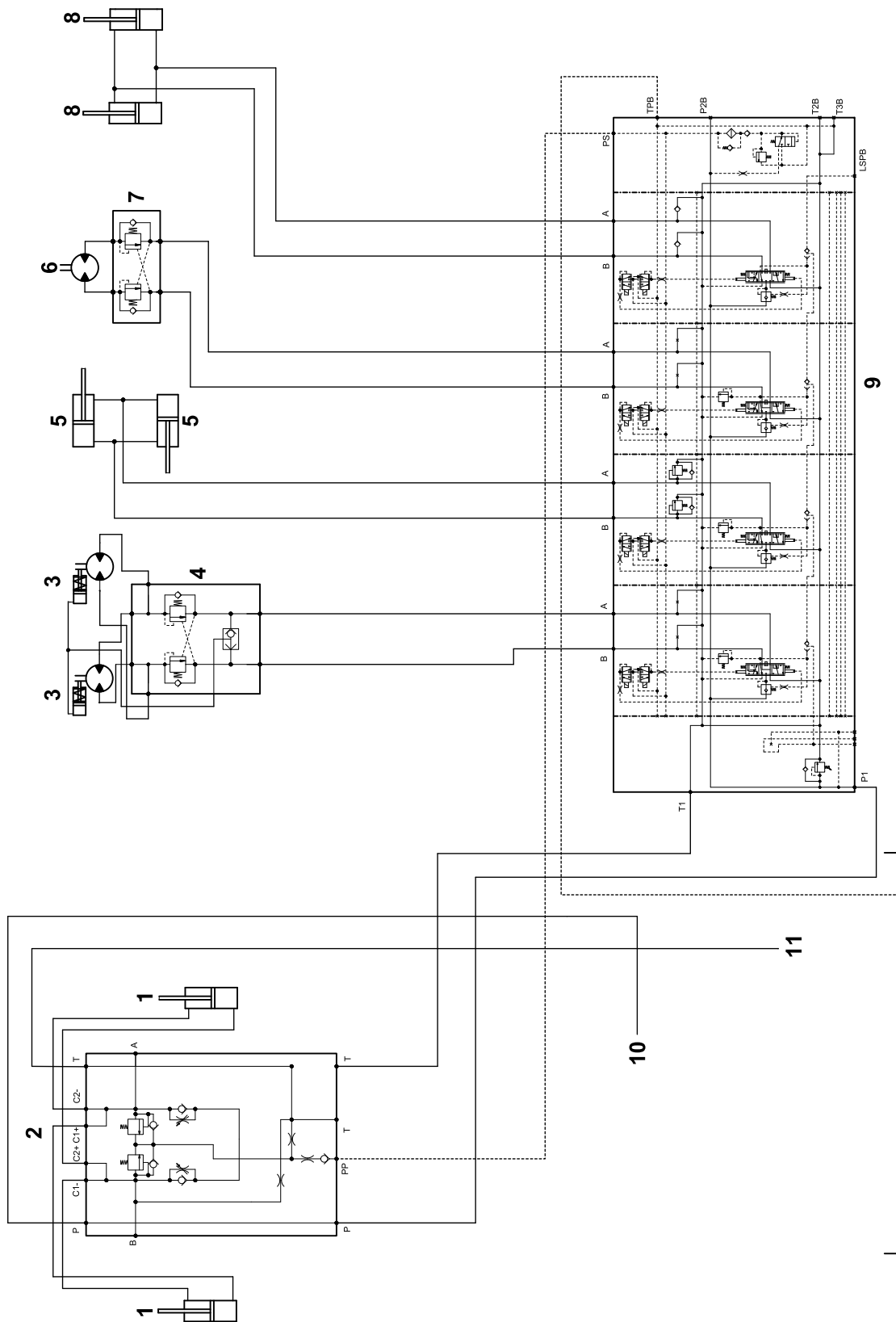
Hydraulic diagram basic machine



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- | | |
|---|--|
| 1. Lift cylinder | 25. Oil return from attachment |
| 2. Valve block lift cylinder | 26. Brake oil filter |
| 3. Extension cylinder | 27. Hydraulic oil filter |
| 4. Valve block, extension cylinder | 28. Cooler hydraulic oil |
| 5. Lift cylinder | 29. Bypass valve, hydraulic oil cooler |
| 6. Valve block lift cylinder | 30. Priority valve |
| 7. Accumulator brake pressure | 31. Pressure limiting valve |
| 8. Brake valve | 32. Fine filter hydraulic oil |
| 9. Parking brake caliper | 33. Brake oil pump |
| 10. Brake cylinder | 34. Hydraulic oil pump 4 |
| 11. Wheel brakes | 35. Hydraulic oil pump 3 |
| 12. Drive axle block | 36. Pressure supply to attachment |
| 13. Make-contact (closing switch) declutch (S220-2) | 37. Pump cooling and filtration of hydraulic oil |
| 14. Make-contact (closing switch) brake light (S216) | 38. Hydraulic oil pump 2 |
| 15. Break contact (opening switch) parking brake (S200) | 39. Hydraulic oil pump 1 |
| 16. Accumulator charging valve | 40. Non-return valve |
| 17. Break contact (opening switch), brake oil pressure (S204) | 41. Accumulator servo pressure |
| 18. Oil cooler brake system | 42. Relief valve, attachment |
| 19. Thermal bypass valve | 43. Valve block servo pressure |
| 20. Breather filter, brake oil tank | 44. Servo filter |
| 21. Brake oil tank | 45. Control valve lifting/lowering and extension |
| 22. Breather filter hydraulic oil tank | 46. Hydraulic oil tank |
| 23. Steering valve | |
| 24. Steering cylinder | |

Hydraulic diagram top lift



013888 (A40853.0100 ver. 4)

1. Tilt cylinder
2. Damping block
3. Rotation motor unit
4. Valve block rotation motor
5. Side shift cylinders
6. Spreading (positioning) motor
7. Valve block spreader motor
8. Twistlock cylinders
9. Control valve, attachment
10. Feed to top lift attachment
11. Return from top lift attachment

Common electrics

Circuit diagram, description

A circuit diagram is divided into circuit names (drawing numbers) and consists of a set of numbered pages.

The circuits and their contents are governed by the following set of rules:

- 20015.0001 circuit drawings-post designations K-standard.
- K-standard 1: norms, rules
- K-standard 2: cables, general physical
- K-standard 5: Designation and marking system, item designations circuit drawings

The following is an explanation of symbols and texts in a circuit diagram:

Connectors

Connectors in the wiring start with an X followed by a number and end with f = female or m = male. If a connector is connected to a component then the component number is inherited into the connector's number, e.g. XB72002Rm which is the connector for Sensor, alignment front right (B7202R).

Under the connector's number the pin is specified with numbers or letters depending on the connector.

- X000-X199: In the cab.
- X200-X299: On the frame.
- X300-X399: On the boom.
- X400-: On the attachment.
- X37-: All grounding points start with X37, e.g. X37-201, which is a grounding point on the frame.

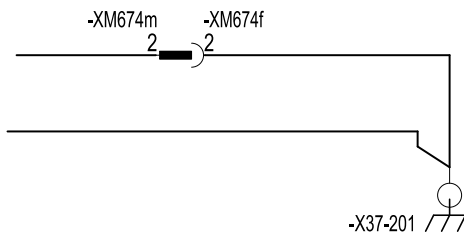
X37-A, X37-B, X37-C and X37-D are grounding points in electronic box, cab.

Zero references are in the control units.

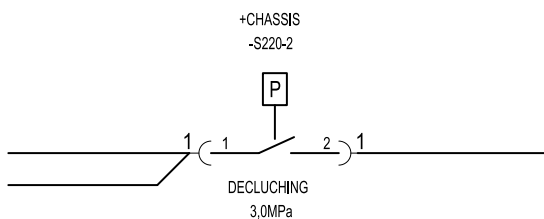
Components

Components are described with component number (S220-2) and a short descriptive text. Components (sensors, switches, etc.) are shown in standby mode i.e. de-energised mode or not mechanical standby mode.

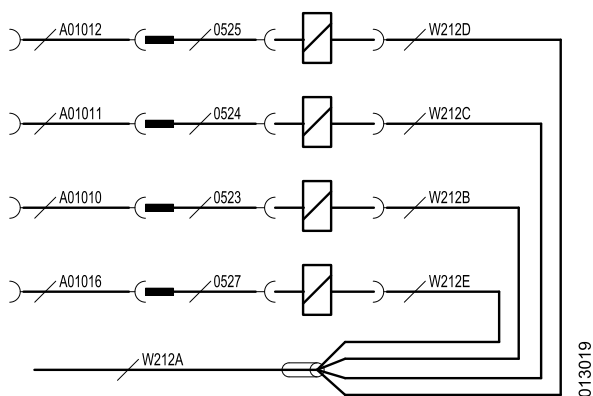
- S indicates the type of component, see *Component designations*, page E:10.
- 220 is component number and indicates the function the component has.
- -2 indicates that it is the second component of this type for the specific diagram.



013017



013018

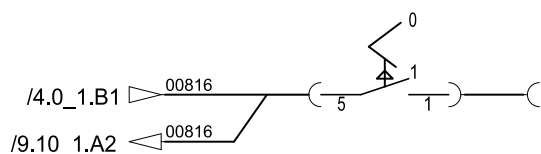


Cable marking

All cables are either white (ground signal) or grey (other wiring) and labelled with numbers.

Cable numbering is interpreted as follows:

- 0525: the number on a cable can usually be traced to a pin in a connector, in this example, connector X052 pin 5.
- W212: cables that start with W and serial number **cannot** be traced directly to a connector.
- A01012: cables that start with A are in the electronic box in the cab.
- W212D: cables that end with a capital letter are jointed in the wiring from a main cable with the same number. Each joint will have its own letter.



References

An arrow symbol means that the circuit continues on another page in the circuit diagram at the specified coordinates. Sometimes there are also references for components that can then be part of a component whose other parts are on a different diagram. In some cases there is also a help text where the cable connects.

Example: /11.5_1.D3 means page 11.5_1 coordinate D3.



Connection to control unit

Connections to control units are described as a table with two fields; the upper one shows the type of connection, the lower one has a reference to the compilation of the control unit's connections. Together with this there are descriptive texts that specify control unit and signal.

For more information about the different connection types on the control units, see section 11 *Common electrics*, group 11.5.5 *Wiring*.

Fuses

Fuse boxes always start with F5. Example: F58-3 means fuse box 3 with 8 fuses.

For most fuse boxes there is also a table and an explanation of the circuits that the various fuses protect.

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 lighting.
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 key lock.
M	Motor. Example: electric motor.
P	Measuring instrument, testing equipment. Example: hour meter.
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 attached as an appendix in the following order.

Sheet	Designation
0.0_1	Circuit Cross references
0.0_2	Circuit Cross references
0.0_4	Circuit Cross references Att
0.0_5	Circuit Cross references Att
1.0_2	Circuit Engine Cummins
1.0_3	Circuit Engine Cummins
1.1_1	Circuit drive-train
2.1_1	Circuit drive-train
4.0_1	Circuit Brake system
4.0_2	Circuit Brake system
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_3	Circuit Spreading Sensor
7.6_1	Circuit Rotation
7.9_1	Circuit Twistlock
7.9_2	Circuit Twistlock
8.2_1	Circuit OP + Scale
8.2_2	Circuit OP + Scale

Sheet	Designation
8.2_3	Circuit Bypass
9.1_1	Circuit Extra Sensor Instr.
9.1_2	Circuit Extra Equipment
9.1_3	Circuit Extra Equipment
9.1_4	Circuit Sensor Instr.
9.1_5	Circuit Option Cab
9.1_6	Circuit Extra Equipment Boom nose
9.1_7	Circuit Extra Equipment
9.3_1	Circuit Cab Driver's Seat
9.3_2	Circuit Cab Driver's Seat
9.4_1	Circuit Climate system
9.4_2	Circuit Climate system
9.4_3	Circuit Climate system
9.5_1	Circuit Wipers
9.6_1	Circuit Working lights
9.6_2	Circuit Extra Work Light Att
9.6_3	Circuit Extra Wor.li. 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 Entry lighting
9.6_10	Circuit Extra Wor.Li. Frame
9.7_1	Circuit Alarm Audible signals
9.7_2	Circuit Alarm Audible signals
9.7_3	Circuit Direction indicators, Hazard flashers
9.7_4	Circuit Back-up alarm
9.8_1	Circuit Radio
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 Att
11.5_7	Circuit 24 V
11.5_8	Circuit 12V + Comm. Radio
11.5_9	Circuit Current Att
11.5_10	Circuit Current 230V Inverter
11.6_3	Circuit CAN BUS opt. Frame KDU
11.6_4	Circuit CAN BUS ATT
1.0_1A1	Circuit Yuchai
1.0_1A2	Circuit Yuchai

Sheet	Designation
1.0_1B1	Circuit Adaptation QSM11
2.0_1A1	Circuit Dana 36000
2.0_1A1	Circuit Dana 36000
2.0_1A2	Circuit Dana 36000

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Ref. No.	1	Anding Design change	Removed Till Lock p 7.4.	Anding nr Change No.	100781	Sign.	TIG	Datum Date	10/06/09	Rev/Draw	Kretz/Design	Sign.	TIG	Datum Date	05/08/09	Issue/Project No.	A500001/0600	H Op.	6	Branding	Kretsar DRFC 400-450	Product/Product	DRFC 400-450	Blind/Sheet	0/
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KDU
ATTACHMENT

+BOOM
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Pin Number	Drawing	Function	Type
Power	/11.5.5.C5		
CAN	/11.6.4.B4		Temperature Input
2-6			Emergency stop
2-11	/11.5.5.B5		Temperature Input
2-13			Reset In
2-15			
2-16			D+

+BOOM
-D791-1

Pin Number	Drawing	Function	Type
1-1	+CAB9.6.1.E1	WORKING LIGHT ATTACHMENT	6A
1-2	/7.6.1.A1	ROTATION C.W.	1.5A
1-3	/7.6.1.B1	ROTATION C.C.W.	1.5A
1-4	+ATTACHMENT7.5.1.B1	20-40 OUT	1.5A
1-5	+ATTACHMENT7.5.1.B1	40-20 IN	1.5A
1-6	/7.9.2.C7	INDICATION LAMPS	0V Ref
1-7	/7.7.1.B2	TILT LOCK	1.5A
1-8	/7.7.1.B2	TILT LOCK	Analog Ref 5V
1-9	/7.5.3.C1	POWER SUPPLY SENSORS	1.5A
1-10	/7.5.3.C1	ROTATION STOP	1.5A
1-11	/7.6.1.C8	DAMPING 20-40	Dg In / 1.5A
1-12	/7.5.3.D7	ALIGNMENT FRONT	Dg In / 1.5A
1-13	+ATTACHMENT7.9.1.C8	CENTRAL LUBRICATION, ATT.	Analog in 0-5V
1-14	/9.14.1.D2	WORKING LIGHT ATTACHMENT	6A
1-15	+CAB9.6.1.F1	ROTATION C.W.	PWM
1-16	/7.6.1.A8	ROTATION C.C.W.	PWM
1-17	/7.6.1.B8	20-40 OUT	PWM
1-18	+ATTACHMENT7.5.1.B8	40-20 IN	PWM
1-19	+ATTACHMENT7.5.1.B8	30-36 STOP	Analog in 0-5V
1-20	/7.5.3.E7		

Pin Number	Drawing	Function	Type
1-21	+CHUSS8.2.Z.C8	MEASUREPOINT SCALE	Analog in 0-5V
1-22	+ATTACHMENT7.9.1.D8	UNLOCKED TWIST LOCK	Analog in 0-5V
1-23	+ATTACHMENT7.9.1.E8	LOCKED TWIST LOCK	Analog in 0-5V
1-24	+ATTACHMENT7.9.1.B8	UNLOCKED TW	1.5A
1-25	/7.9.2.B1	ALIGNMENT REAR	Dg In / 1.5A
1-26	+ATTACHMENT7.9.1.C8	ALIGNMENT REAR	Analog in 0-5V
1-27	+ATTACHMENT7.9.1.E8	WARNING ALARM AUTO SPREADING	6A
1-28	/7.5.2.B1	ALIGNMENT	1.5A
1-29	/7.9.2.C1	SIDEShift RIGHT	2.5A
1-30	+ATTACHMENT7.5.1.D1	SIDEShift LEFT	2.5A
1-31	+ATTACHMENT7.5.1.C1	LOCK TW	1.5A
1-32	/7.9.2.D1	UNLOCK TW	1.5A
1-33	/7.9.2.D1		1.5A
1-34			1.5A
1-35	/9.1.B.A1	SENSORS	Dg In / 1.5A
1-36	/9.1.B.B1	LOCKED TW	Dg In / 1.5A
1-37	/9.1.B.B1	ALIGNMENT FRONT	0V Ref
1-38	/7.5.3.C7	UNLOCKED TWIST LOCK	1.5A
1-39	/7.9.2.C1	EXTRA WORKING LIGHT	Dg In / 1.5A
1-40	+ATTACHMENT7.9.1.A8		Analog in 0-5V
1-41	+ATTACHMENT7.9.1.B8		
1-42	+ATTACHMENT9.6.2.B2		6A

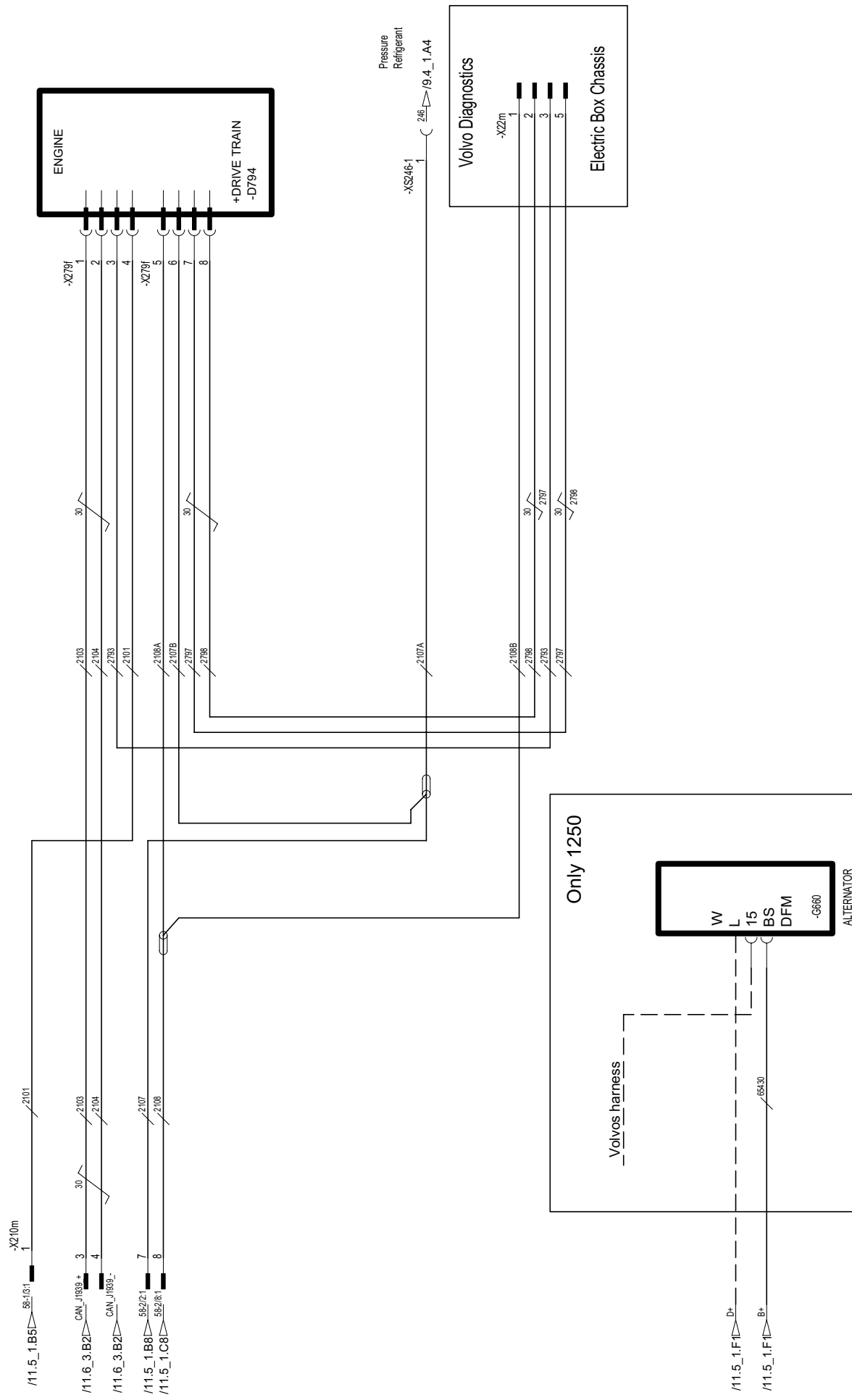
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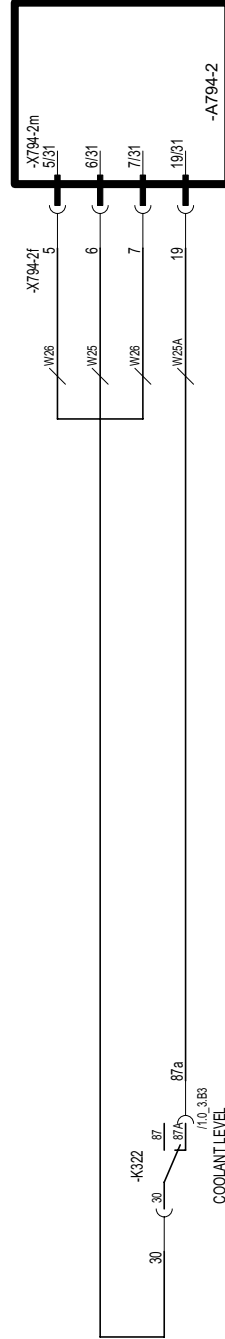
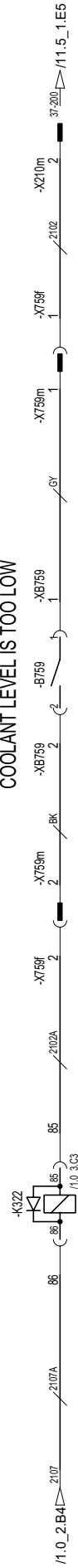
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Rev.	Nr.	Andring	Design change	Avinding nr	Sign.	Datum	Sign.	Drawn	Sign.	Drawn Date	Revision	Project
1	1	Removed Tilt Lock p.7.4.		100781	TKB	100809	TKB	TKB	TKB	050511	A50000.0800	Kalmar

Rev.	Nr.	Andring	Design change	Avinding nr	Sign.	Datum	Sign.	Drawn	Sign.	Drawn Date	Revision	Project
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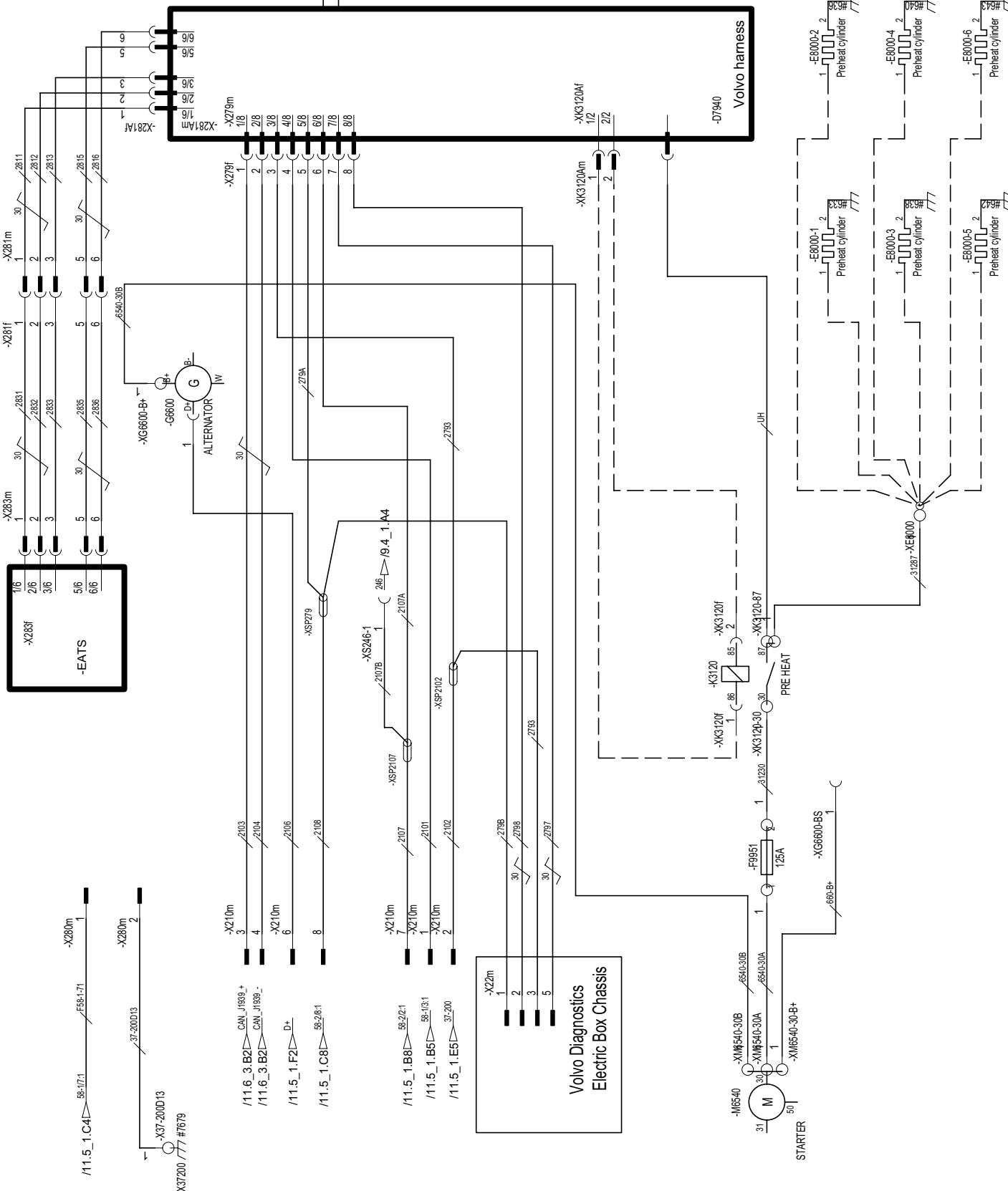
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1	1	Removed Tilt Lock p.7.4.		100781	TKB	100809	TKB	TKB	TKB	050511	A50000.0800	Kalmar

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ELECTRONIC CONTROL UNIT: ENGINE

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Revisions		Drawing Information		Project Information		Approval		Revision History	
Rev. No.	Date	Design No.	Sign.	Date	Sign.	Name	Title	Model/Product	Sheet No.
1		1	Removed T11 lock p.7.4.					DRFC 400-450	10.4/
								Refer to Drawing No.	Uplink/Down
								A50001.0100	21
T=Title, Added, U=Uplink, Deleted, V=Var/Vias									



Revising
Krets Motor Volvo D13
Name
Wiring Motor Volvo D13

Model/Product
DRFC 400-450
Sheet No.
10.4/

Revision History
A50001.0100
Uplink/Down
21

Approval
Name
Title

Project Information
Model/Product
Sheet No.

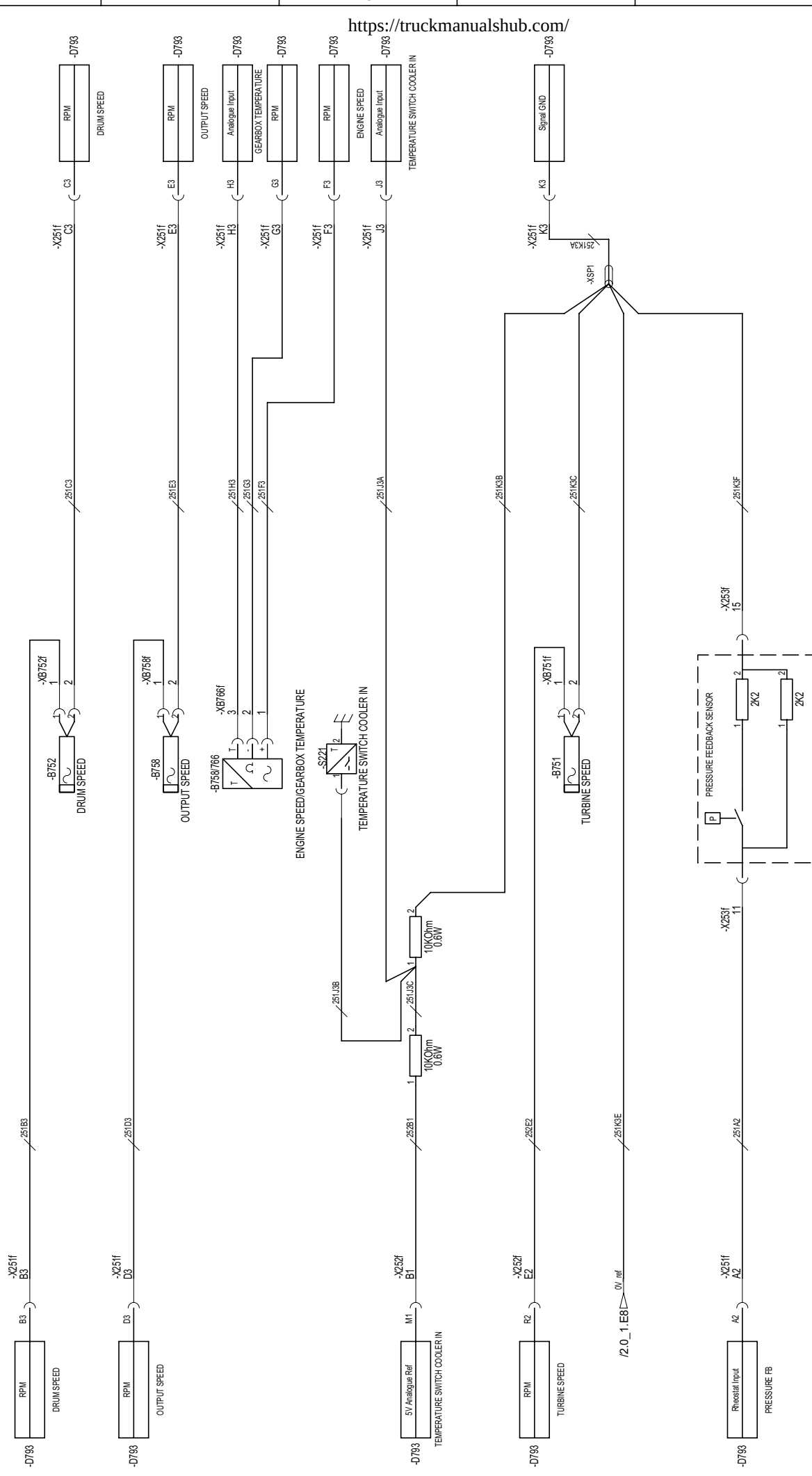
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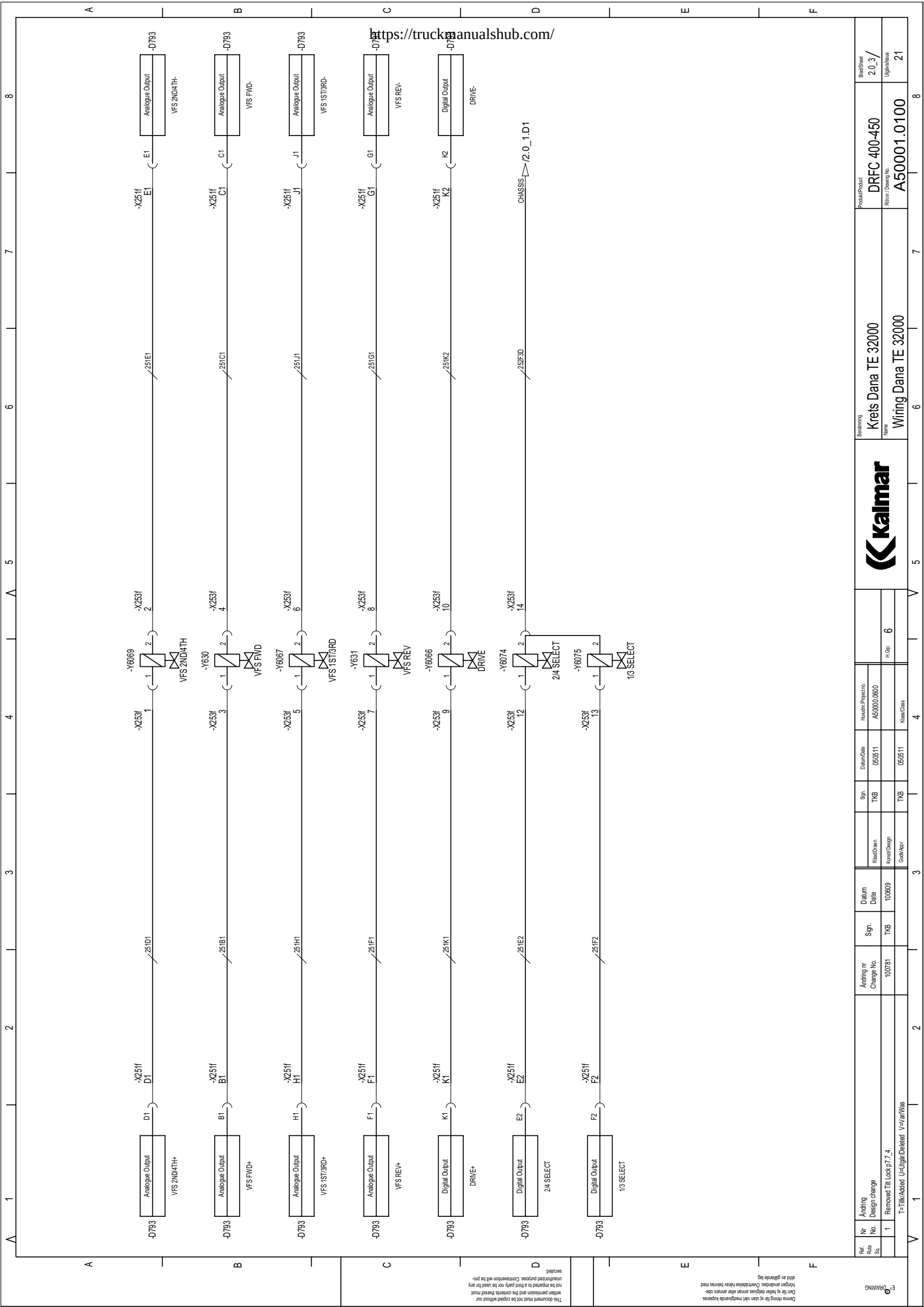
Revisions
Rev. No.
Date
Design No.
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Date

Revision History
A50001.0100
Uplink/Down
21

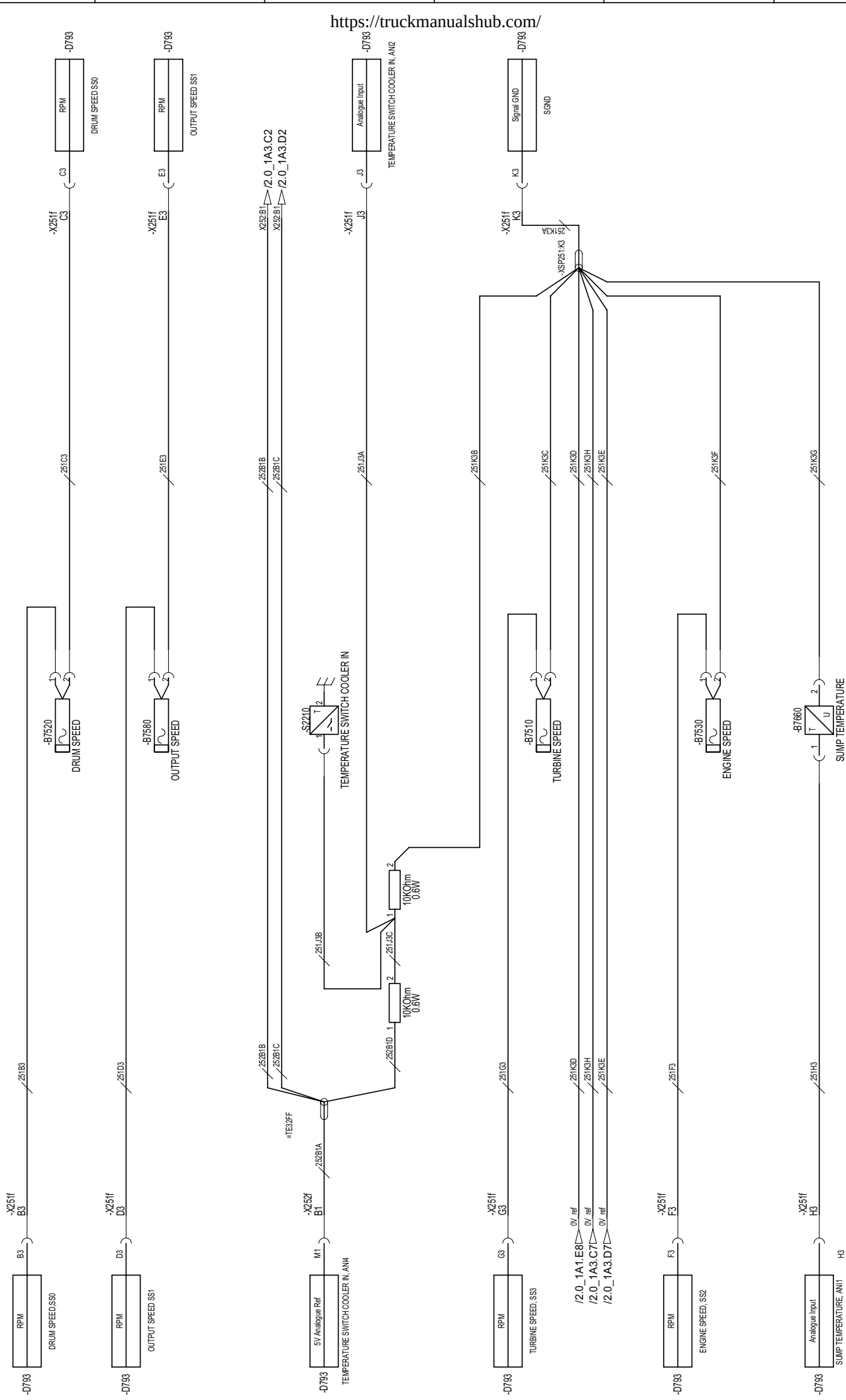
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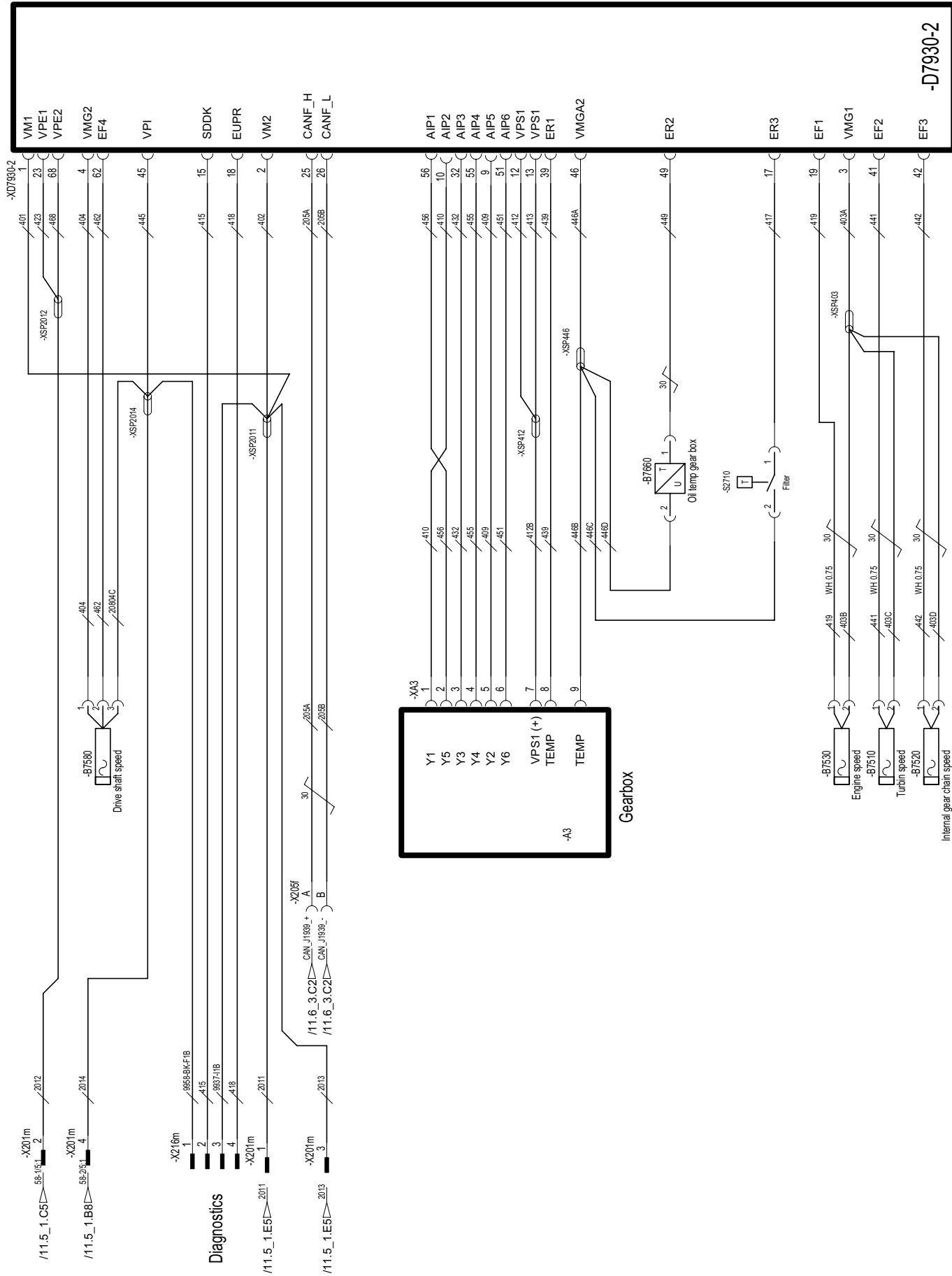
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T=Trunk/Added U=Unger/Deleted V=Van/Vas										Wiring Dana TE 32000	A50001.0100	21





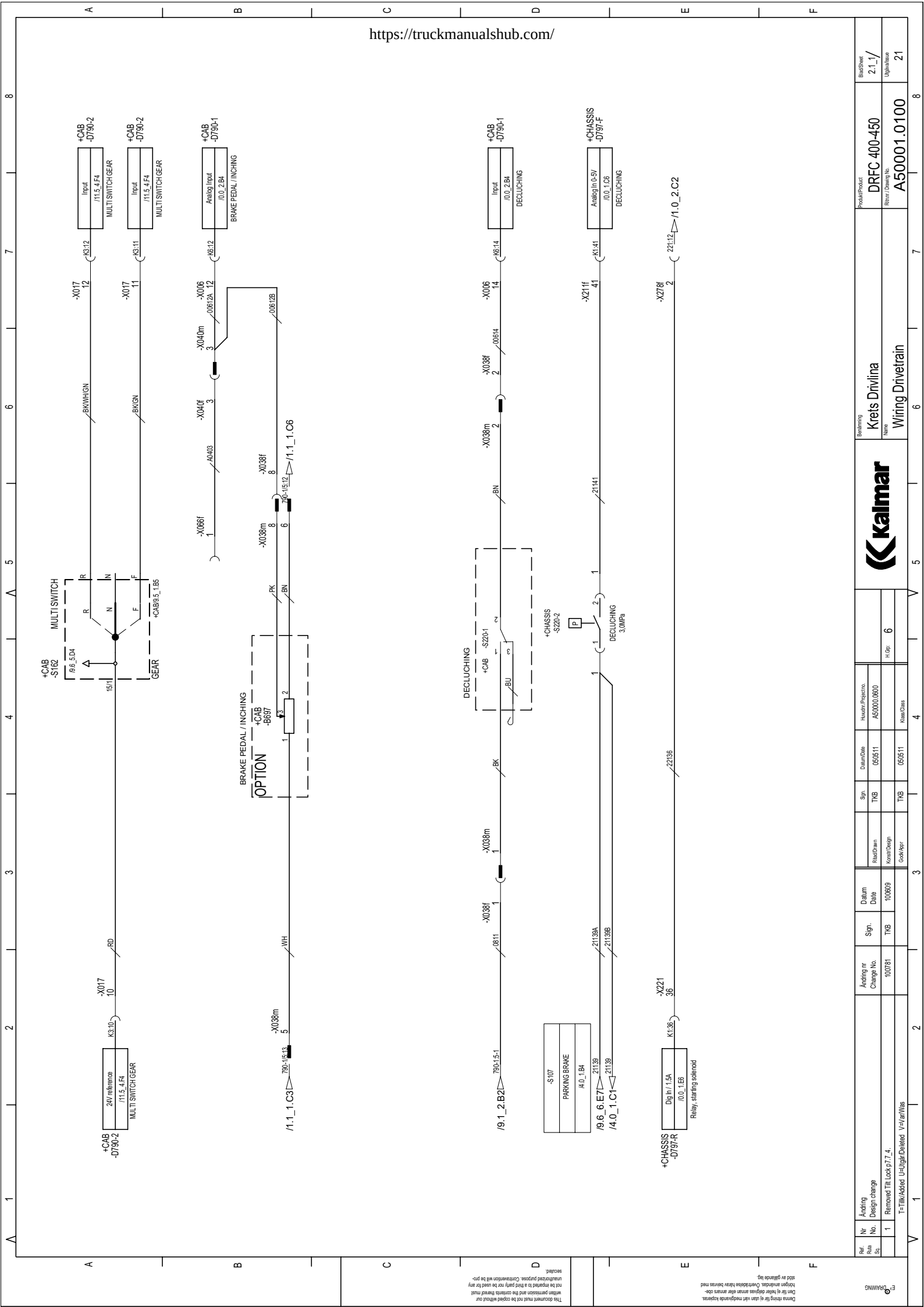
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T=TKB/Added U=Ughar/Deleted V=Var/Vas										AS0001.0100	21



Krets schema växling ZF

Product
DRFC 400-450
BackSheet 20_1B/

Ughavens
AS0001.0100
21



Ref. No.	Rev.	Design change	Design No.	Sign.	Date	Drawn	Checked	Class	Project	Product	Rev.
1	1	Removed T11 lock p.7.4.	100781	TMB	100809	Kretz/Design	Good/Approved	Class 6	Krets Drivlina	DRFC 400-450	2.1.1

T=Truck/Added U=Ugly/Deleted V=Var/Vas									
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Wiring Drivetrain									
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Krets Drivlina									
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Krets Drivlina									
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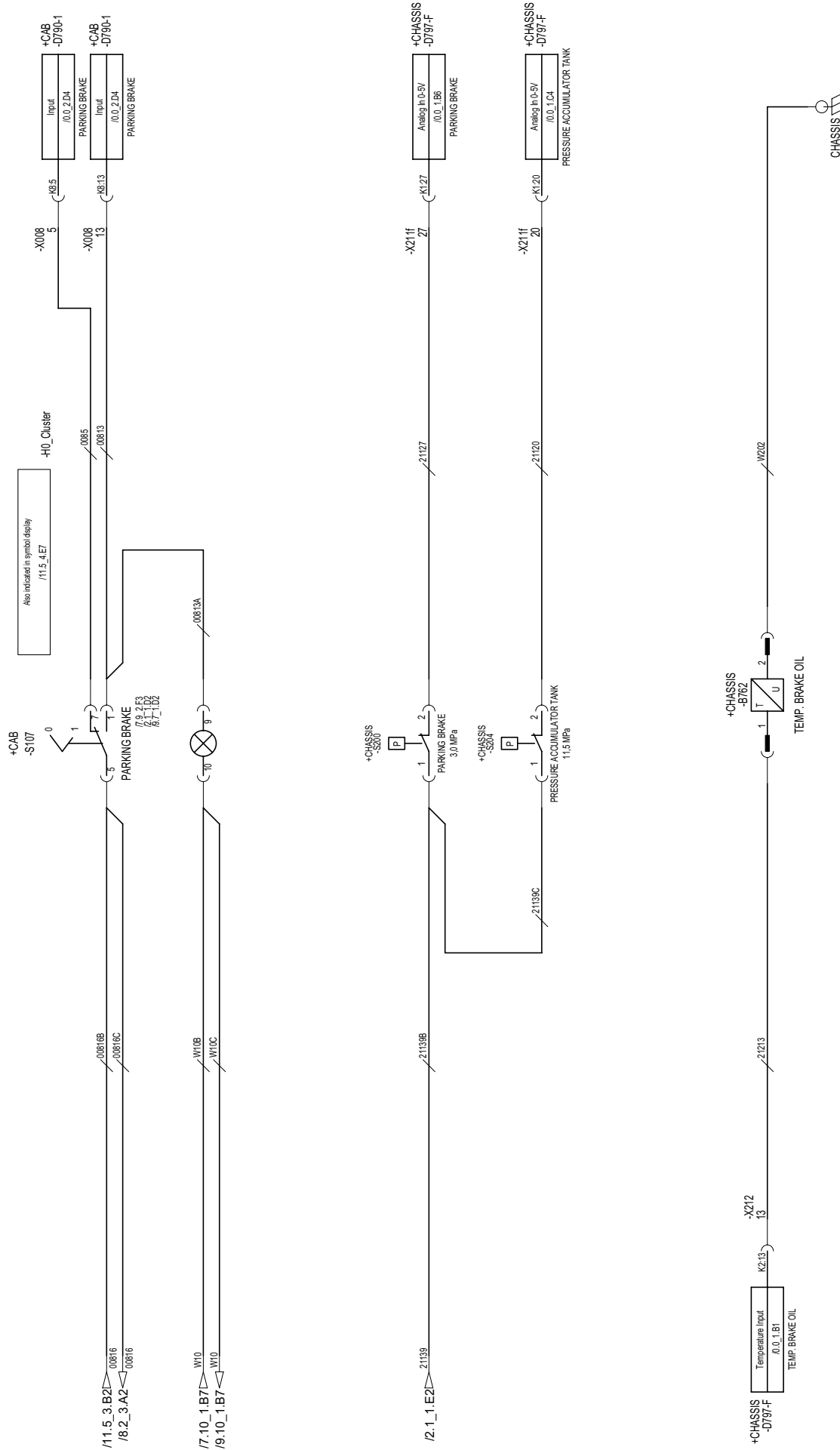
Krets Drivlina									
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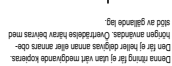
Krets Drivlina									
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Krets Drivlina									
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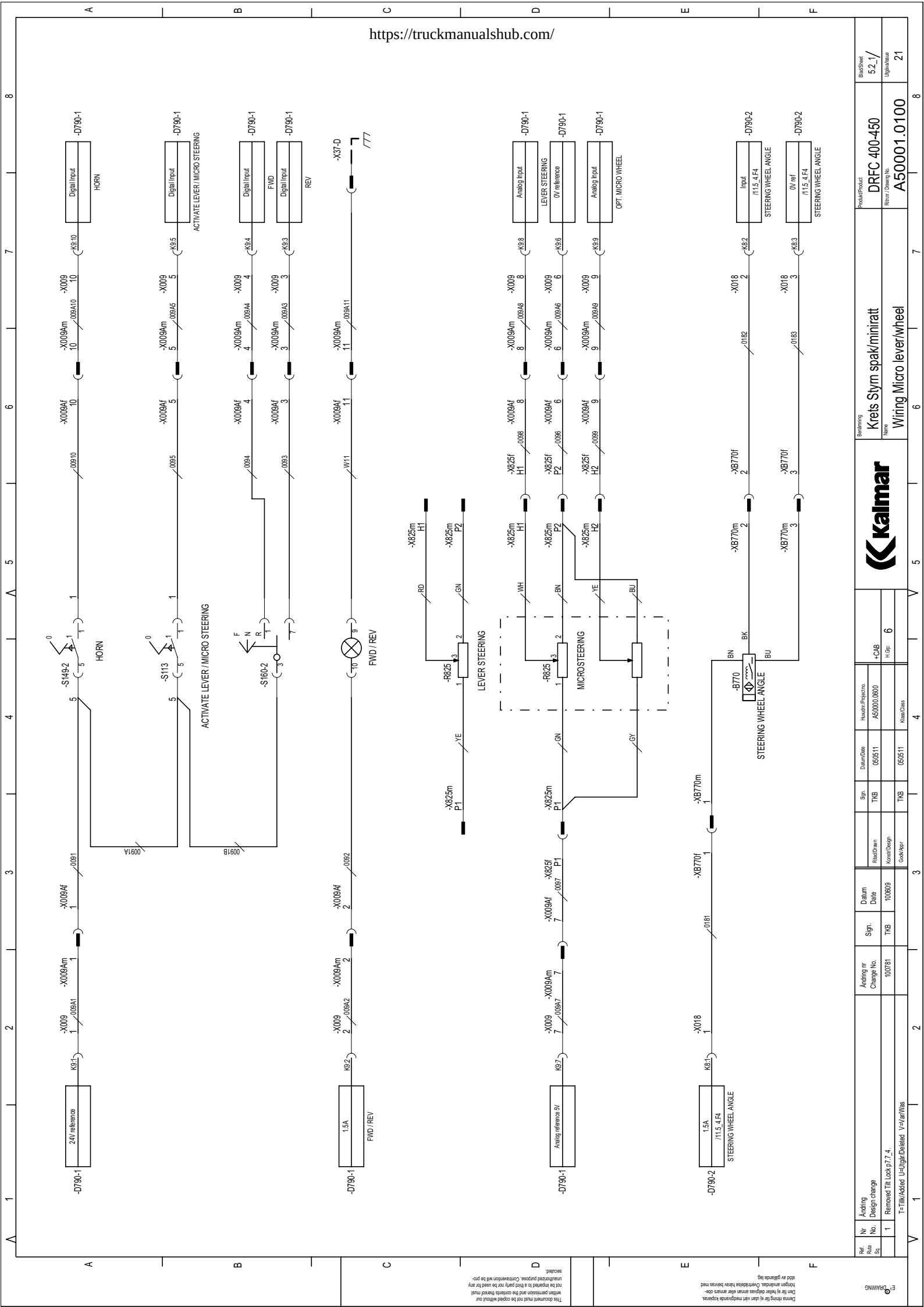
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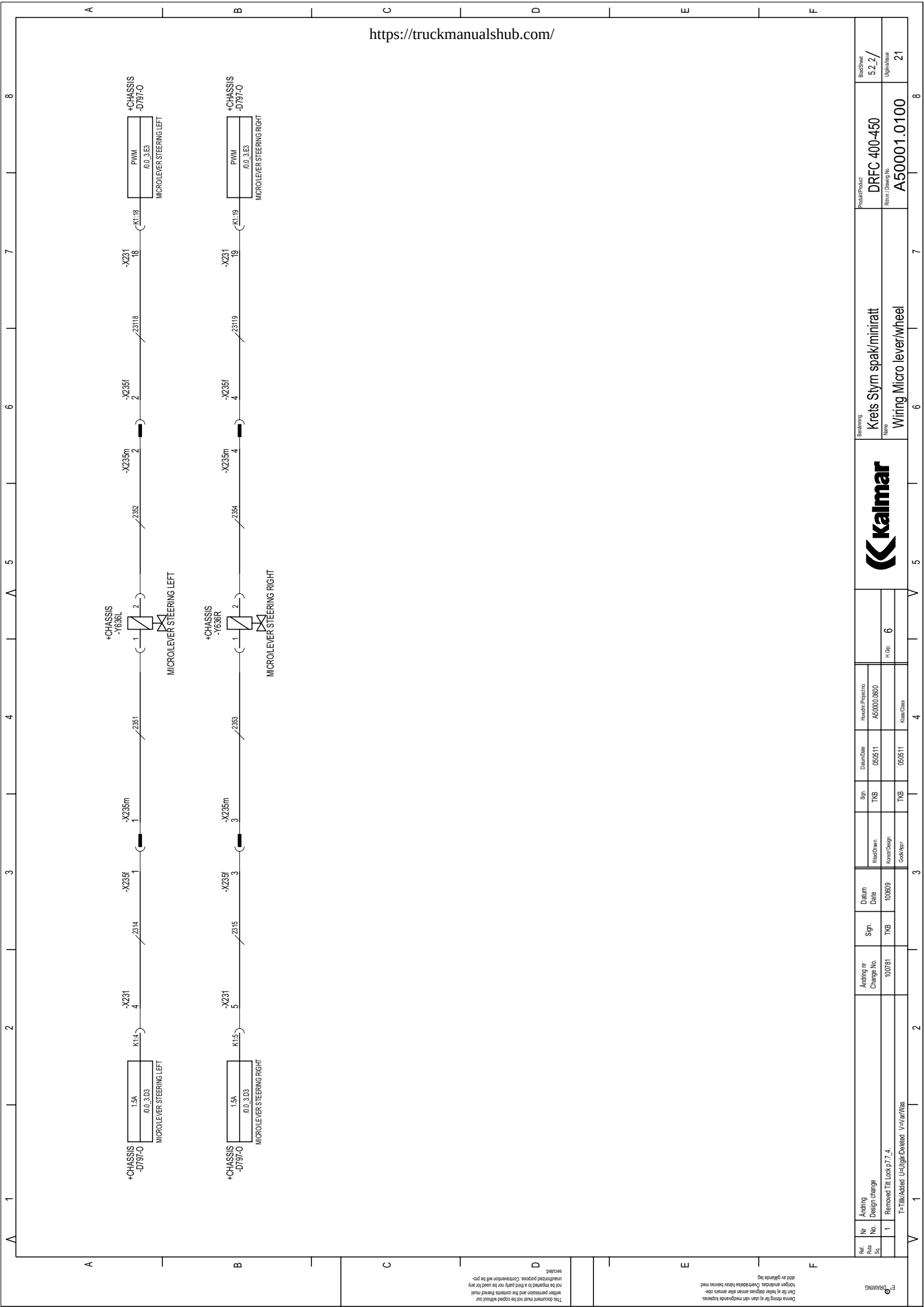
Krets Drivlina									
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[illegible]

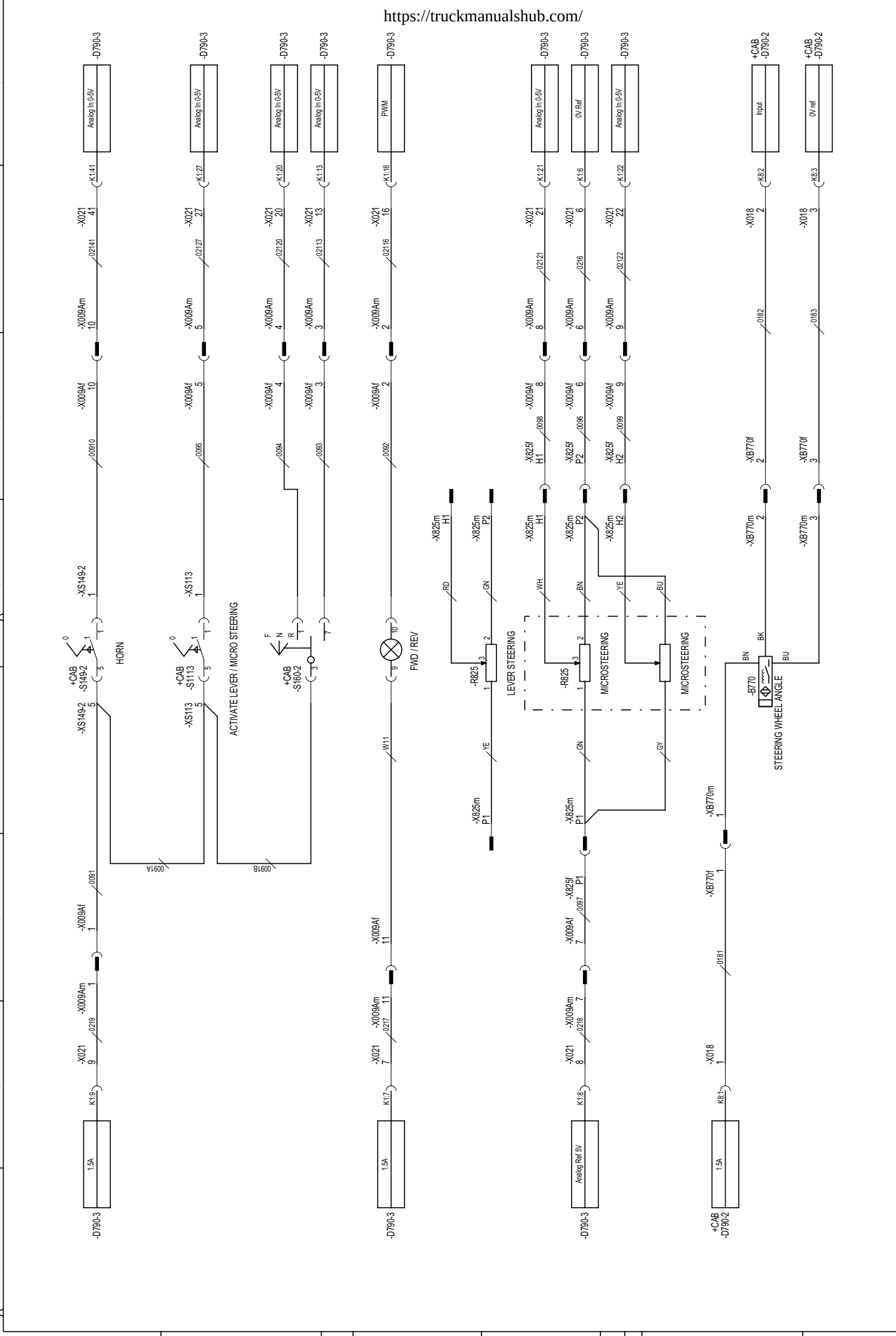


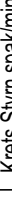
© DRAWING



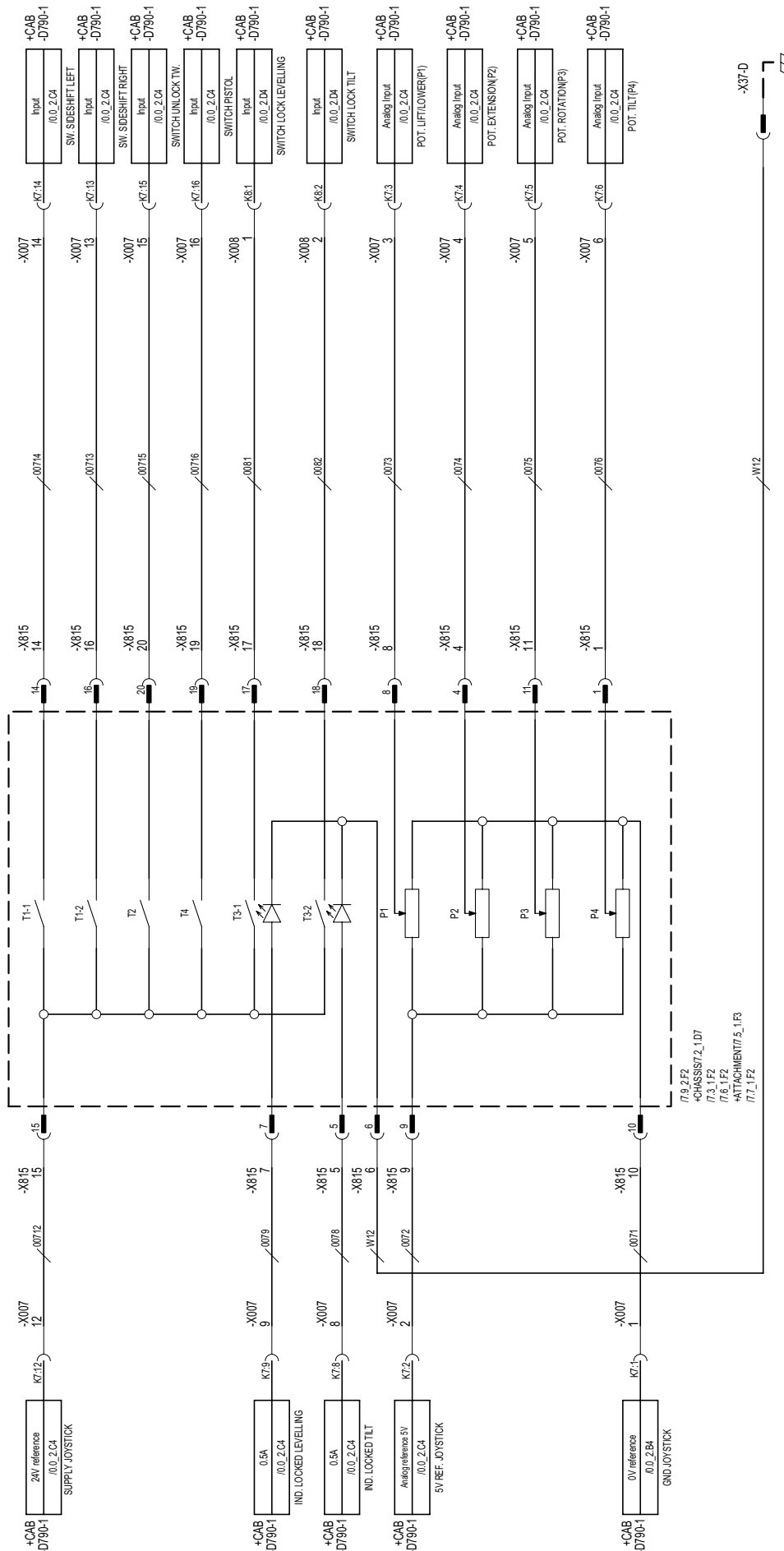


Ref. No. Anding No. Design Change No. Sq	Anding nr Change No. Removed Till lock p.7.4.	Anding Design Change No. 1	100761	Sign. TMB	Datum Date 100809	Sgn. TMB	Drawn TMB	Sgn. TMB	Date 050511	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn. 6	H. Sgn.
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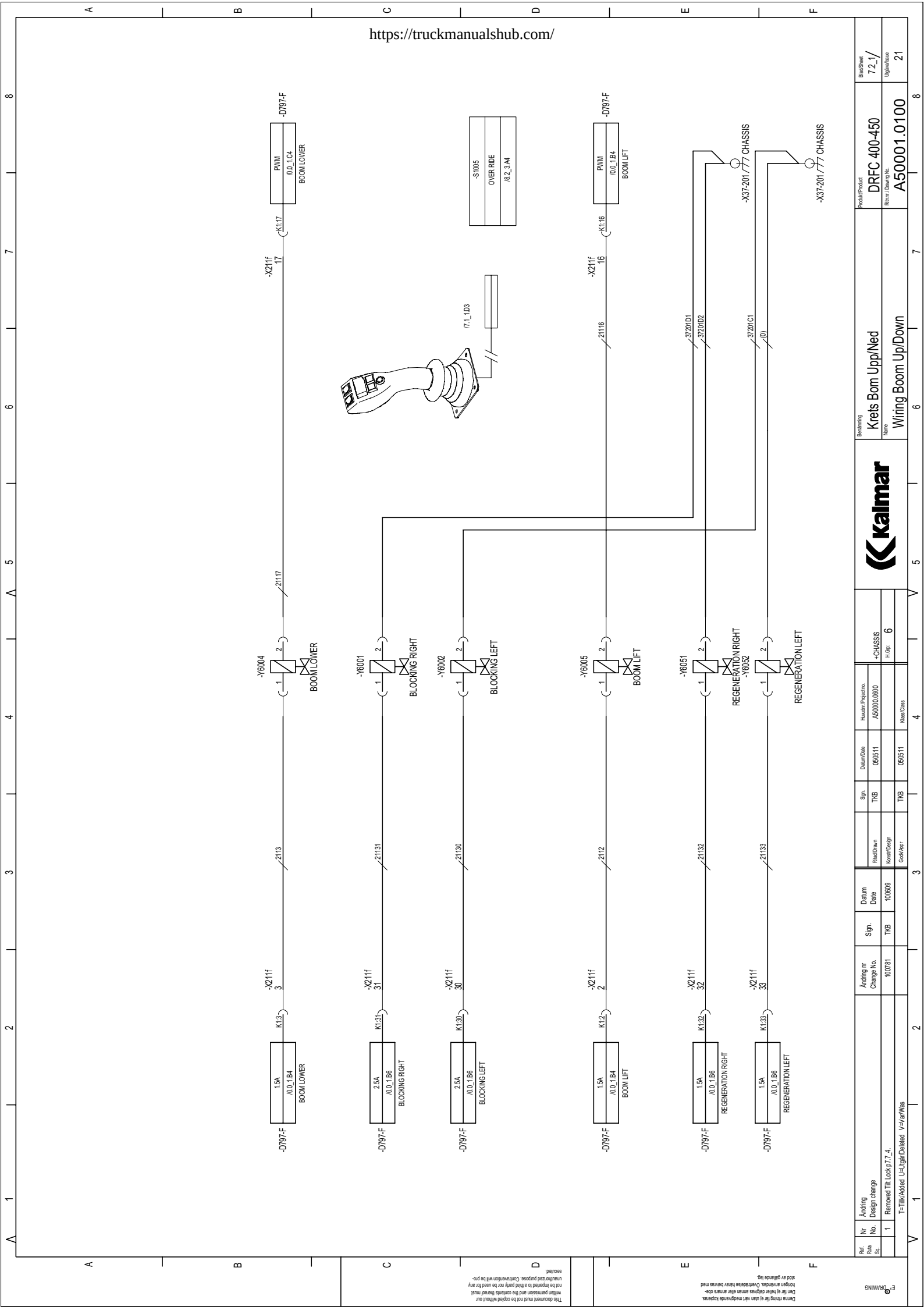


Ref. No.	Inr	Adding Design change	Adding nr Change No.	Sgn.	Datum Date	Sgn.	Drawn Date	Headn Projecto.			Benämning	Product/Product	Serial/Serial
SN	1	Removed Tilt Lock p7.7.4.	100781	TMB	10/06/09	Read/Drawn	05/05/11	A50000.0600			Krets Styrm spak/miniratt och Kombiagg	DRFC 400-450	5.2.3/
		T=Tim/Added U=Unger Deleted V=Var/Var				Kontroll/Design			Utgåve	21	Wiring Micro lever/wheel and Combi Att	Revis / Drawing No.	A500001.0100

Lever 815



Ref. No.	Nº	Anding Design change	Avding nr Change No.	Sign.	Datum Date	Rev/Dwn	Sign.	Datum Date	H. Op.	Krets Joystick	Product	Sheet
1	1	Removed Tilt Lock p.7.4.	100781	TMB	100809		TMB	050511	6	Wiring Joystick	DRFC 400-450	7.1.1/
T=Title/Added U=Ugly/Deleted V=Var/Vas										A50001.0100	Ugly/Sheet	21



Ref. No.	Rev.	Change No.	Change Date	Sign.	Design	Drawn	Checked	Approved
1	1	1	10/08/19	TMB	Kretz Design	Gook/Arp		

Rev.	Rev.	Change No.	Change Date	Sign.	Design	Drawn	Checked	Approved
1	1	1	10/08/19	TMB	Kretz Design	Gook/Arp		

Rev.	Rev.	Change No.	Change Date	Sign.	Design	Drawn	Checked	Approved
1	1	1	10/08/19	TMB	Kretz Design	Gook/Arp		

Rev.	Rev.	Change No.	Change Date	Sign.	Design	Drawn	Checked	Approved
1	1	1	10/08/19	TMB	Kretz Design	Gook/Arp		

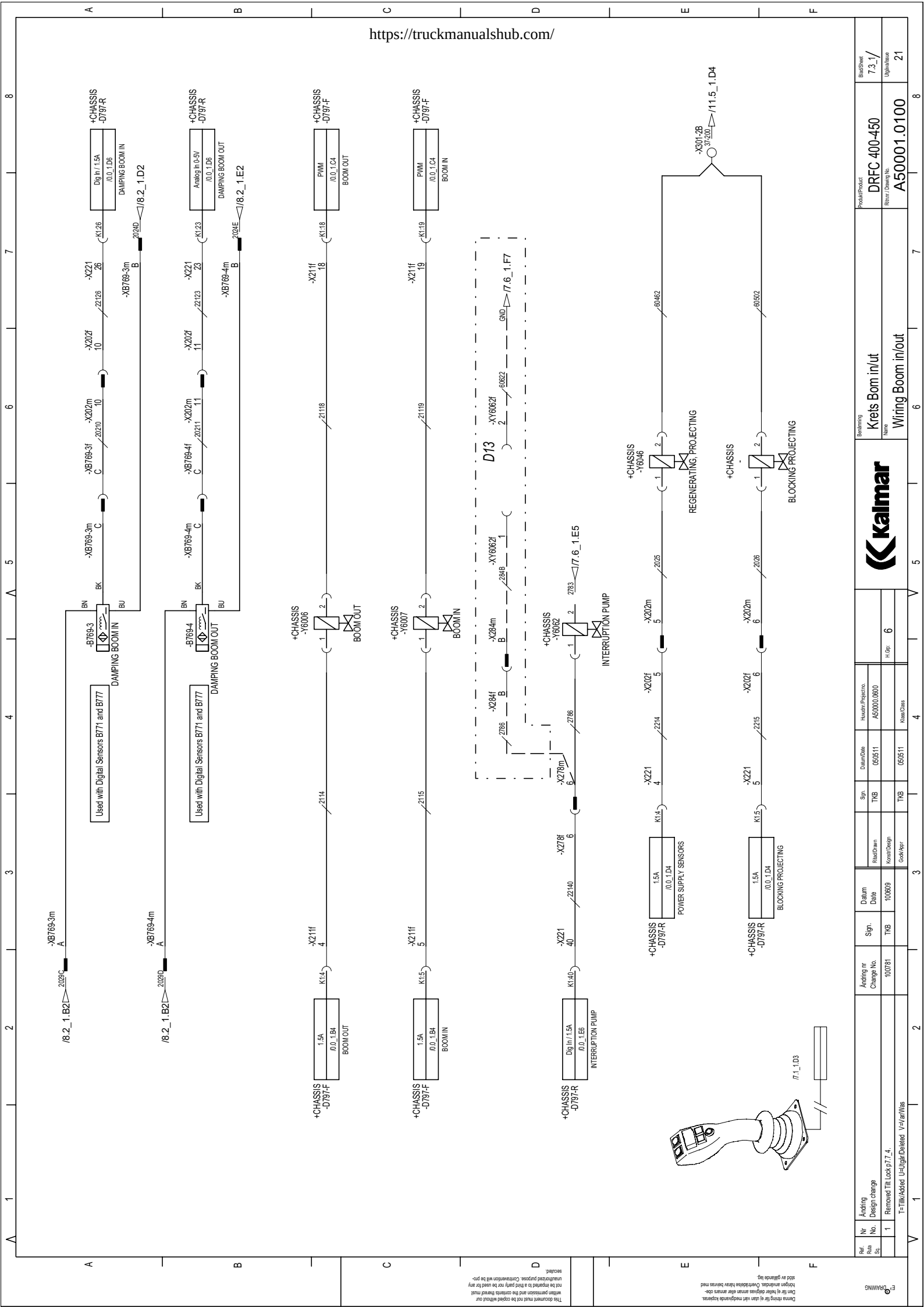
Rev.	Rev.	Change No.	Change Date	Sign.	Design	Drawn	Checked	Approved
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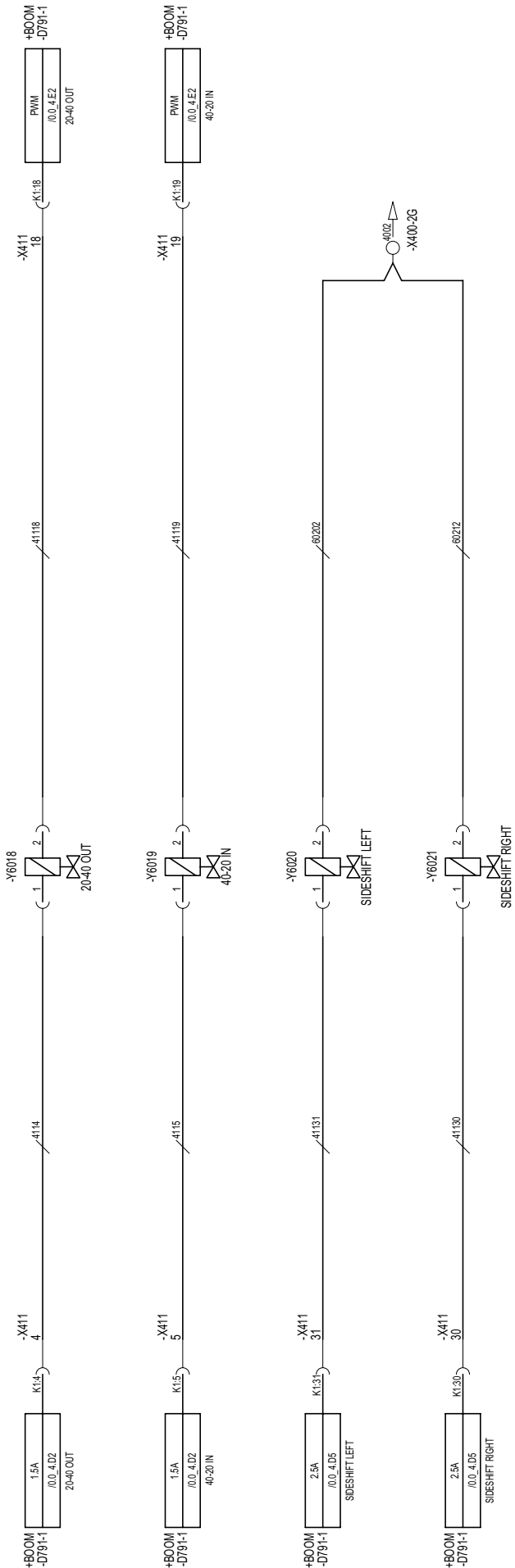
Rev.	Rev.	Change No.	Change Date	Sign.	Design	Drawn	Checked	Approved
1	1	1	10/08/19	TMB	Kretz Design	Gook/Arp		

Rev.	Rev.	Change No.	Change Date	Sign.	Design	Drawn	Checked	Approved
1	1	1	10/08/19	TMB	Kretz Design	Gook/Arp		

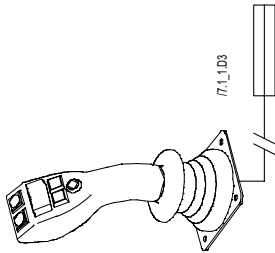
Rev.	Rev.	Change No.	Change Date	Sign.	Design	Drawn	Checked	Approved
1	1	1	10/08/19	TMB	Kretz Design	Gook/Arp		

Rev.	Rev.	Change No.	Change Date	Sign.	Design	Drawn	Checked	Approved
1	1	1	10/08/19	TMB	Kretz Design	Gook/Arp		



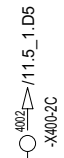


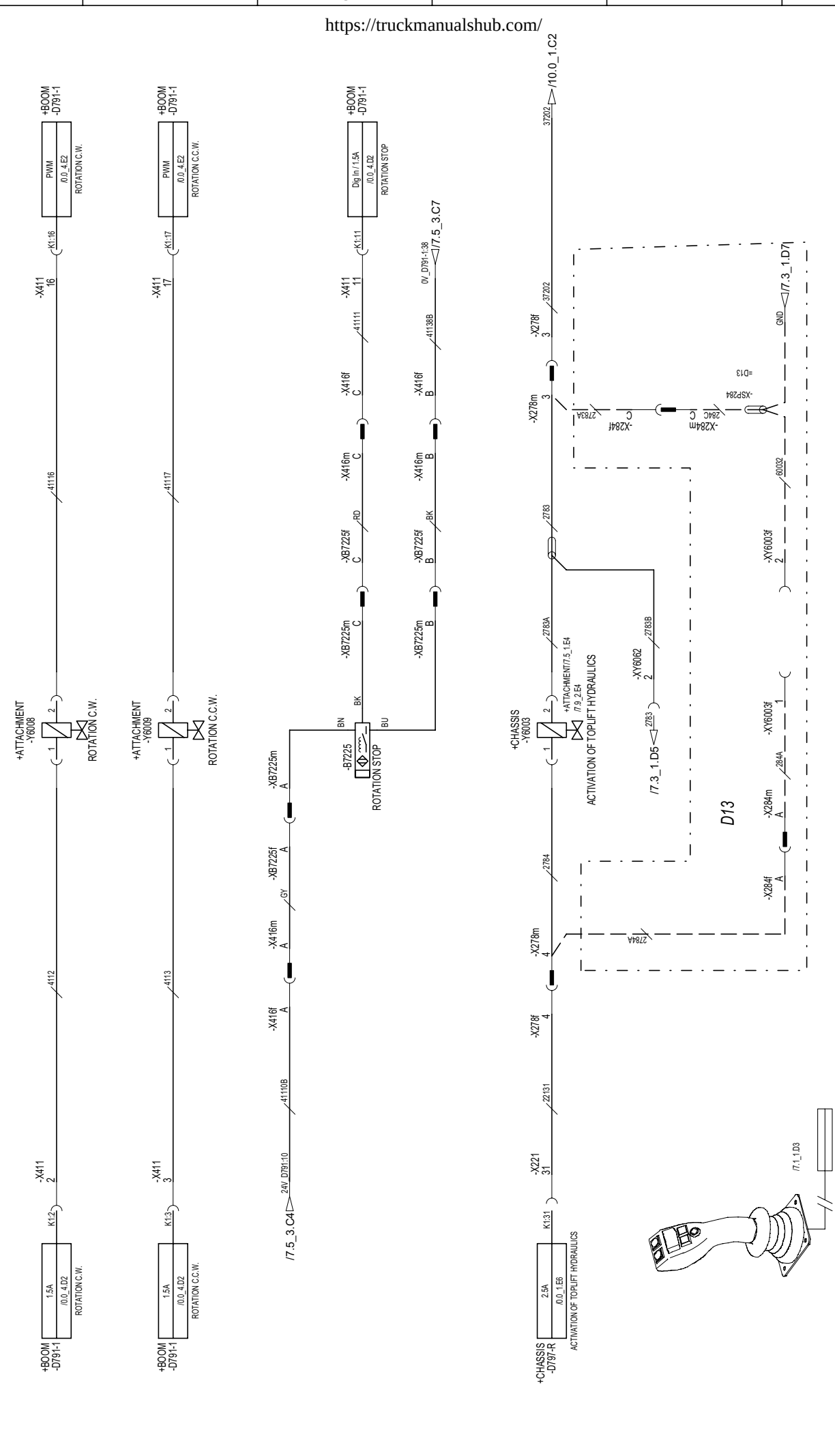
-Y6003
Hydraulic valve
17.6, 1 D5

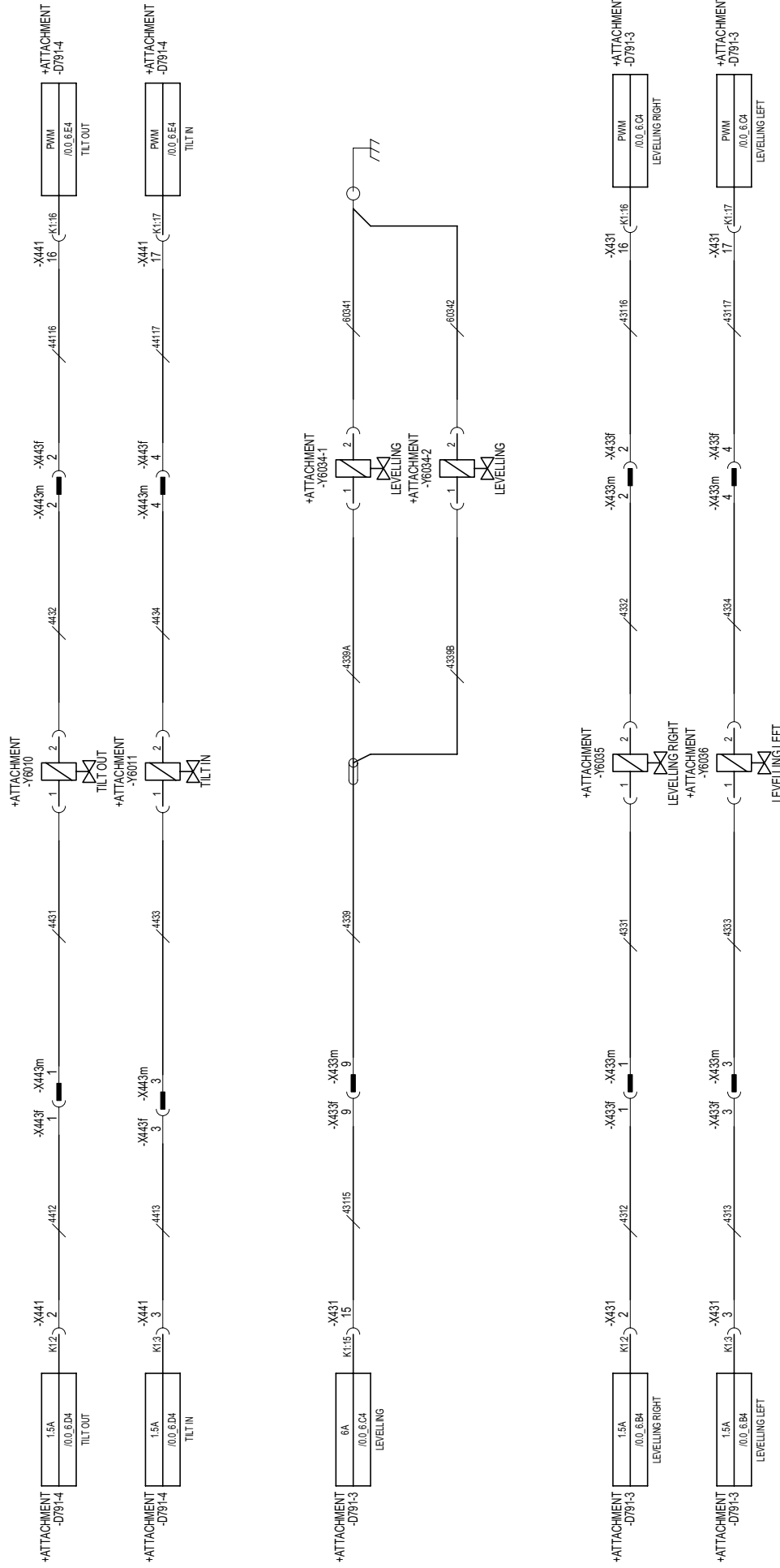


-S1005
OVER RIDE
18.2, 3, 4, 4

Ref. No.	Nº	Anding Design change	Change No.	Sign.	Datum Date	Revised	Sign.	Datum Date	Hydraulic Project	+ATTACHMENT	Name	Model/Product	Sheet No.	Total Sheets
1	1	Removed T11 Lock p.7.4.	100781	TMB	100809				A50001.0800	6	Krets Spreading Ventil	DRFC 400-450	75.1/	21
T=Title/Added U=Ugly Deleted V=Var/Vas												A50001.0100	Ugly/Sheet	21

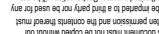
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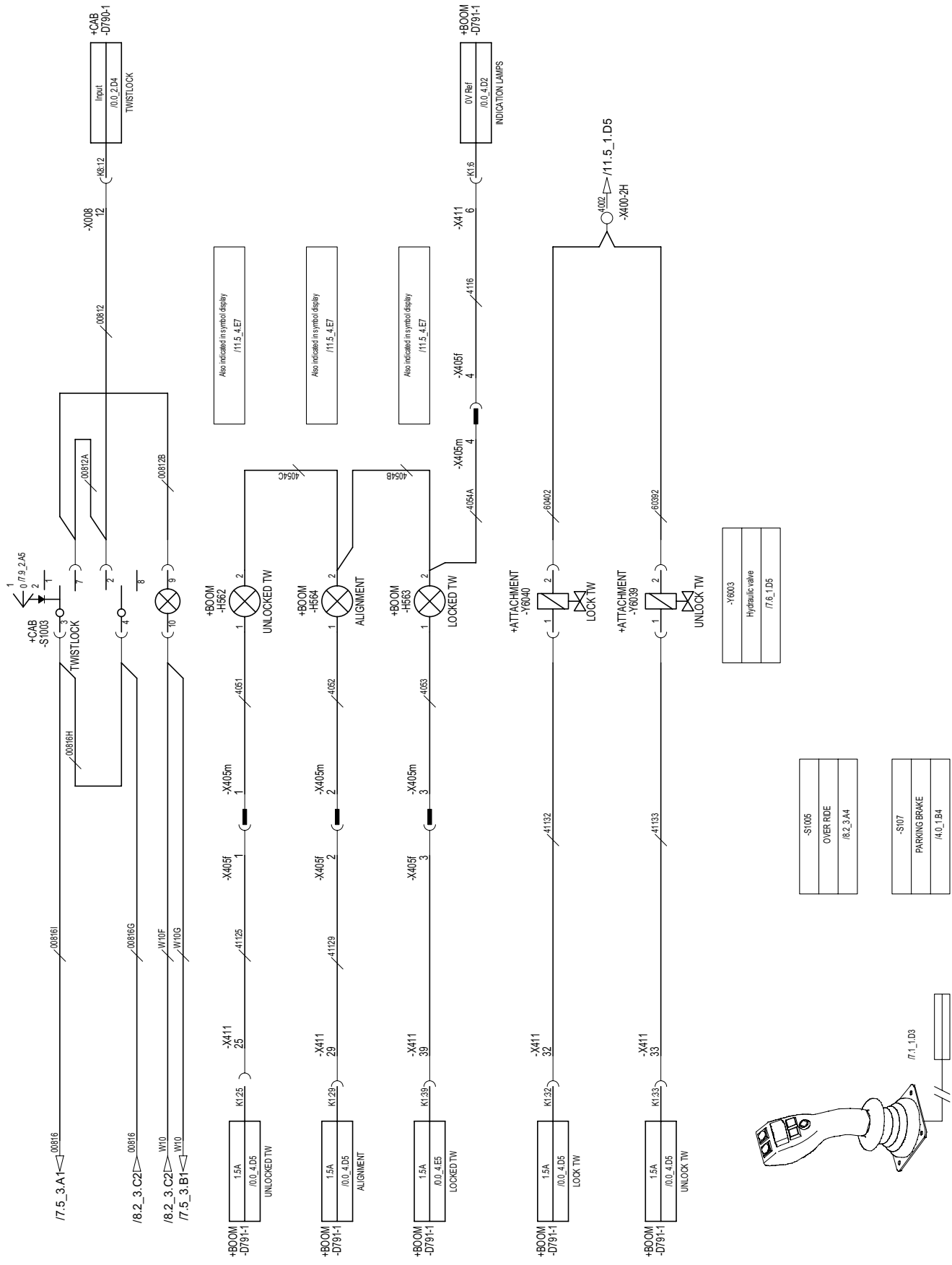
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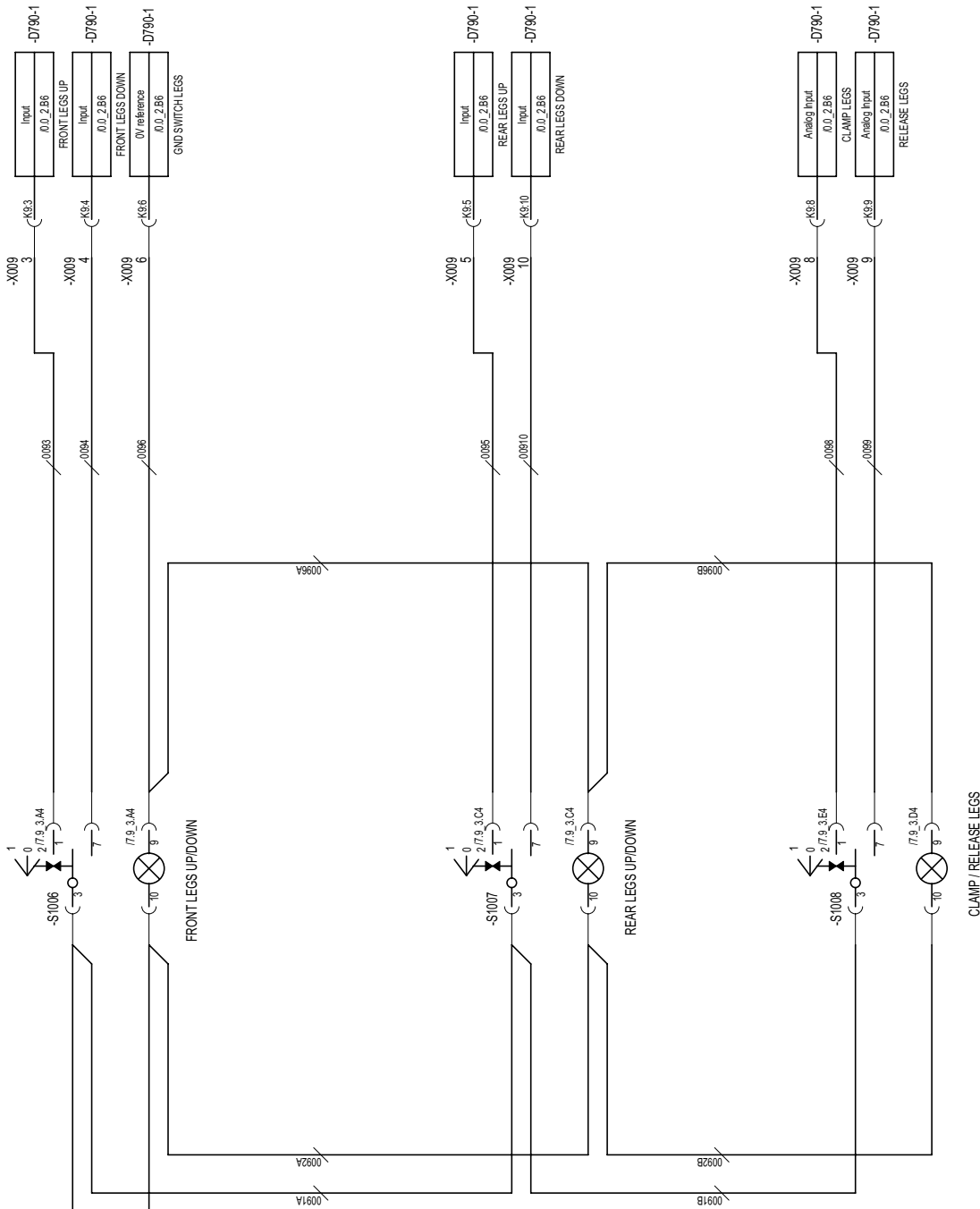
Tilt and levelling with Combi Attachment

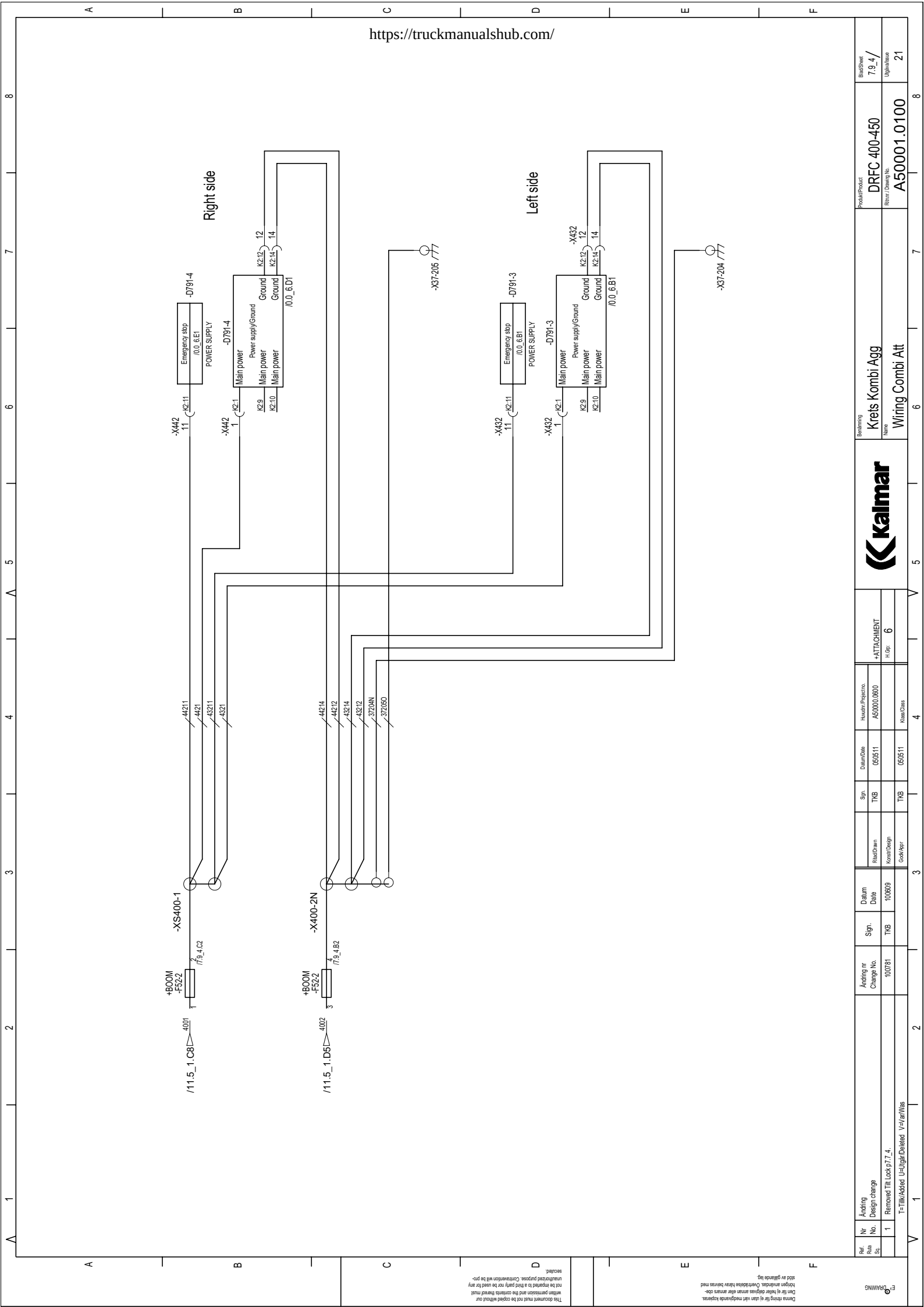
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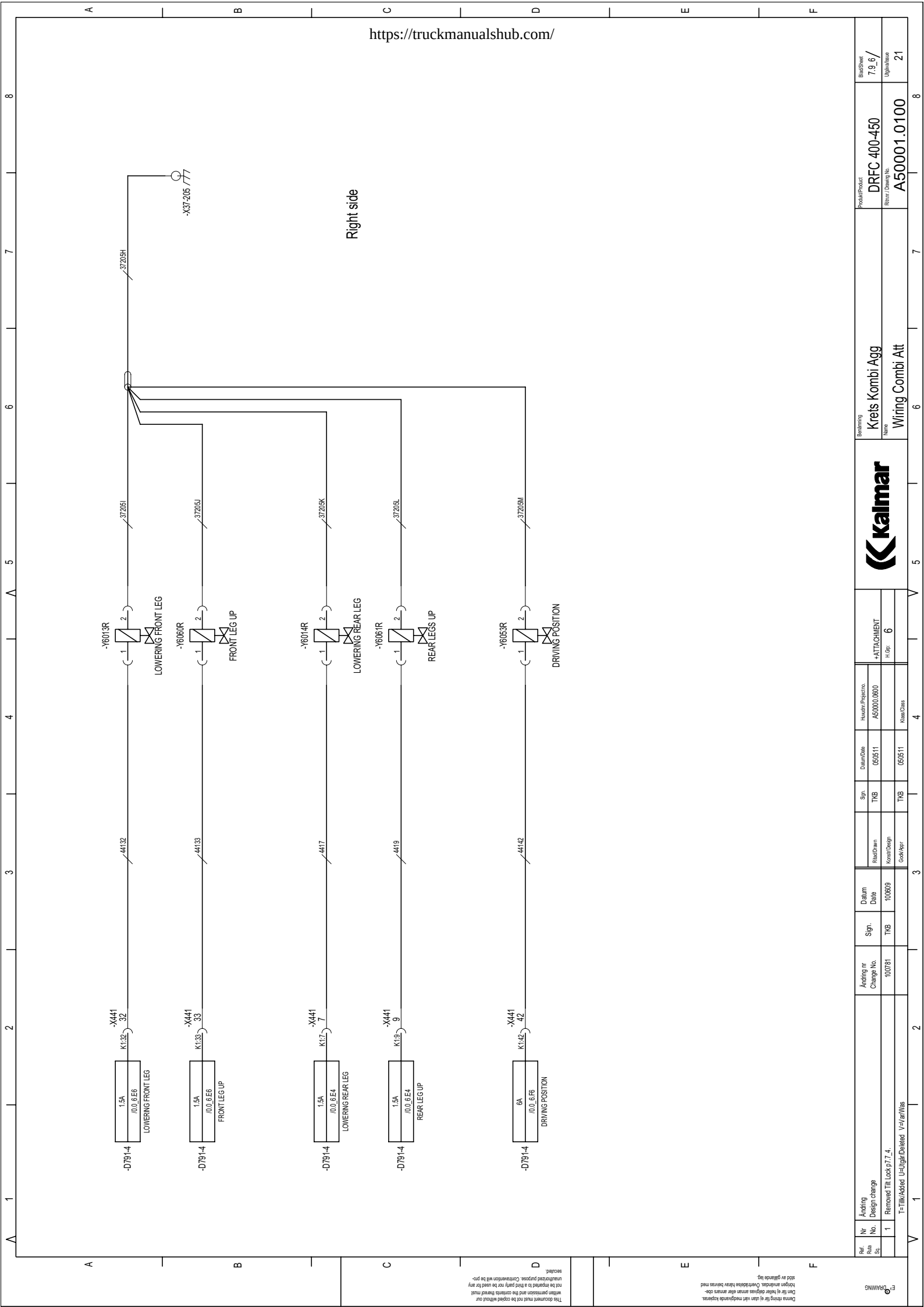




Ref. No.	Andring Design change	Ref. No.	Andring or Change No.	Sign.	Date	Spn.	Drawn Date	House Project No.		Beginning	Product/Model	BlackSteel
1	Removed Tilt lock p.7.4.	100781	100781	TWB	10/08/09	TRB	05/05/11	A50000.0600		Krets Twistlock	DRFC 400-450	79.2 /
T=Trim/Added U=Unger/Deleted V=Van/Was										Notes	Revis / Drawing No.	Update/Issue
										Wiring Twistlock	A50001.0100	21

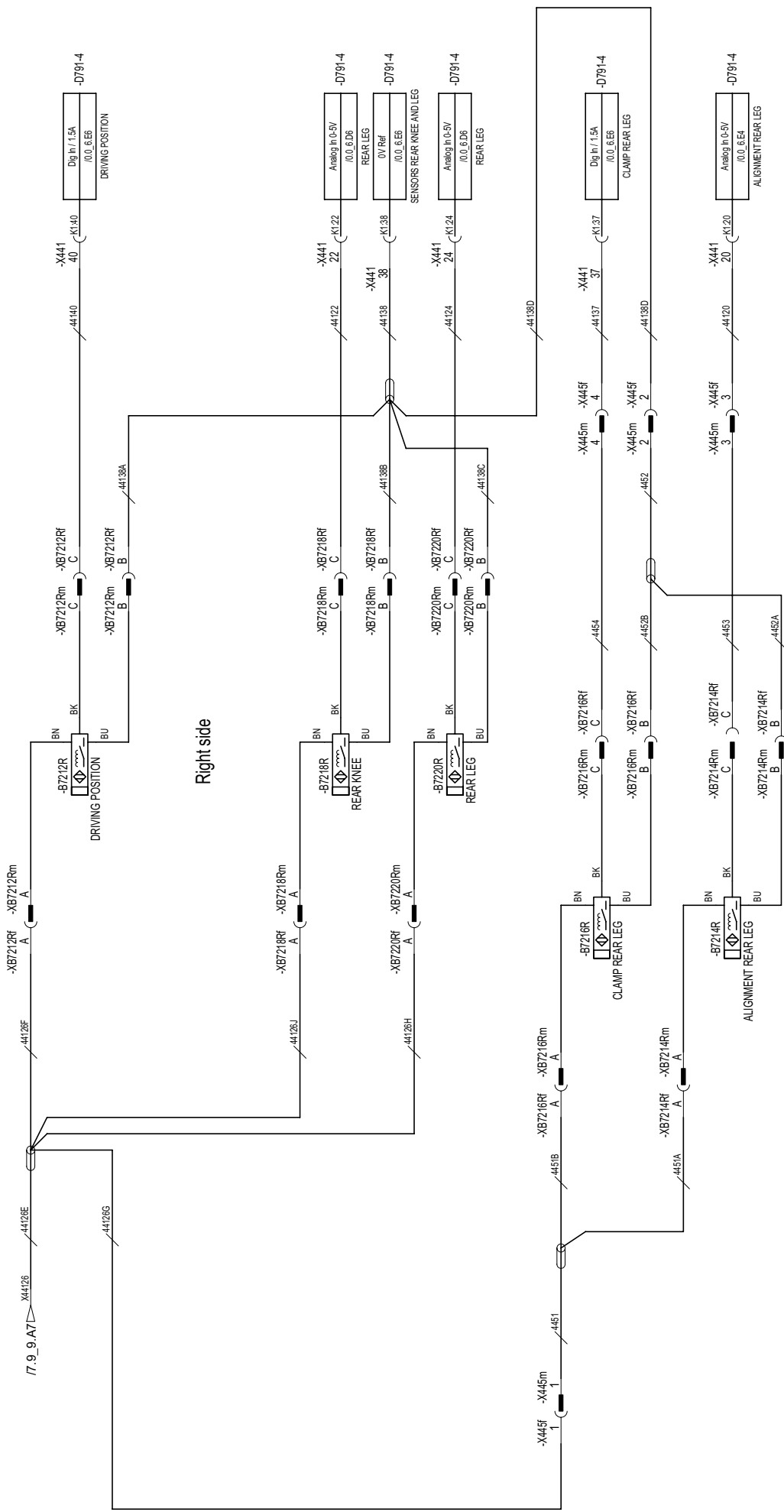
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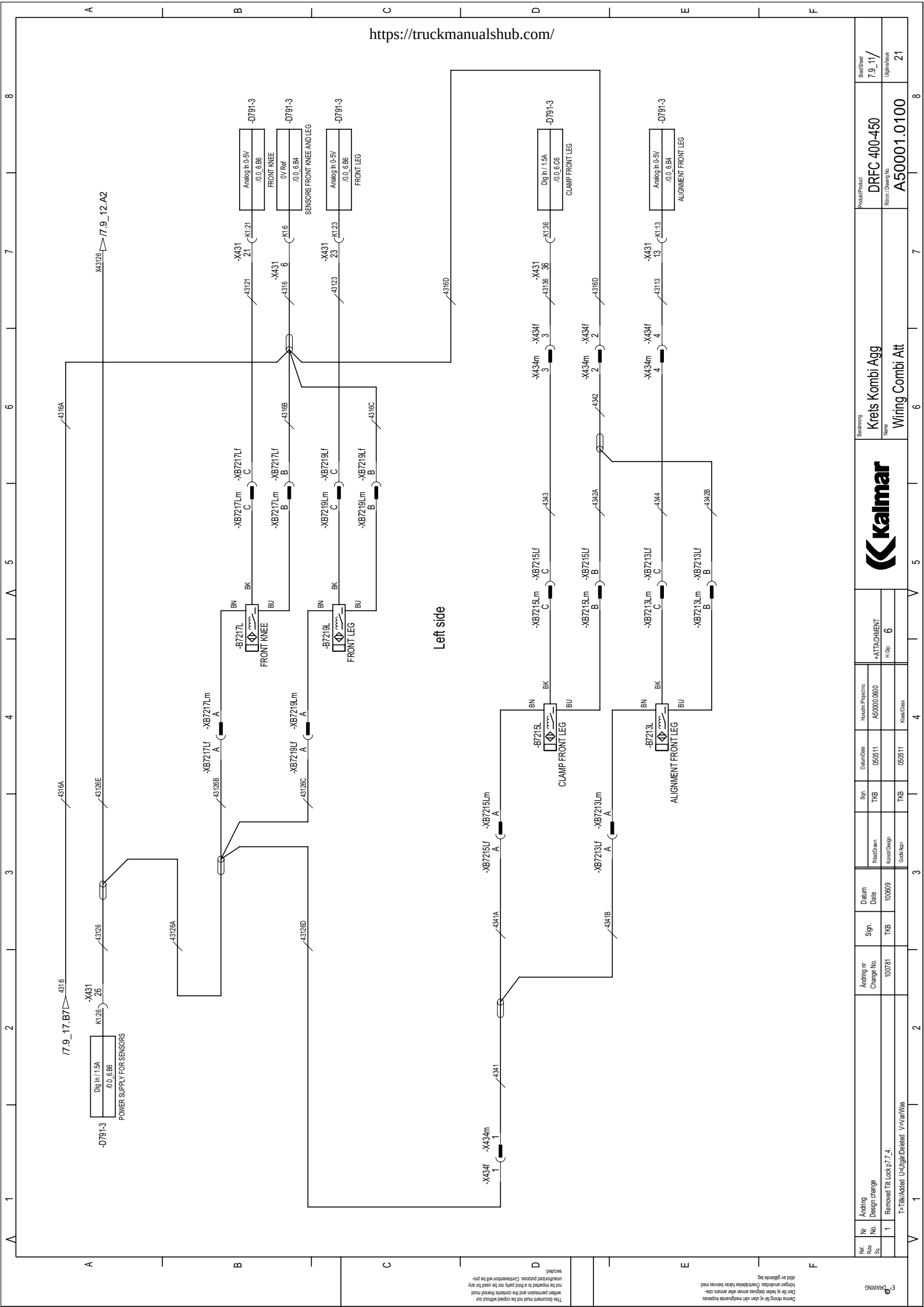




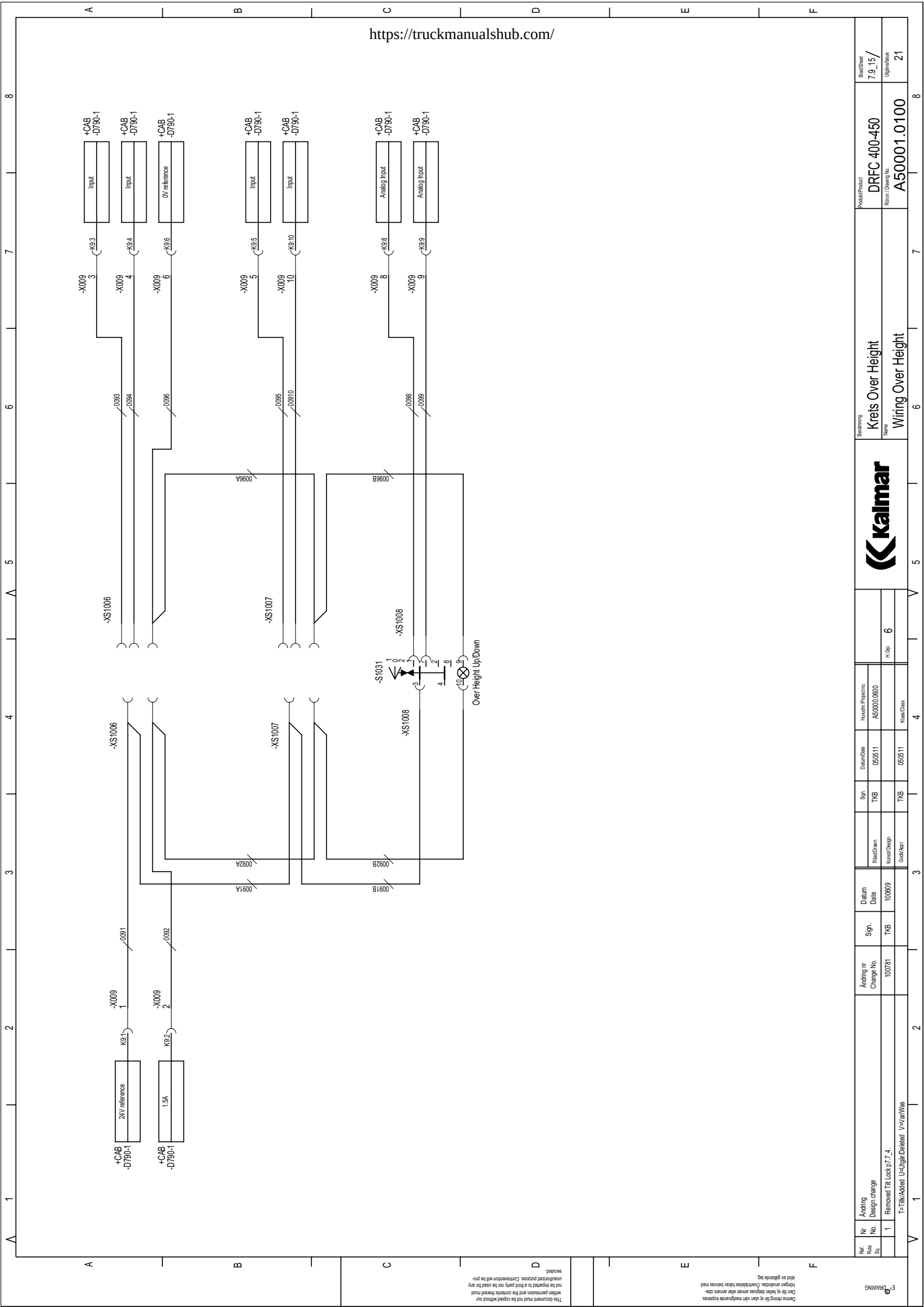
Rev.	Ordering No.	Ordering or Design change	Ordering No.	Design No.	Datum Date	Sgn.	Date/Date	Header Project/	Kreits Kombi Agg		Product/Product	Blank/Sheet
1	1	Removed TFL Lock 67.7.4.	100781	TKB	100609	TKB	050511	A50000.0600	+ATTACHMENT	Name	DRFC 400-450	7.9.9 /
T=Time/Added U=Urgent/Deleted V=Variant										Header / Downst No.	A50001.0100	Urgent/Issue
										Wiring Kombi Att		21

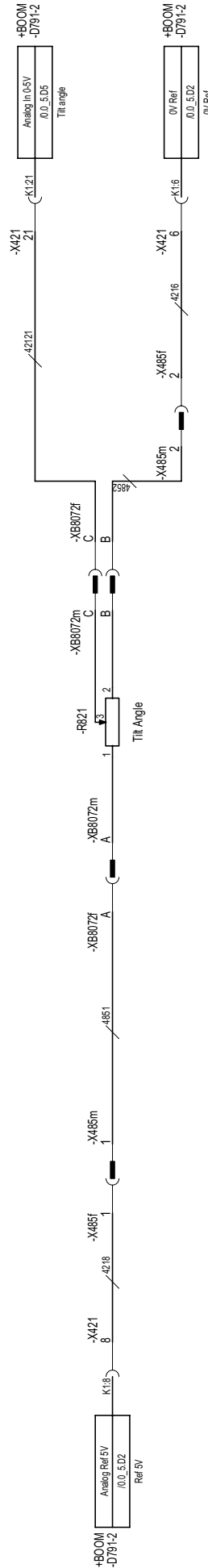
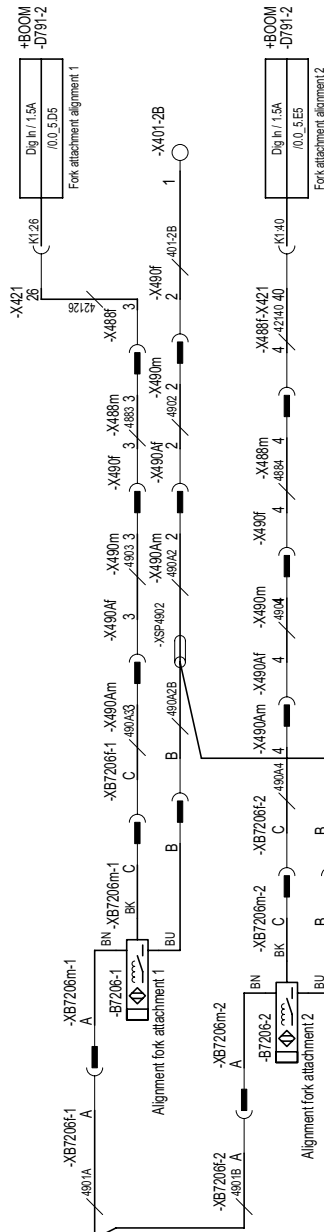


Ref. No.	Andring Design change	Ref. No.	Andring or Change No.	Sign.	Datum Date	Spn.	Drawn Date	Hand-drawn Project No.			Beginning	Product/Product	BlackSteel
Rev. No.									+ATTACHMENT H-01p: 6		Krets Kombi Agg	DRFC 400-450	7.9.10/
1	Removed Tilt lock 0.7.4.		100781	TRB	10/08/09	Reviz/Dawn	10/08/09	Hand-drawn Project No.			None	Reviz / Drawing No	Update release
T=Trim/Added U=Unger Deleted V=Van/Vas													
A50001.0100													
21													

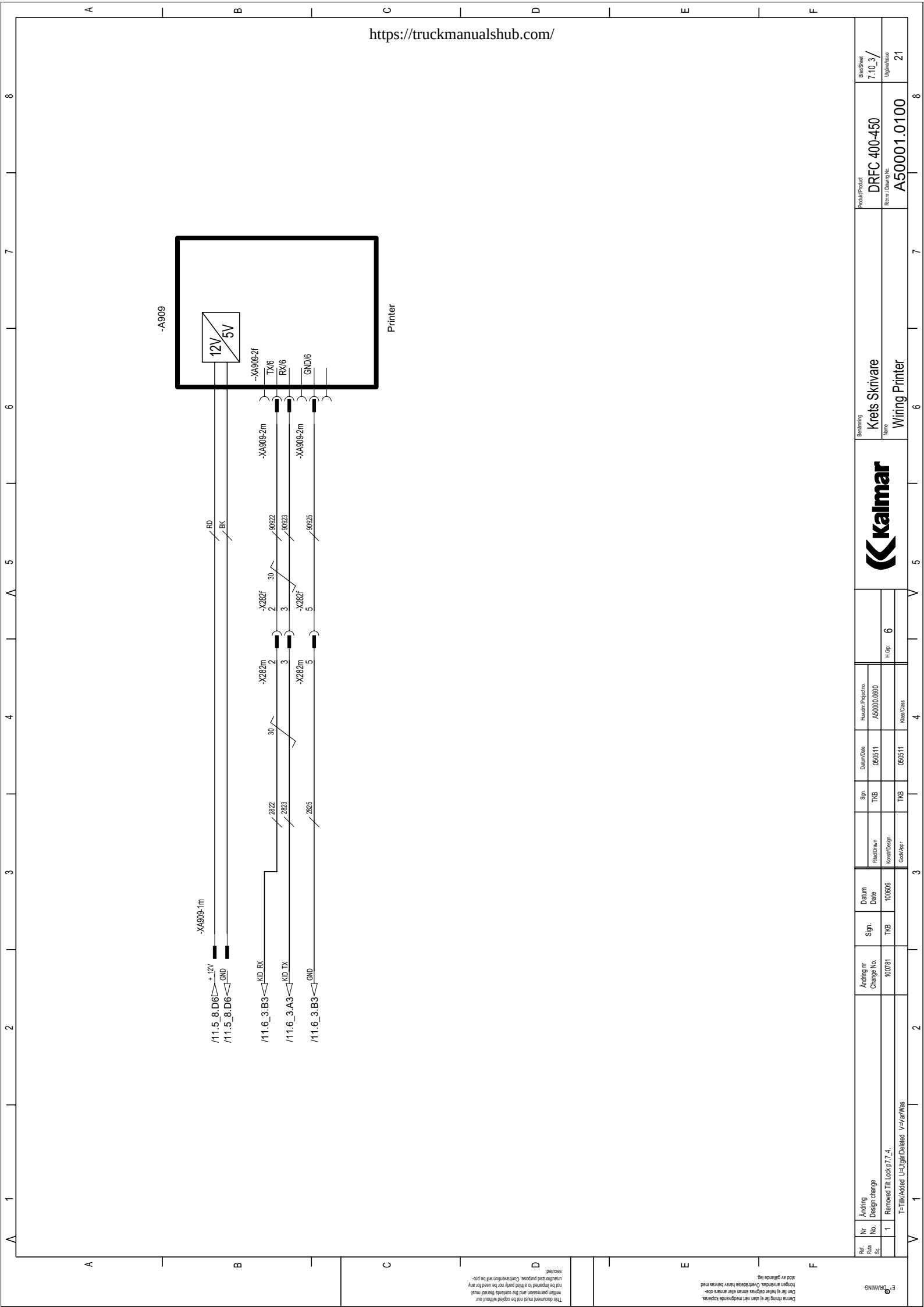


Left side





Andring Nr. Design change 1	Rem. 1 Removed Till Lock p17.4.	Andring nr Design Change No. 100781	Sgn. TKG	Datum Date 100803	Sgn. RSO	Datum Date 100104	Master Projects A50000.0800		Book/Project Krets gaffelaggregat Name Wiring Fork attachment	Product/Model DRFC 400-450 Rotor / Drawing No. A50001.0100	Sheet/Sheet 7.9.18/ Uppdragsnr 21
T= Till/Adress U=Ullgar Deleted V=Var/Nas											



Ref. No.	Rev.	Andring	Design change	Andring nr	Change No.	Sign.	Date	Drawn	Sign.	Date	Project	Project No.	Project Class	Project	Project No.	Project Class
1		Removed	Till Lock p.7.4.	100761	TKB	TKB	100809	TKB	TKB	050511	A50000.0600	A50000.0600	Klass	A50000.0600	A50000.0600	Klass

Andring nr	Change No.	Sign.	Date	Drawn	Sign.	Date	Project	Project No.	Project Class
1	100761	TKB	100809	TKB	TKB	050511	A50000.0600	A50000.0600	Klass

Andring nr	Change No.	Sign.	Date	Drawn	Sign.	Date	Project	Project No.	Project Class
1	100761	TKB	100809	TKB	TKB	050511	A50000.0600	A50000.0600	Klass

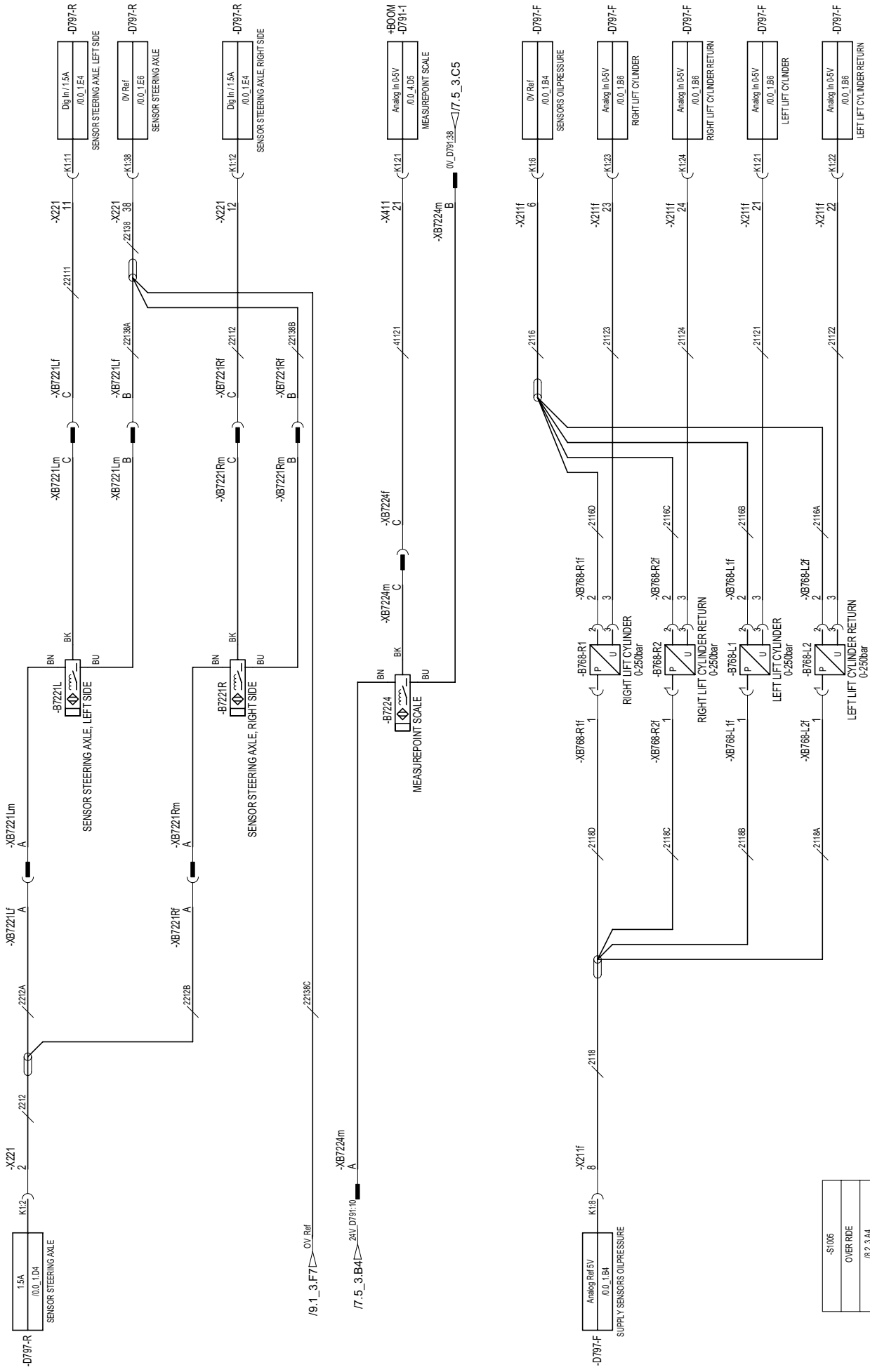
Andring nr	Change No.	Sign.	Date	Drawn	Sign.	Date	Project	Project No.	Project Class
1	100761	TKB	100809	TKB	TKB	050511	A50000.0600	A50000.0600	Klass

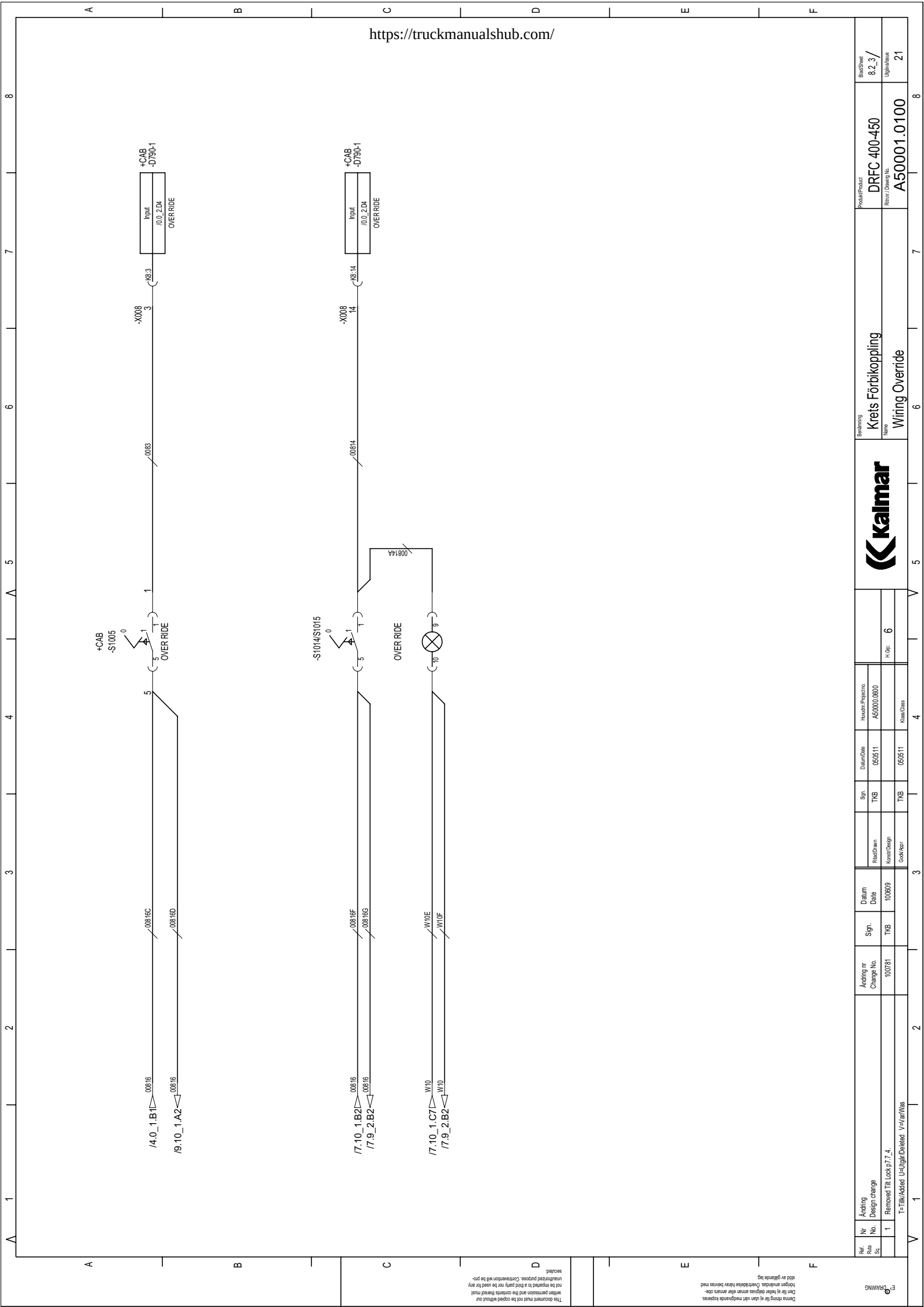
Andring nr	Change No.	Sign.	Date	Drawn	Sign.	Date	Project	Project No.	Project Class
1	100761	TKB	100809	TKB	TKB	050511	A50000.0600	A50000.0600	Klass

Andring nr	Change No.	Sign.	Date	Drawn	Sign.	Date	Project	Project No.	Project Class
1	100761	TKB	100809	TKB	TKB	050511	A50000.0600	A50000.0600	Klass

Andring nr	Change No.	Sign.	Date	Drawn	Sign.	Date	Project	Project No.	Project Class
1	100761	TKB	100809	TKB	TKB	050511	A50000.0600	A50000.0600	Klass

Andring nr	Change No.	Sign.	Date	Drawn	Sign.	Date	Project	Project No.	Project Class
1	100761	TKB	100809	TKB	TKB	050511	A50000.0600	A50000.0600	Klass

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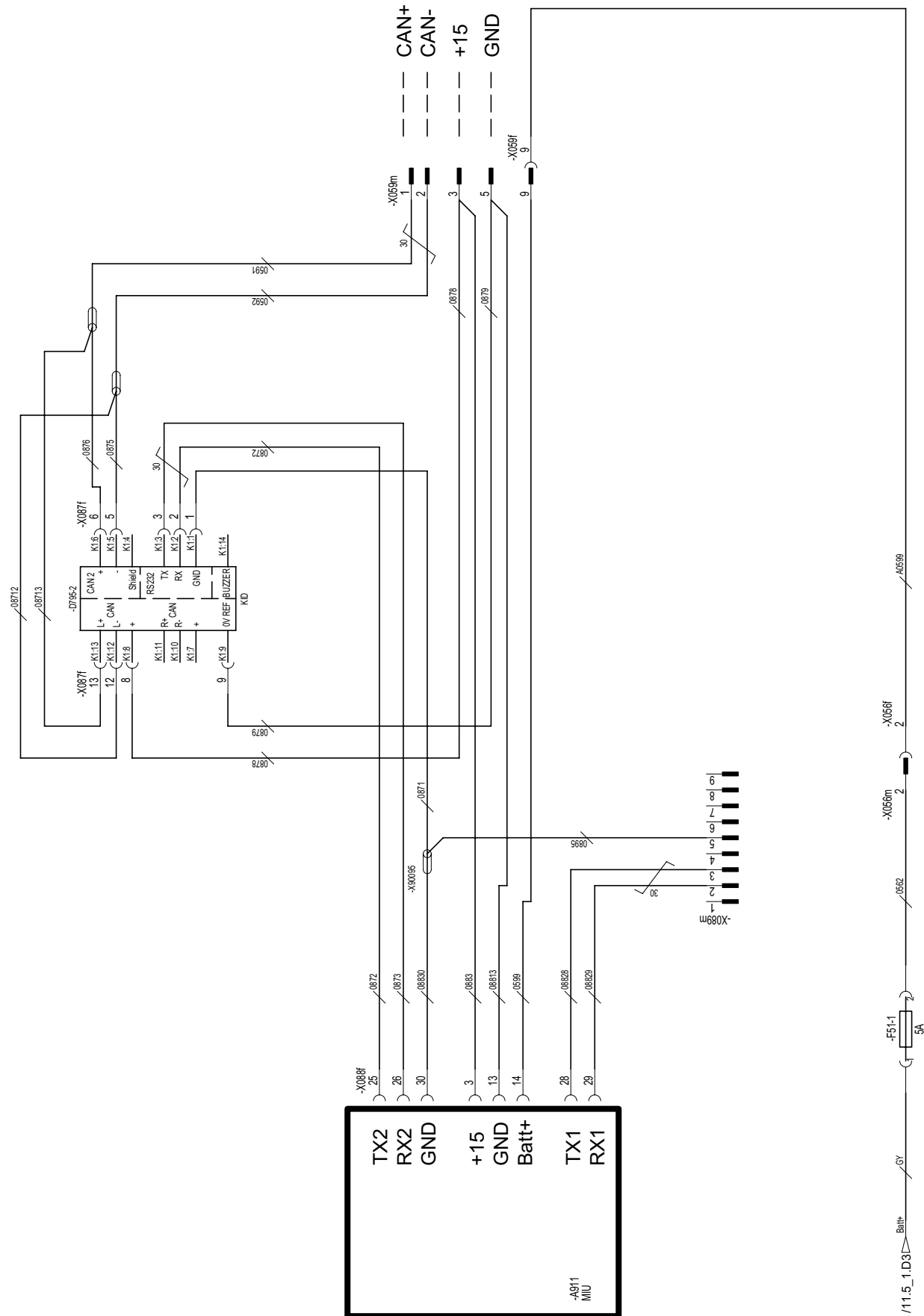


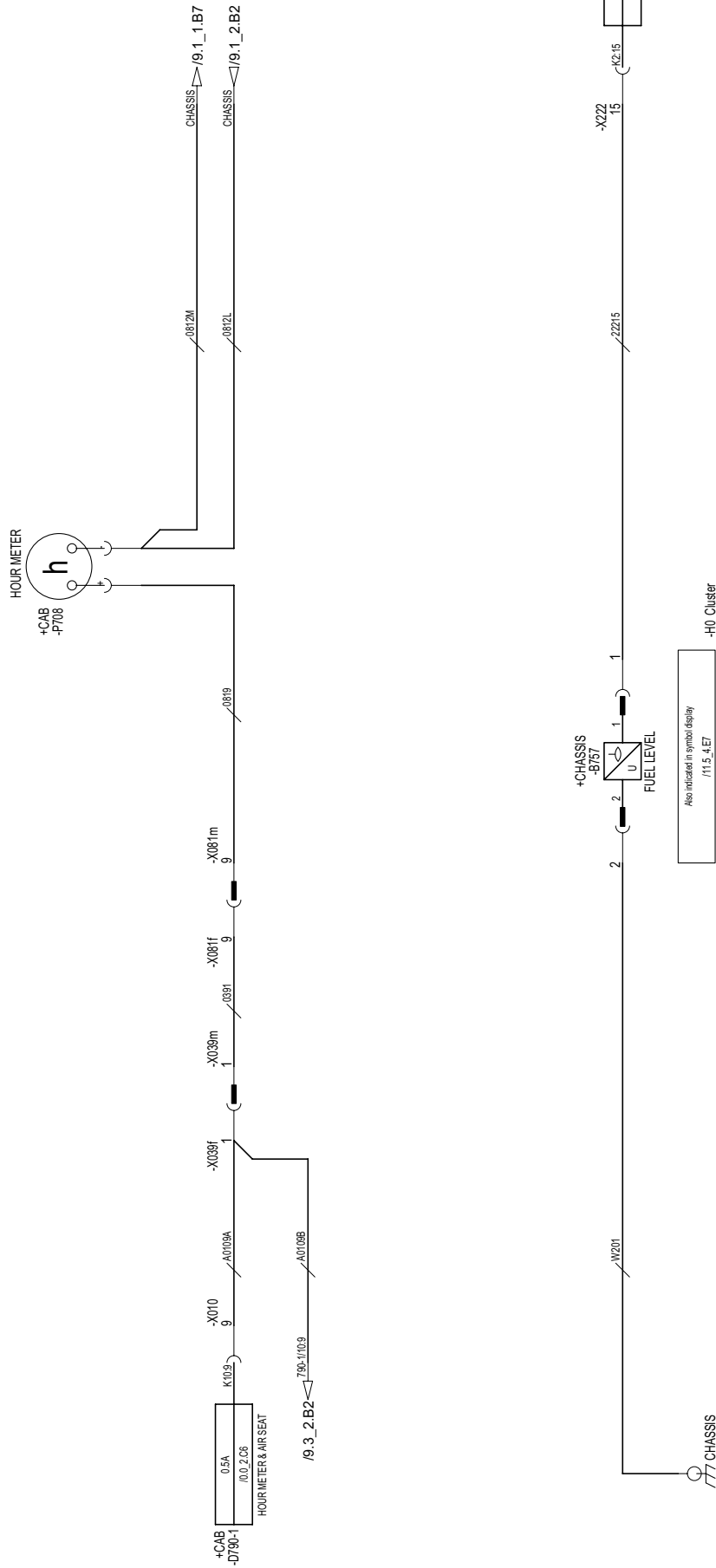
Rev.	Nr.	Andring	Design change	Design No.	Sign.	Date	Drawn	Sign.	Date	Project	Class	Class
1	1	Removed T11 Lock p.7.7.4.	100781	TKB	100809	TKB	050511	TKB	050511	A50000.0800	A50001.0100	A50001.0100

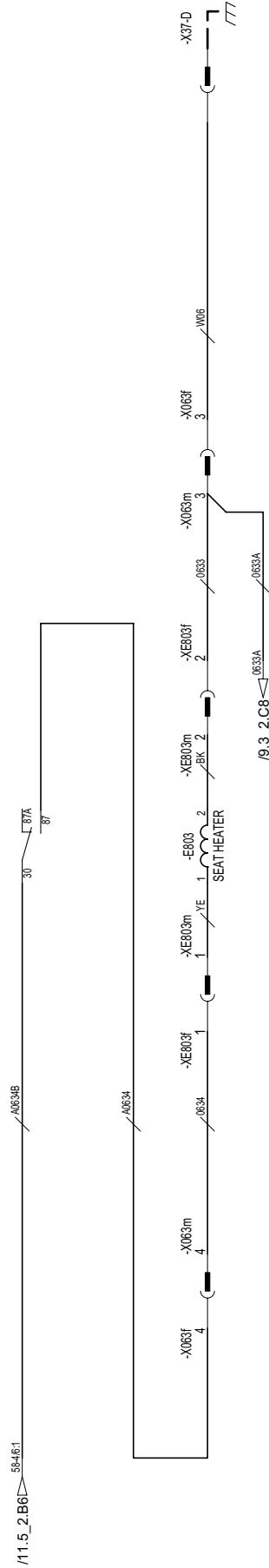
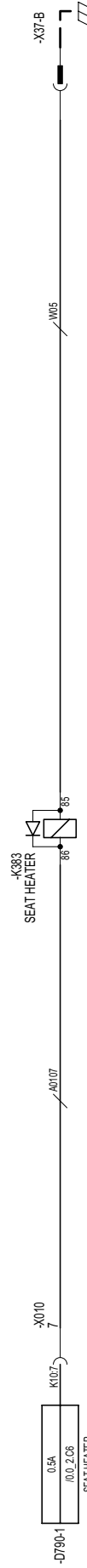
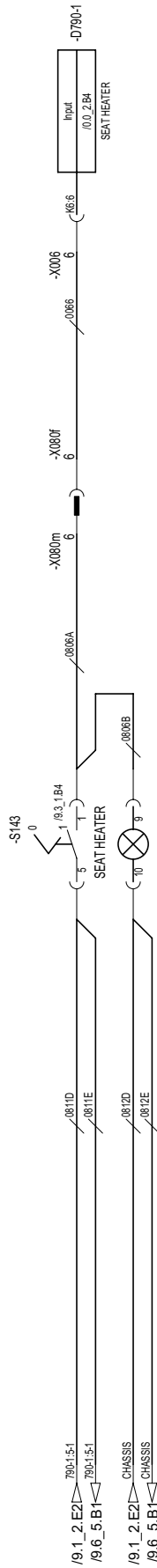
Krets Föribikoppling		Wiring Override	
Name		A50001.0100	

Kalmar		Krets Föribikoppling		Wiring Override	
Name		A50001.0100		A50001.0100	

Product		DRFC 400-450		82.3 /	
Revision		A50001.0100		21	

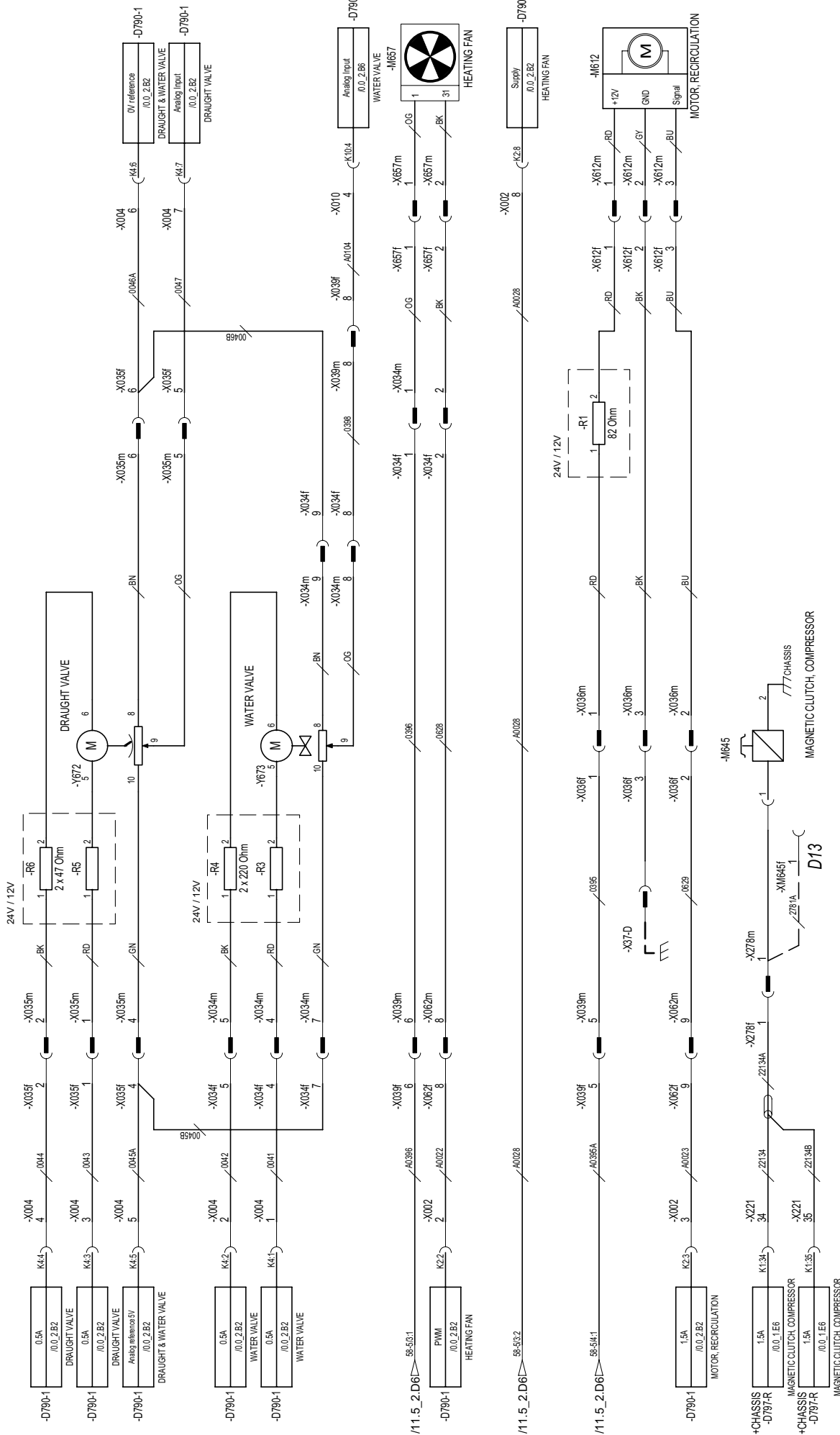
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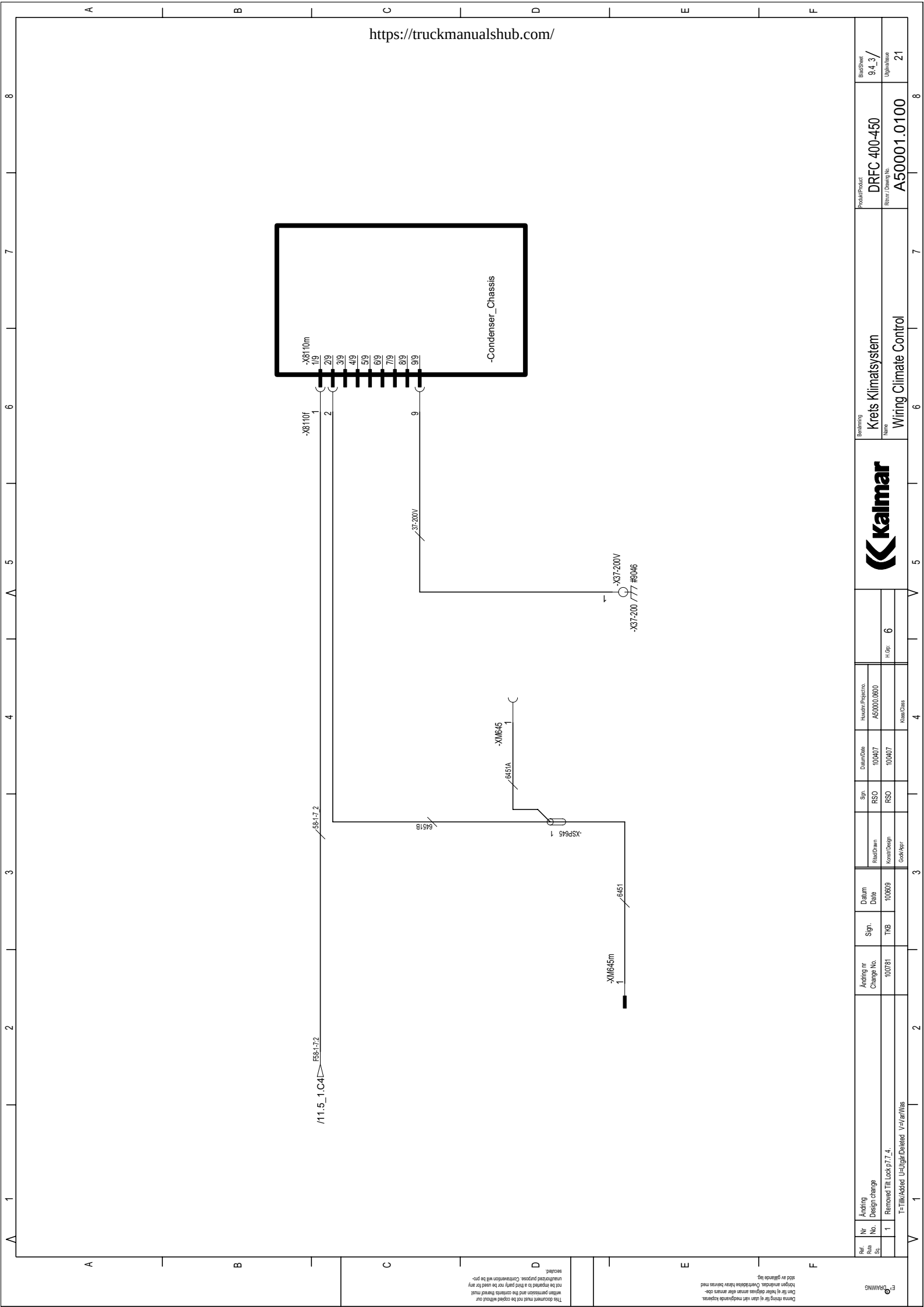
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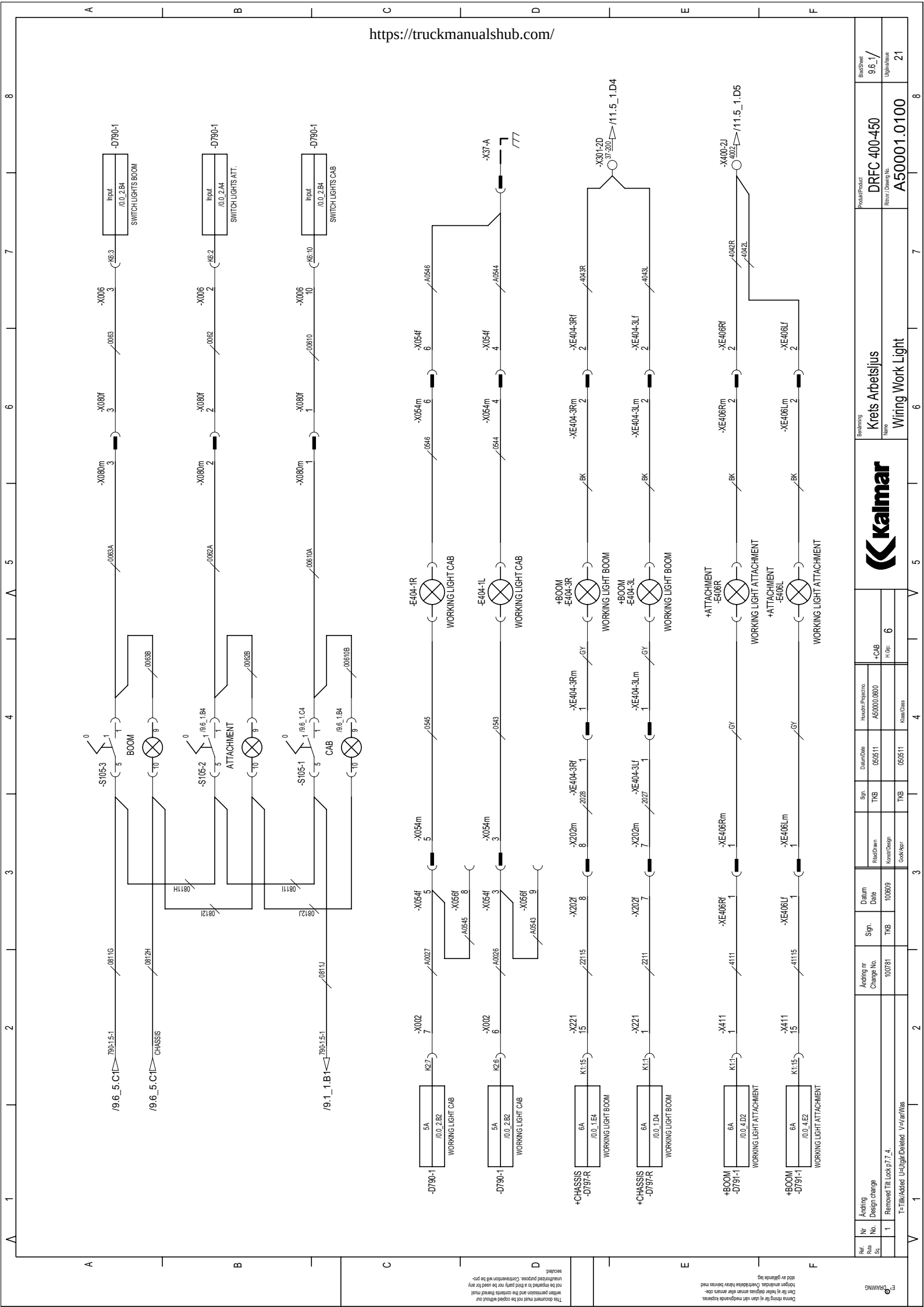
ELECTRICAL HEAT

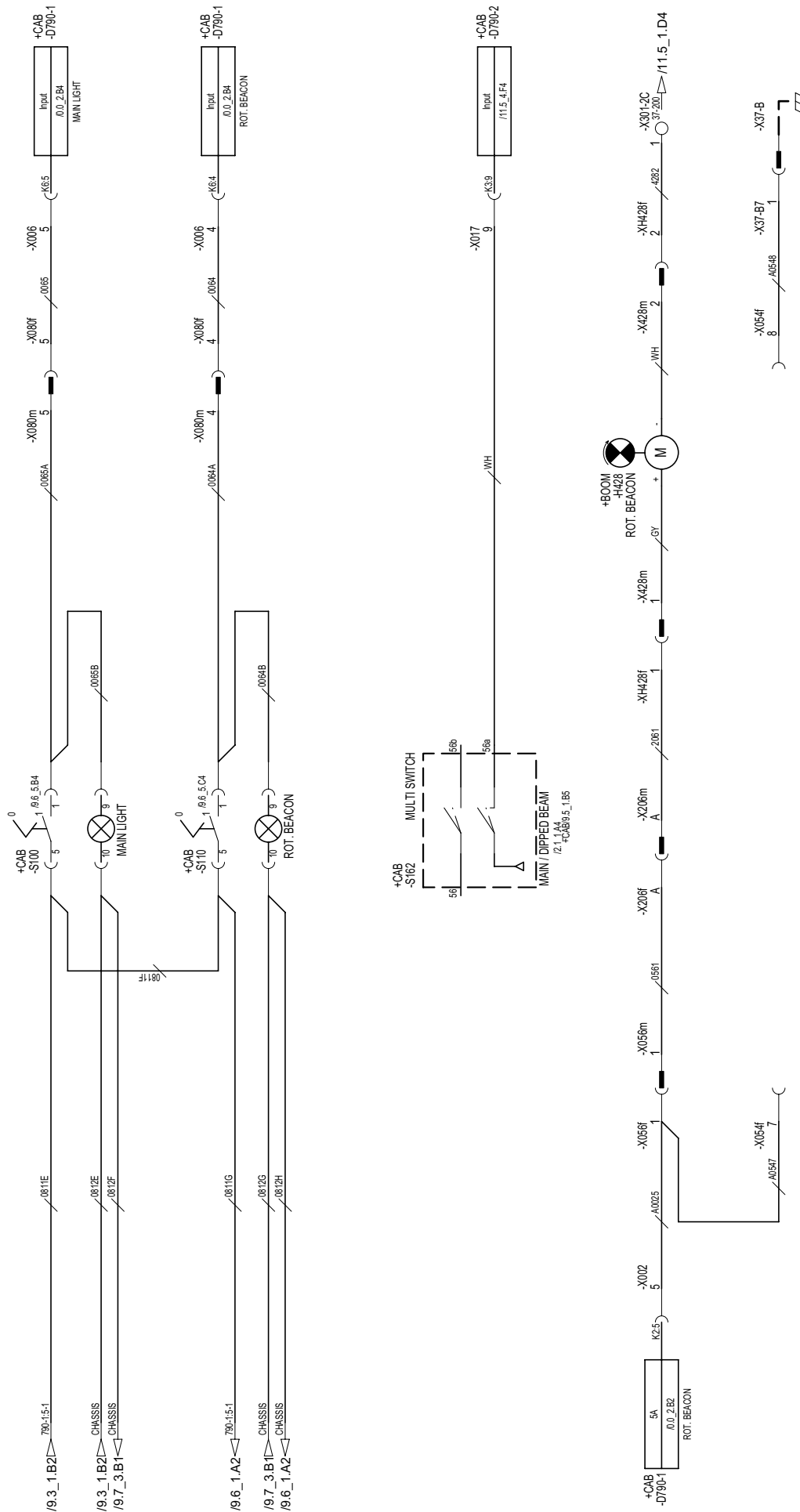
RF Rev Sg	Nr No.	Ändring Design change	Ändring nr Change No.	Sign.	Datum Date	Sign.	Datum Date	Modell/Projektnr. Model/Project No.	Sign.	Modell/Produkt Model/Product	Blad/Sheet 9.3.1/
1	1	Removed Title Lock p 7.4.	100781	TKB	100609	TKB	050511	A50000.0900	+CAB	DRFC 400-450	9.3.1/
										Wiring Cab Seat OPT	Uppskallade Upgrades
										Wiring Cab Seat OPT	21

[illegible]

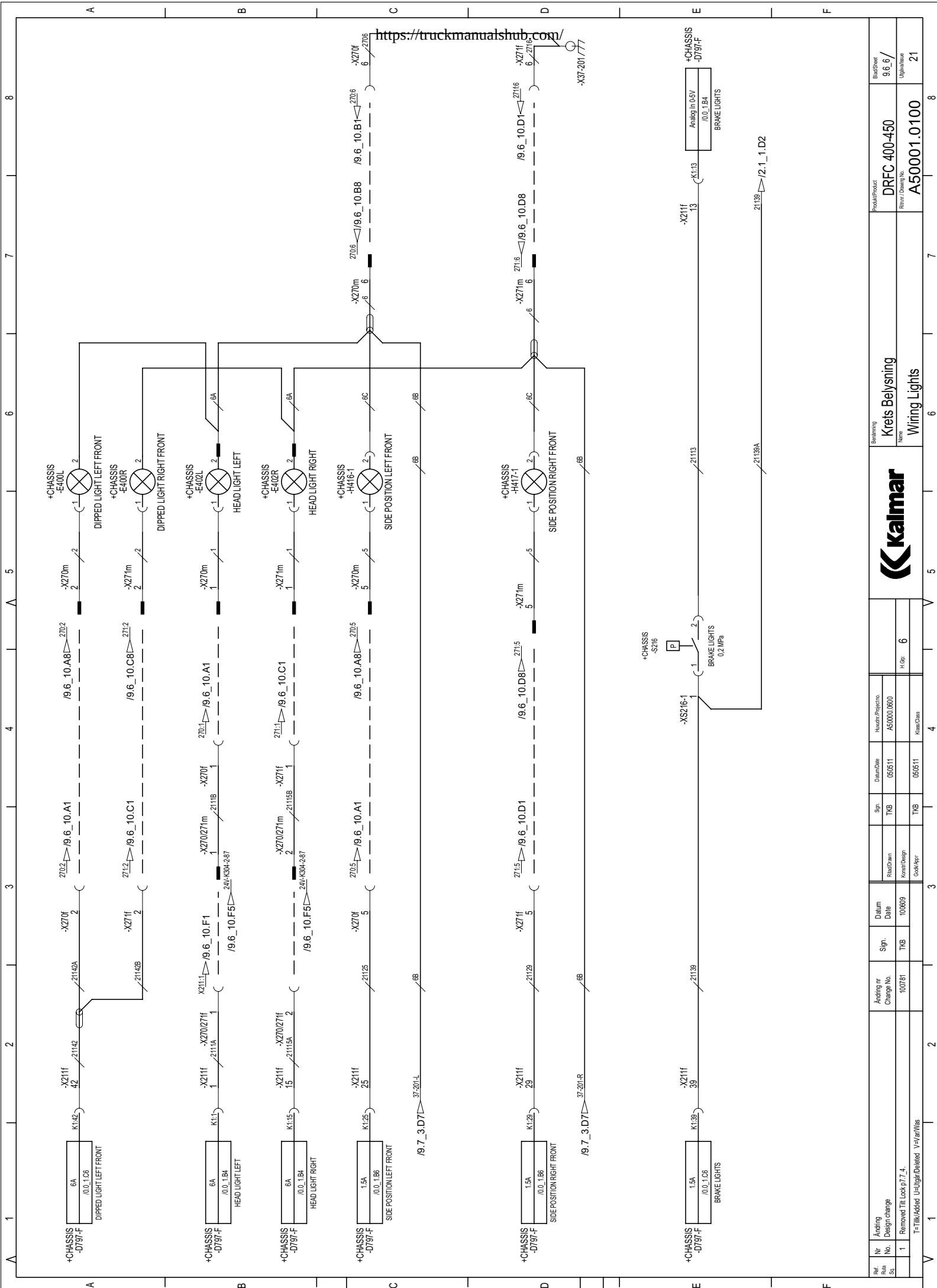


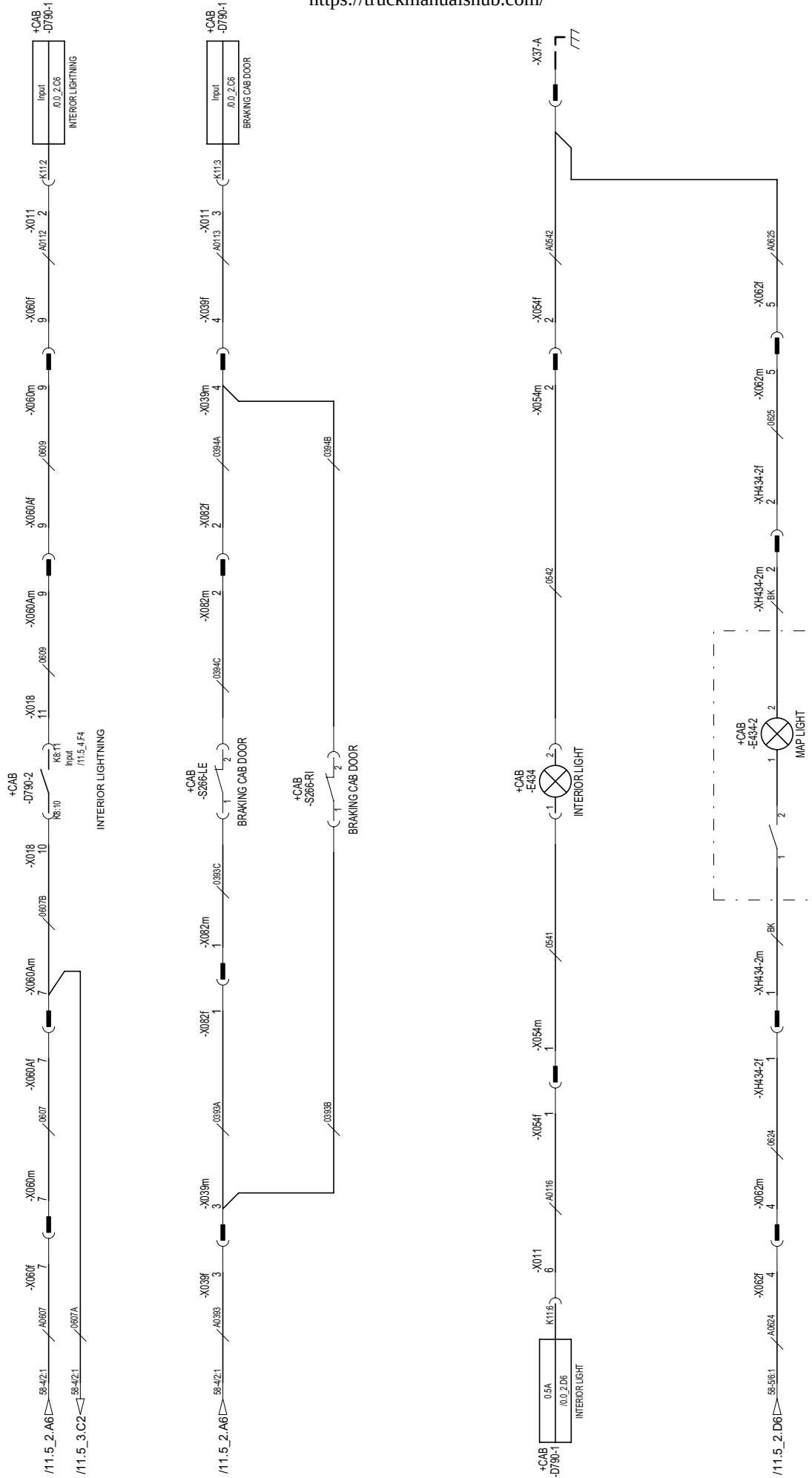


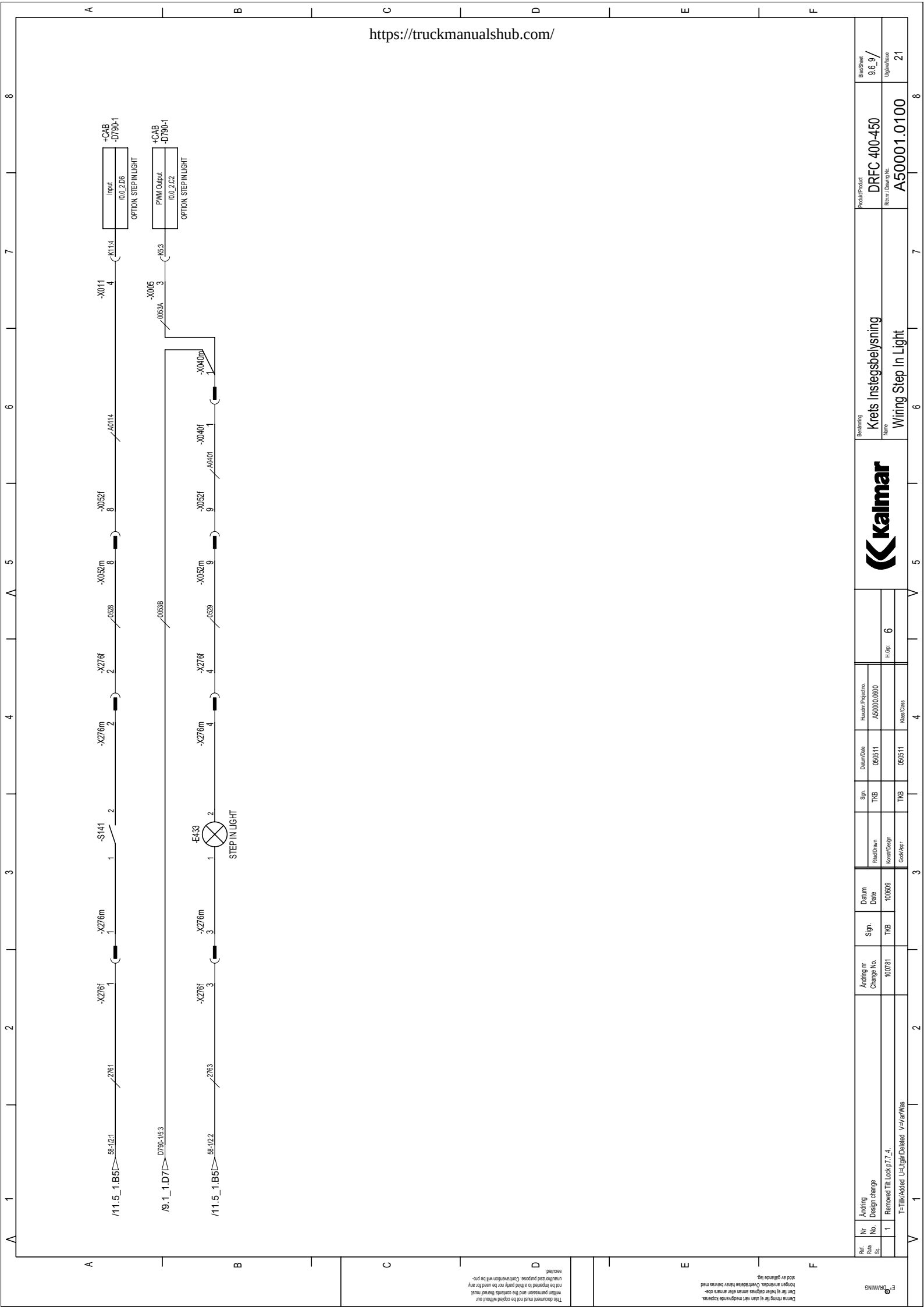




Ref. / Rev. / Rev. / Rev. /	Nr Anding Design change	Anding nr Design No.	Sign.	Datum Date	Datum	Sign.	Date	Inventor / Project no.		Drawing Name	Drawing No.	Drawing Scale				
													Rev'd Own	Rev'd Design	Rev'd Appr	Rev'd Class
1	Removed Tilt Lock p.7.7.4.	100761	TMB	100809		TMB	050511	Krets Belysning	Wiring Lights	DRFC 400-450	9.6.5 /	21				
										A50001.0100						



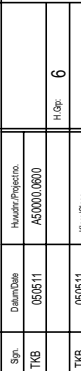
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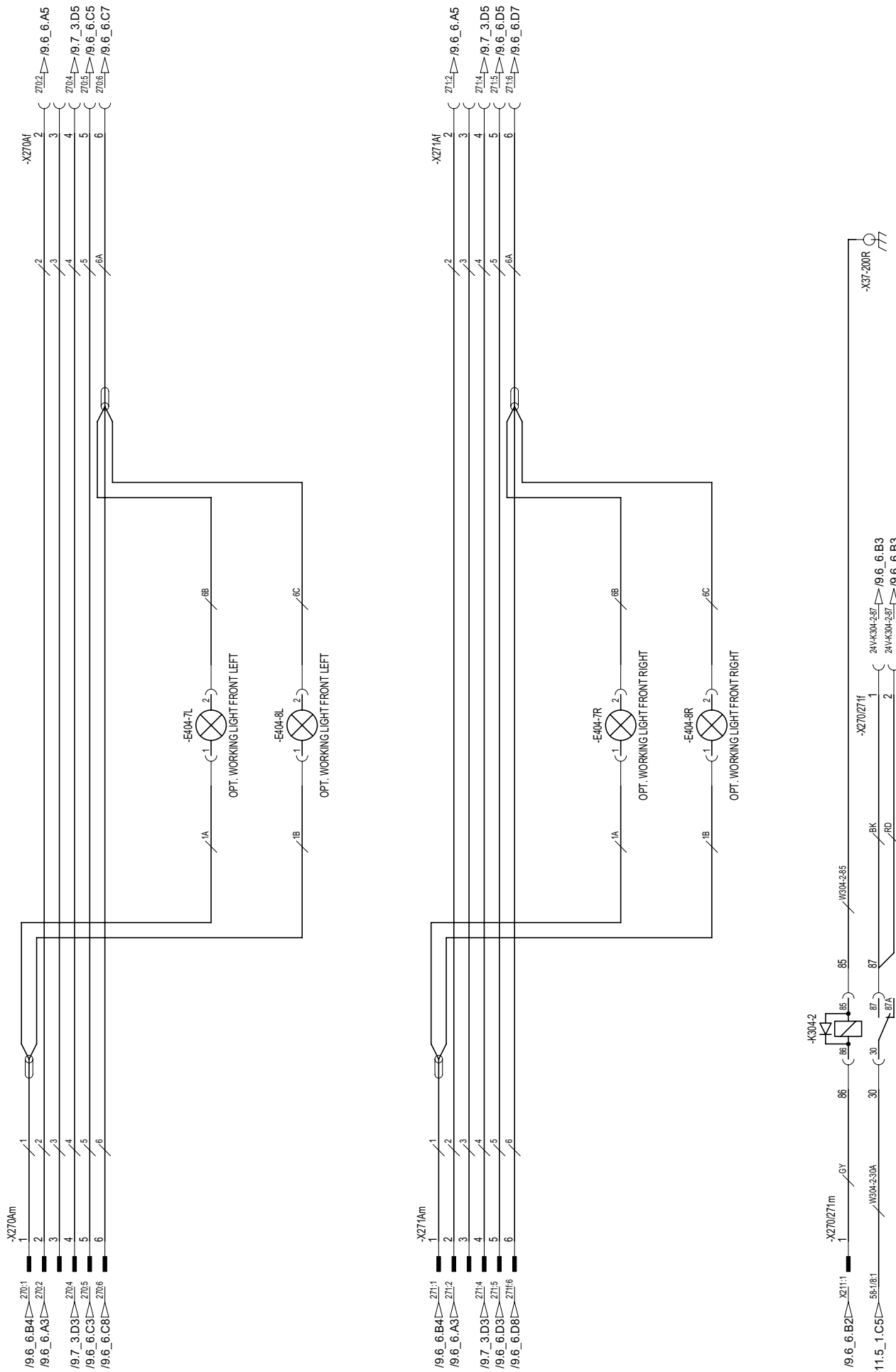


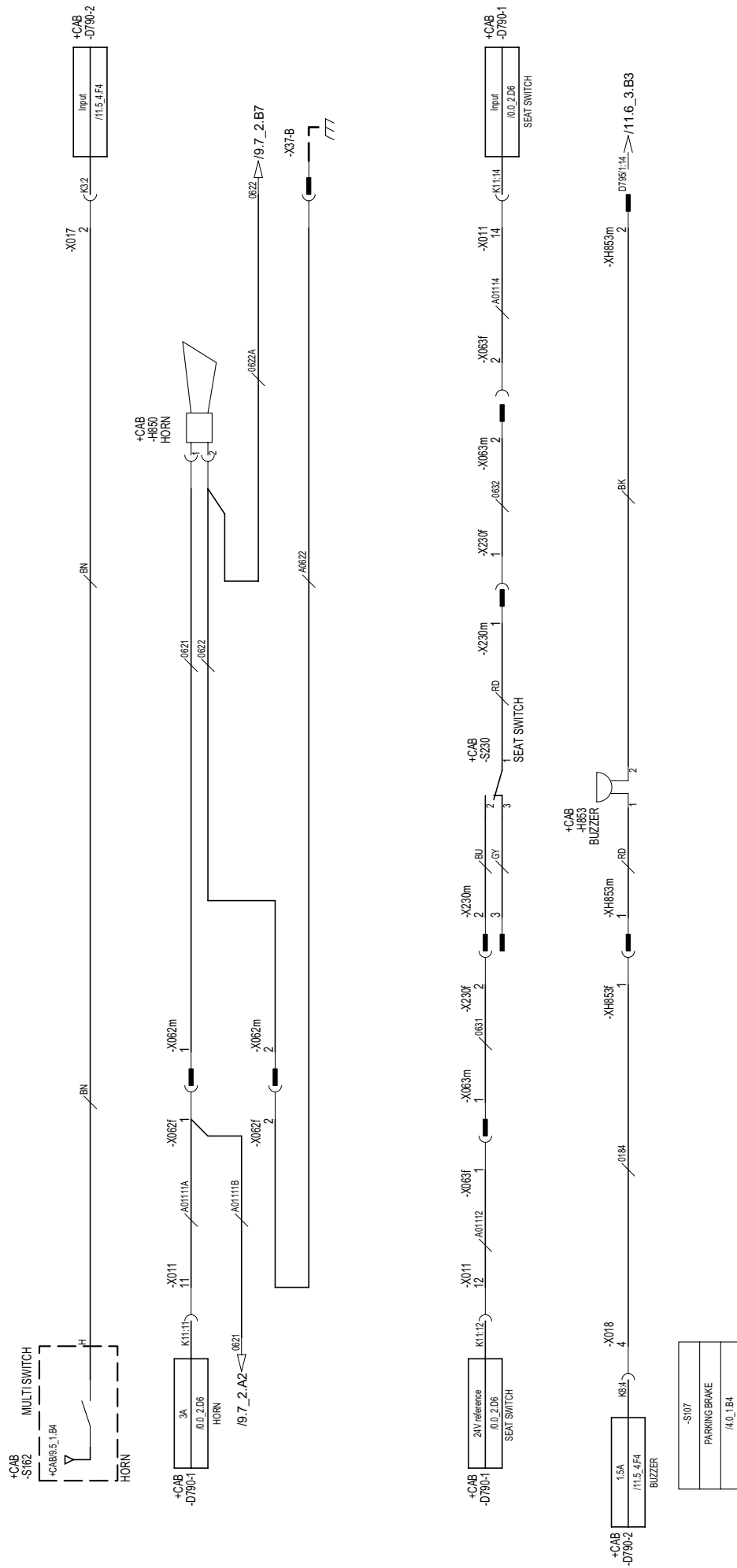
Rev.	Nr.	Andring	Design change	Design No.	Sign.	Datum	Date	Rev.	Drawn	Checked	Project No.	Revision
1	1	Removed	Till Lock p.7.4.	100781	TKB	100809	100809	1	TKB	TKB	A50000.0600	6

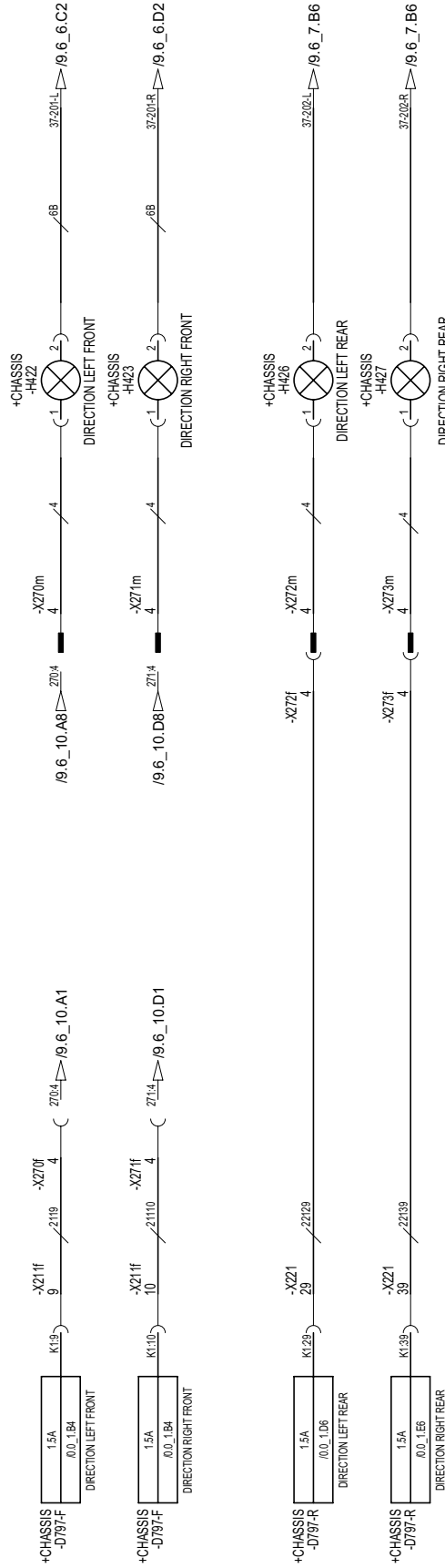
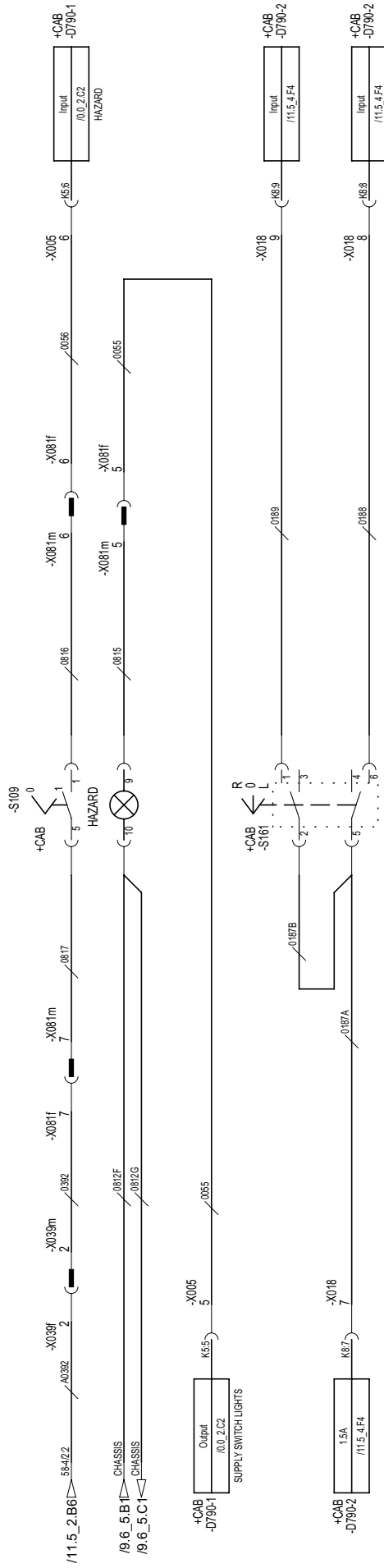
T= Till / Added	U= Udgår / Deleted	V= Var / Was
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Revisering	Krets Instegsbelysning	Model/Product	DRFC 400-450	BackSheet	96.9 /
Name	Wiring Step In Light	Rev. / Drawing No.	A50001.0100	Uplink/Sheet	21

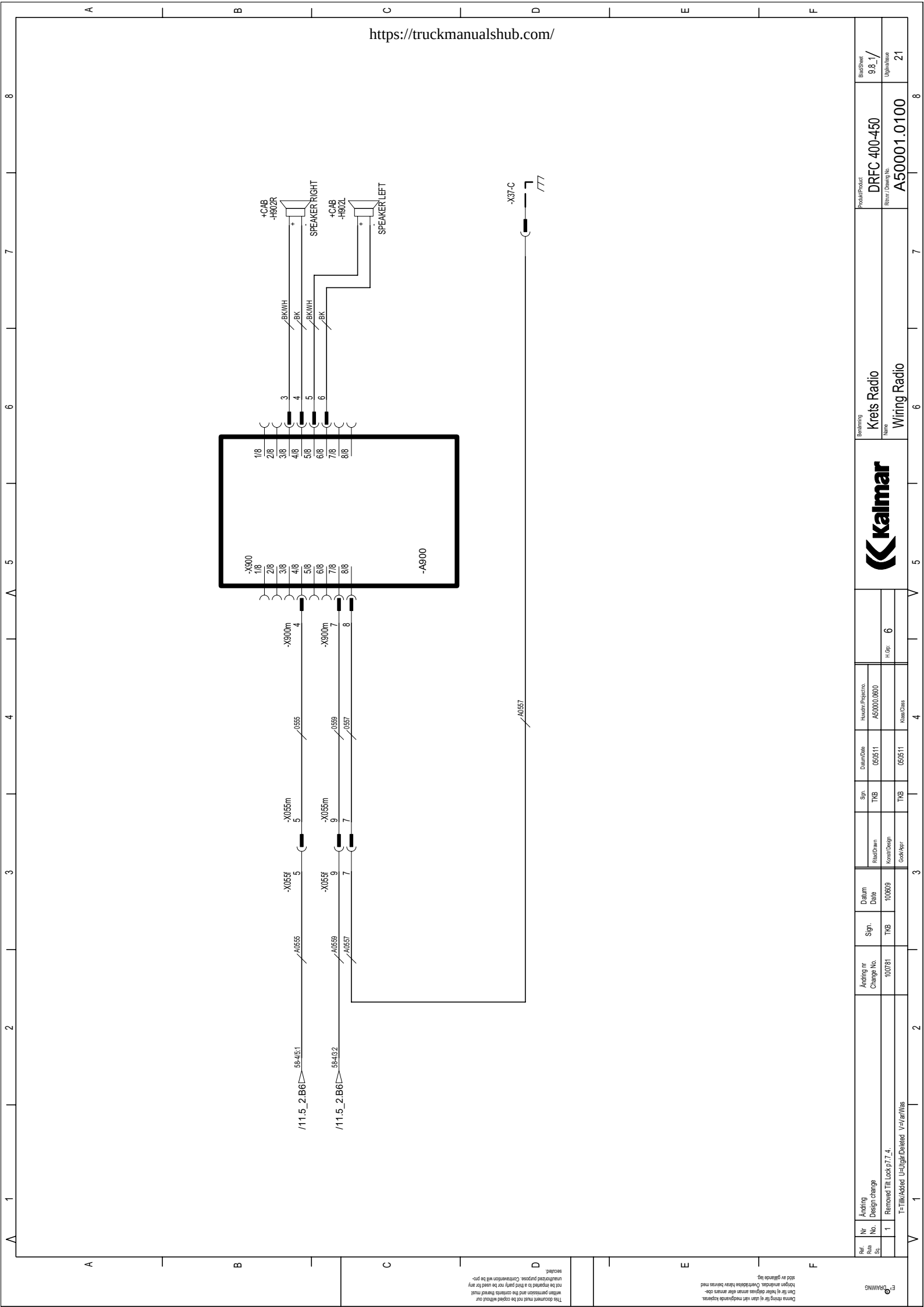


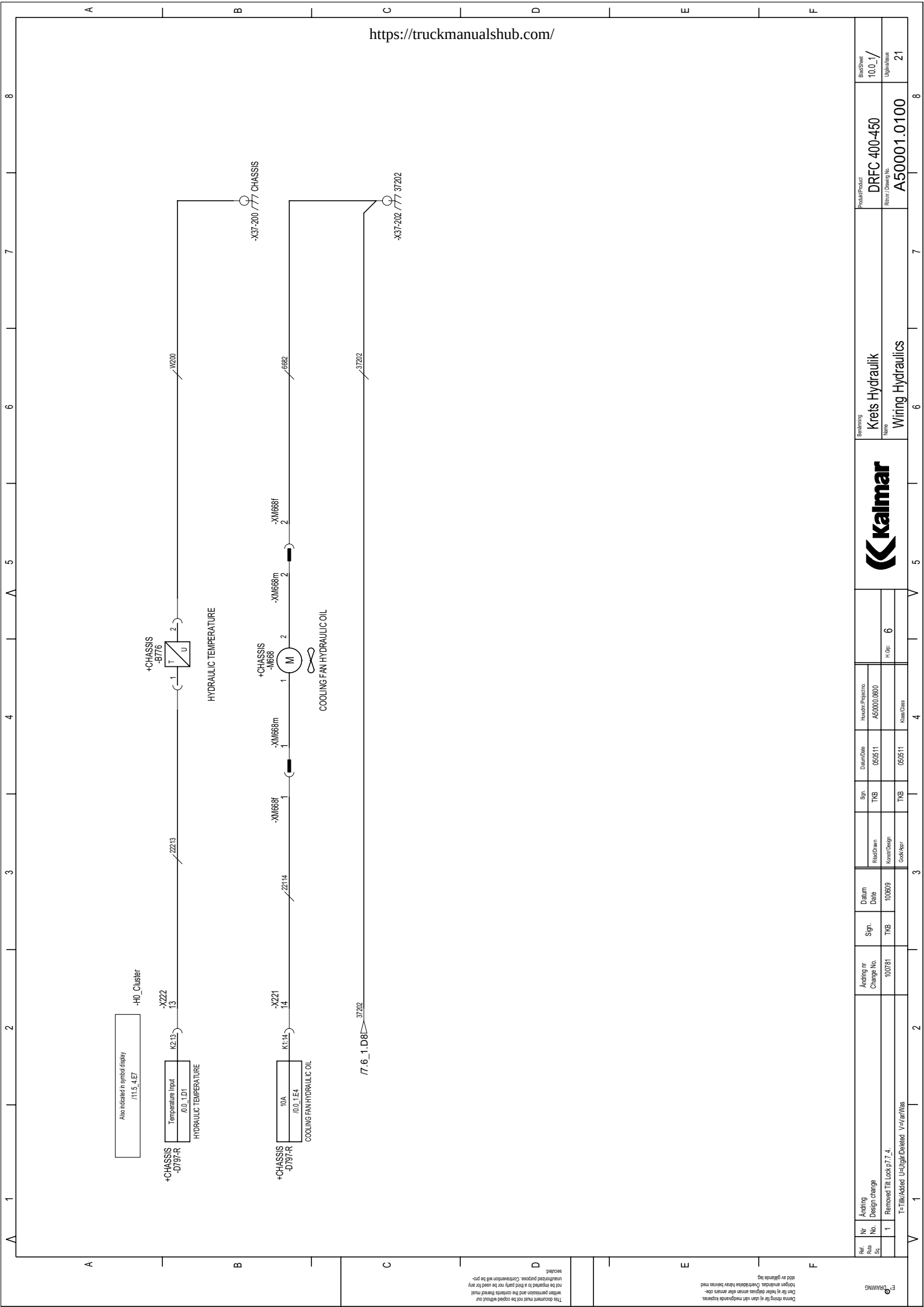


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Ref. No.	Asking Price	Asking Change	Asking nr	Sign.	Datum Date	Sign.	Date/Date	Header Project No.			Bidding	Product	Best/Bid
1	Removed Till Lock 07.7.24.	Design Change	100781	TxB	10/06/21			A50000.0600			Krets Blinkers, Varningsblinkers	DRFC 400-450	97.3 /
											Name	Reviz / Drawing No.	Utgivelse
											Wiring Flashing Indicator, Hazard		
												A500001.0100	21

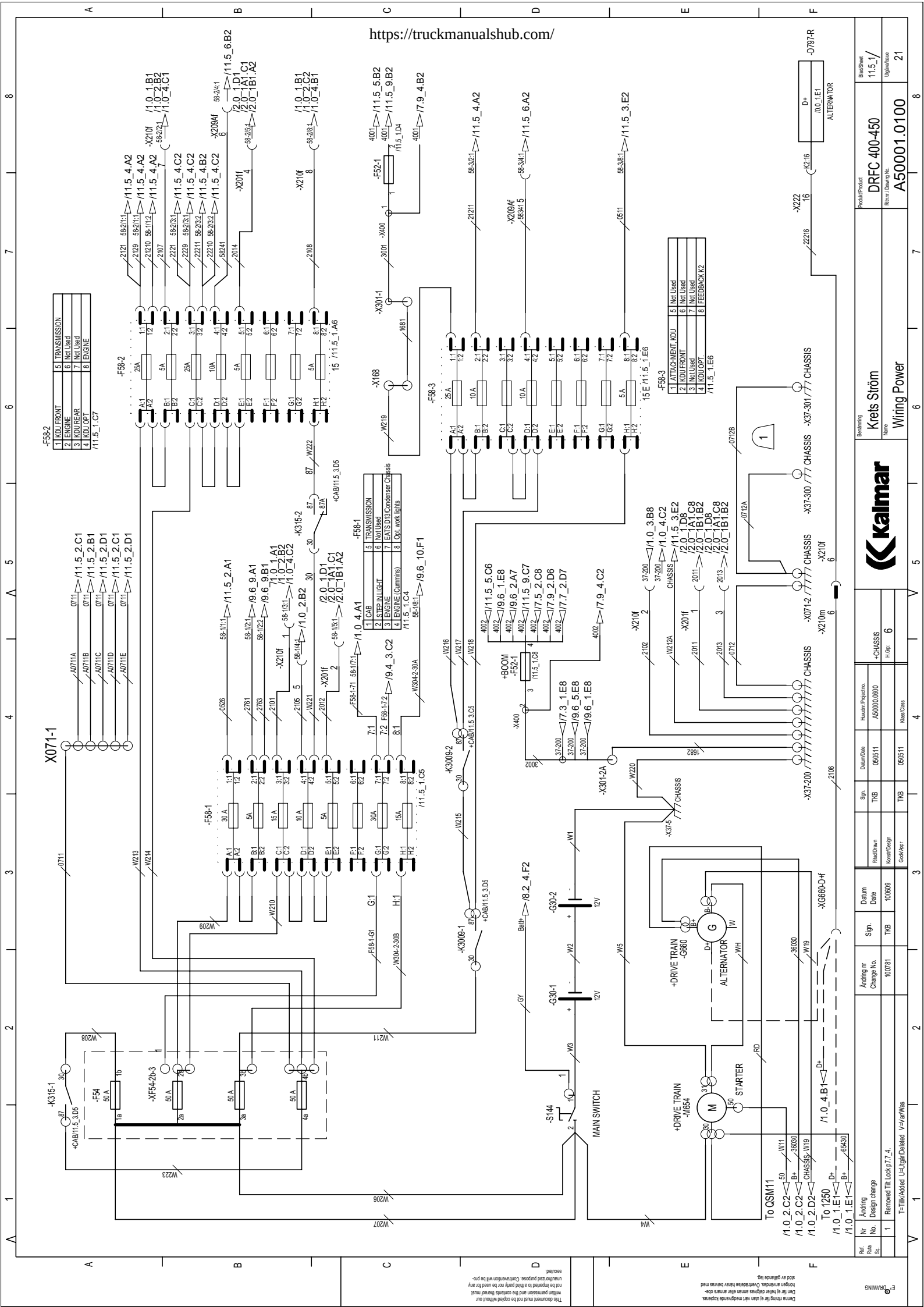


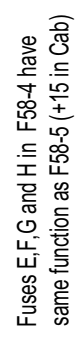


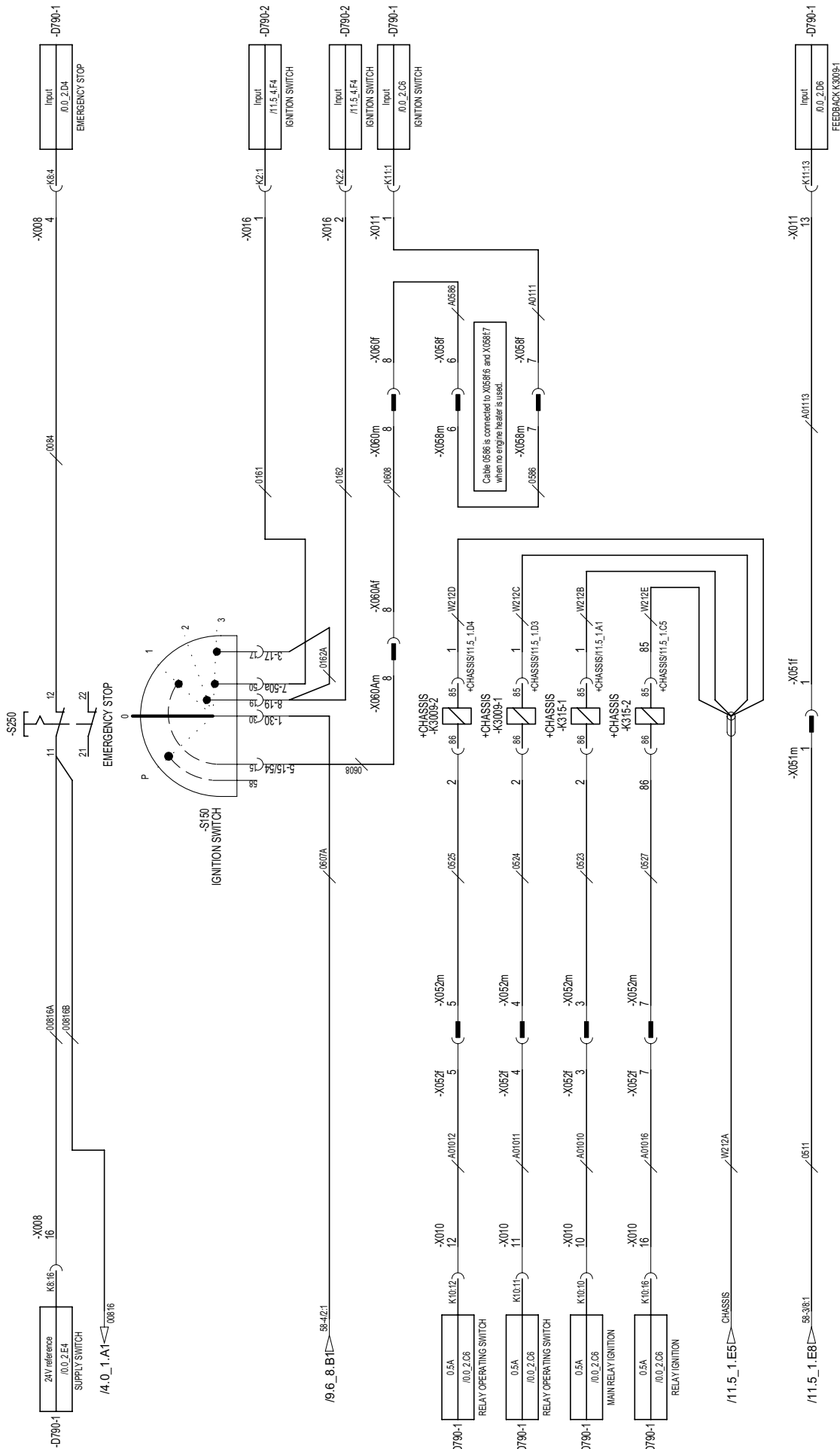
Rev.	Nr.	Andring	Avindning nr.	Sign.	Datum	Sign.	Drawn	Project	Product	Sheet
1	1	Removed T11 Lock p.7.4.	100781	TKB	100809	TKB	050511	A50000.0600	DRFC 400-450	10.0.1
T=Trim/Added U=Ugly Deleted V=Van/Vas										21



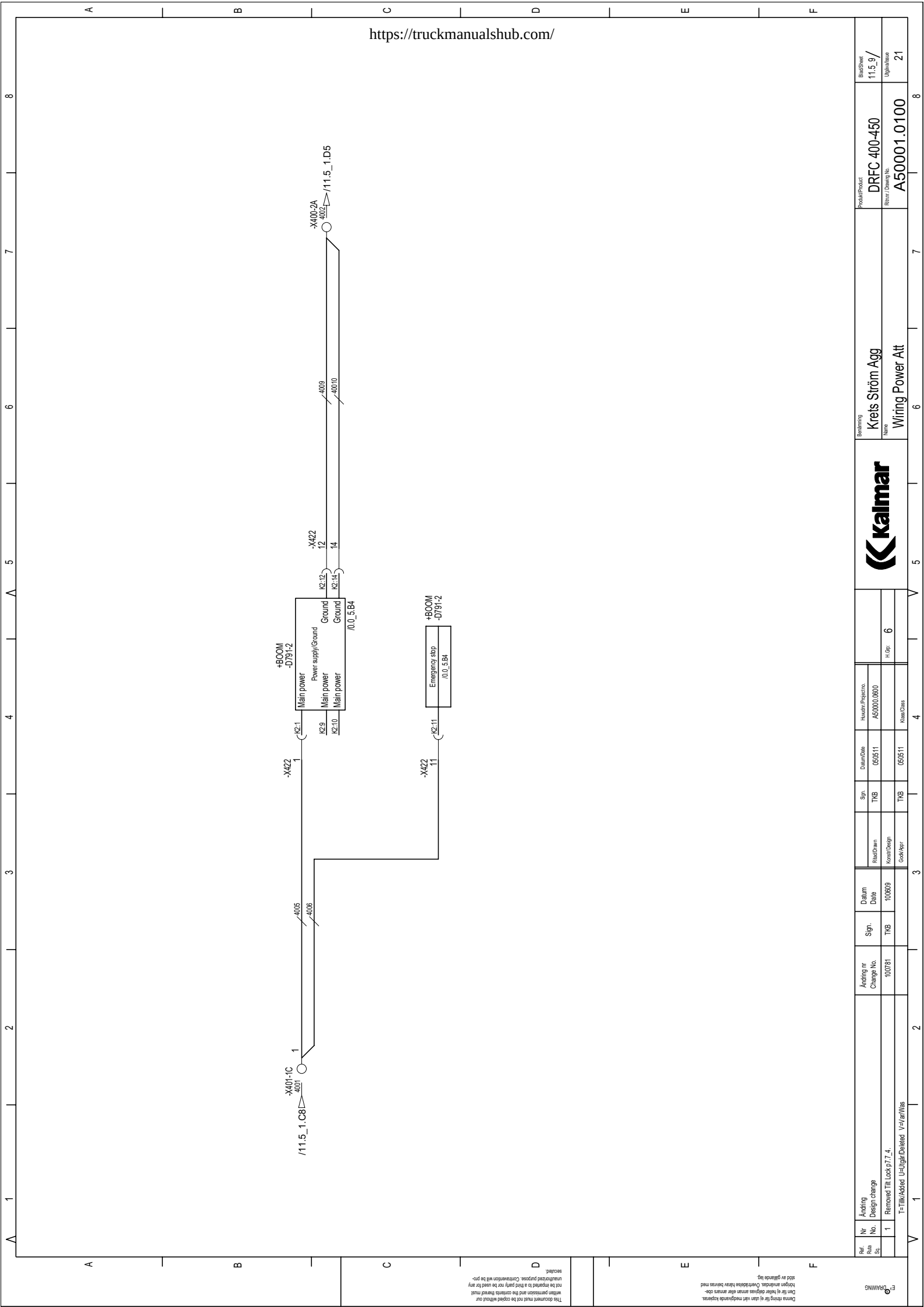
Benaming	Krets Hydraulik	Product	DRFC 400-450	Sheet	10.0.1
Name	Wiring Hydraulics	Refer / Drawing No.	A50001.0100	Ugly/Sheet	21



[illegible]



Ref. No.	Rev.	Nº	Anding	Design change	Change No.	Sign.	Datum	Date	Sign.	Drawn	Checked	Project	Project	Product	Sheet	Total
1		1	Removed	Till Lock p.7.4.	100781	TKB	100809	050511	TKB	050511	050511	A50000.0600	A50000.0600	DRFC 400-450	115.3/	21
T=Talk/Added U=Unger/Deleted V=Var/Vas													Wiring Power			
Krets Ström													A50001.0100			
Name													Ughjshuue			



Ref. No.	Anding No.	Design change	Anding nr Change No.	Sign.	Date	Drawn	Sign.	Date	Project	Project No.	Project Name	Project No.	Project Name
1	1	Removed T11 Lock p.7.4.	100761	TKB	100809	TKB	050511	050511	A50000.0800	A50000.0100	Krets Ström Agg	DRFC 400-450	115.9/
T=TKB/Added U=Ulgår/Deleted V=Var/Vas										6	Wiring Power Att	A50001.0100	Ughjælp



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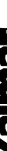
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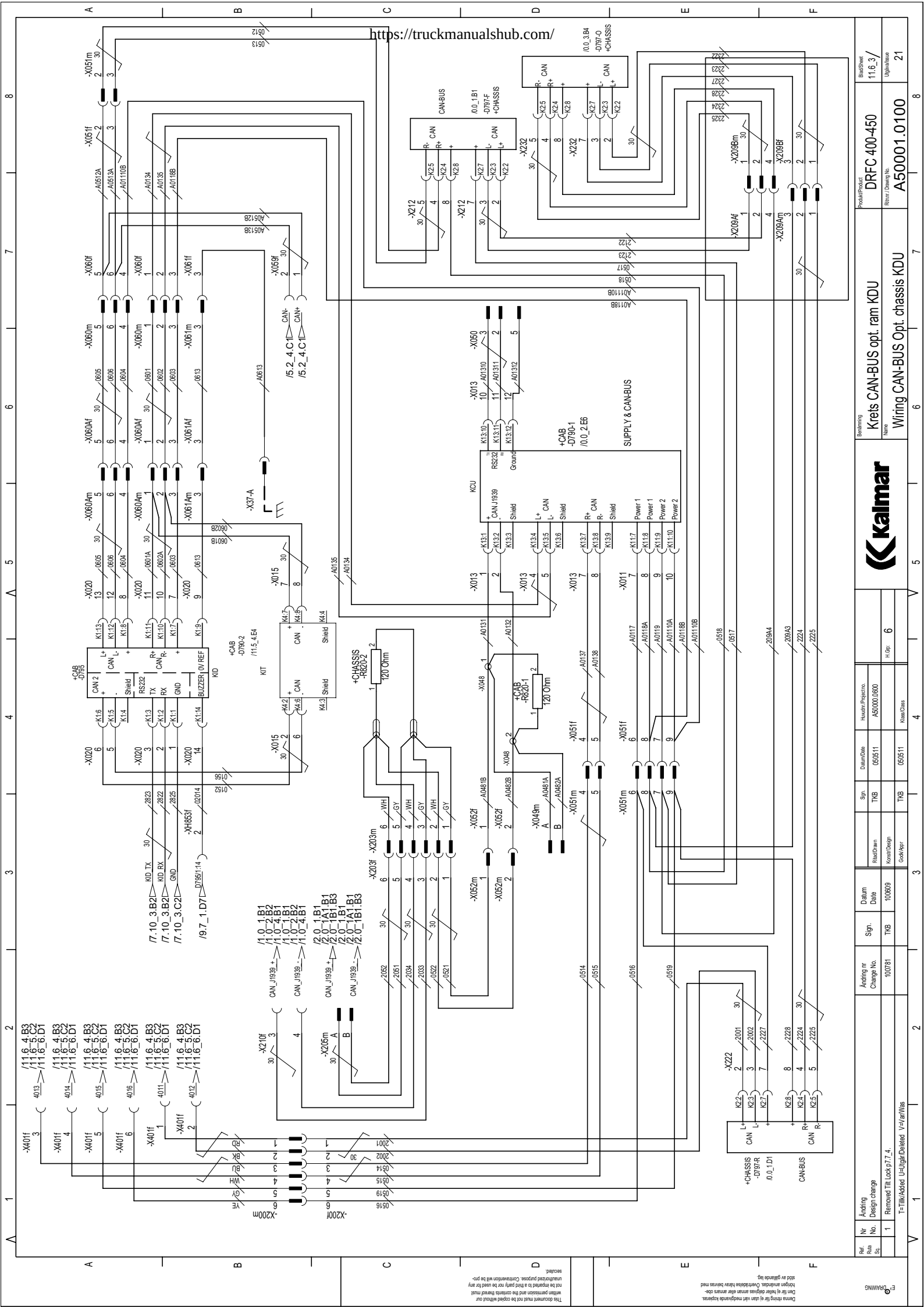
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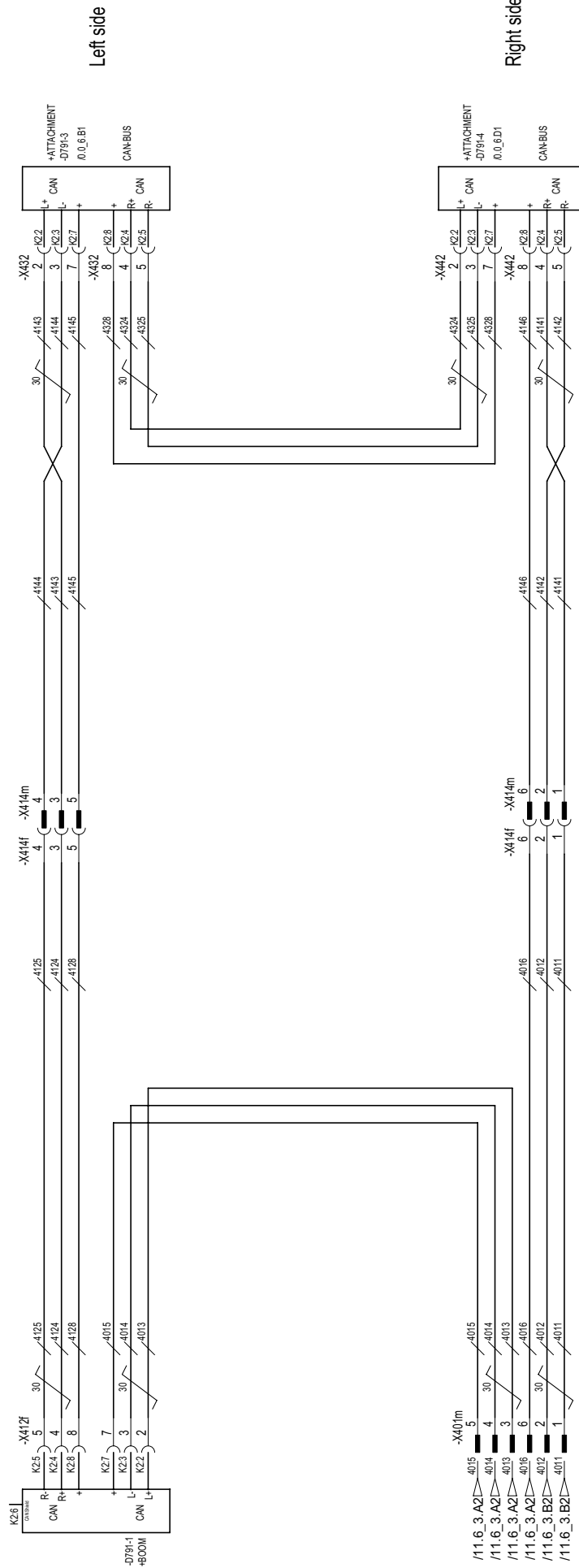
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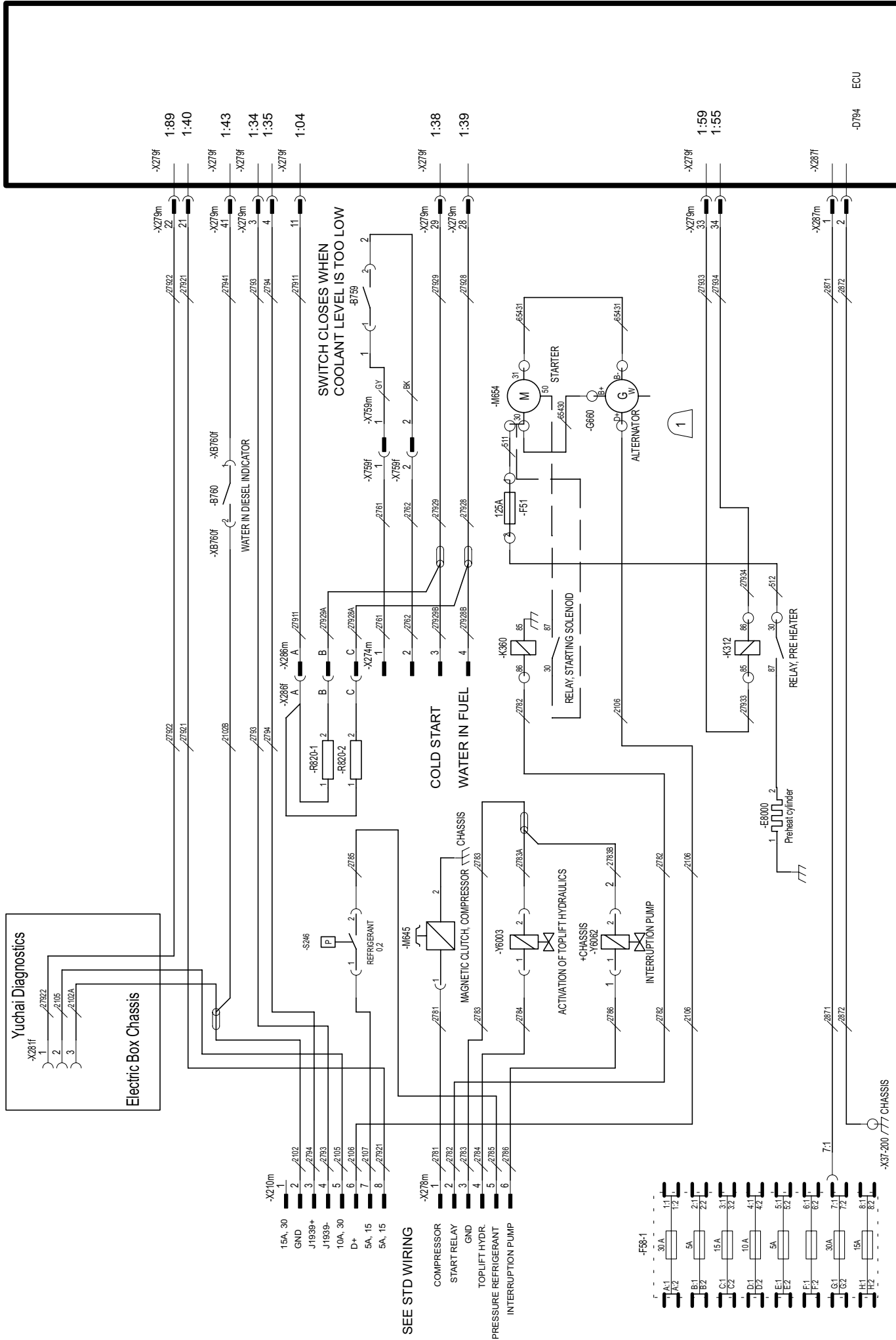
Denna riktning får ej utän vart medgivande kopieras. Den får ej heller delgivas annan eller annars obehörigen användas. Övertäckelse härav beivras med stöd av gällande lag.

Ref. No.	Asking Design change	Asking nr	Datum	Sign.	Sign.	Date/Date	Header/Projectno.			Bewijzing	BestelSheet
1	Removed TILL lock 7.7.4.	100781	TUG	RSO	RSO	091103	091103	6	Krets Ström 230V Inverter	Product/Product	11.5.10 /
T = filled/Added Undigital Deleted V=Van/Was										Name	Uplink/Time
										Wiring Power 230V Inverter	21
										Reviz / Drawing No.	A50001.0100



DRAWINGS		Krems CAN-BUS opt. ram KDU		Product/Part		Sheet/Total	
Ref. No.	1	Anding Design change	100781	Rev. No.	1	116.3/	21
1		Removed T11 lock 7.7.4.	100781	Wiring CAN-BUS Opt. chassis KDU		A50001.0100	
2				Name		Refer / Drawing No.	
3				Drawing		116.3/	
4				Krems Class		116.3/	
5				Krems Class		116.3/	
6				Krems Class		116.3/	
7				Krems Class		116.3/	
8				Krems Class		116.3/	
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100				Krems Class		116.3/	

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NUMBER	SVENSKA	ENGLISH
A 32	Kretskort elcentral	Printed circuit board, Junction box
A 685	Reglerenhet termostat AC	Control unit, termostat AC
A 779	Reglersystem återladdning (EC)	Control system, recharging (EC)
A 782	Logik interface 2 drivmotorer	Logic (interface) two main motors (EC)
A 783	Logik interface gaspådrag	Logic (interface) throttle
A 784	Logik interface bromsregl	Logic (interface) brake control
A 785	Logik interface styrsystem	Logic (interface) control system
A 786	Servoförstärkare styrsystem	Servo amplifier steering system
A 799	Logik allm (option)	Logic, general (option)
A 806	Aggregat klimatanläggning	Aggregate, air conditioner
A 810	Kondensor AC, fläkt	Condensor AC, fan
A 827	Växellåda	Gearbox
A 900	Radio/bandspelare	Radio/tape recorder
A 905	Kommunikationsradio	Communication radio
A 907	Monitor	Monitor
A 908	Kamera	Camera
A 909	Skrivare	Printer
A 911	Dataterminal	Dataterminal
A 912	Alkolås	Interlock device
A 940	Logik batterivakt	Logic switch , battery watch
A 950	Logik transistortändning	Logic transistor ignition
A 955	Logik övervarvningsskydd (LPG)	Logic overspeed protection (LPG)
A 960	Logik rev-spärr/aut-vxl	Logic unit, reversing interlock/automatic gear changing
A 961	Motor/kupevärmare	Engine- and cab heater
B 649	Termostat klimatannläggning	Thermostat, air condition
B 690	Fartreglage (EC)	Speed control (EC)
B 697	Elbroms	Electric brake
B 751	Givare varvtal turbin	Transmitter, speed turbin
B 752	Givare varvtal inre växellåda	Transmitter, speed internal gear chain
B 753	Varvtalsgivare motor	Transmitter, engine revolution
B 754	Givare lufttryck	Transmitter, air pressure
B 755	Givare hydraulfilter indikering	Transmitter, hydraulics filter indication
B 756	Temperatur kylvätska motor	Transmitter, engine coolant temperature
B 757	Bränslenivågivare	Transmitter, fuel level
B 758	Varvtalsgivare v-låda	Transmitter, gear box revolution
B 759	Nivåindikator kylvätska	Transmitter, coolant level
B 760	Givare rev-spärr/aut-vxl trans	Transmitter, reversing interlock / automatic gear change system (on gearbox output shaft)
B 761	Givare rev-spärr/aut-vxl motor	Transmitter, reversing interlock / automatic gear changing system (engine speed)
B 762	Givare temp,spolkrets bromsar	Transmitter, brake flushing circuit
B 763	Givare nivå hydraulolja	Transmitter, hydraulic fluid level
B 764	Givare servotryck växellåda	Transmitter, gear box servo pressure
B 765	Givare oljetryck v-låda	Transmitter, oil pressure gear box
B 766	Givare oljetemp. v-låda	Transmitter, oil temperature gear box
B 767	Givare oljetryck motor	Transmitter, oil pressure engine
B 768	Givare oljetryck hydraulik	Transmitter, hydraulic pressure
B 769	Givare ändläge	Transmitter, end position
B 770	Givare rattutslag	Transmitter, steering wheel angle
B 771	Givare vinkel	Transmitter, angle
B 772	Givare temp bromsolja	Transmitter, temperature brake fluid

NUMBER	SVENSKA	ENGLISH
B 773	Givare närvaro	Transmitter, presence
B 774	Givare utomhustemp	Transmitter, ambient temperature
B 775	Givare temp klimatanläggning	Transmitter, temperature air condition
B 776	Givare temp hydraulolja	Transmitter, hydraulic temperature
B 777	Givare läge	Transmitter, position
B 778	Givare drivbrytning	Transmitter, drive break
B 789	Givare allmän	Transmitter, common
B 902	Högtalare	Loud speaker
B 7224	Givare, mätläge våg	Sensor, measurepoint scale
B 7225	Givare, rotationsstopp	Sensor, rotation stop
B 7226	Givare, tryck lyftcylinder	Sensor, pressure lift cylinder
B 7227	Givare, tryck klämma	Sensor, pressure clamp
B 7228	Givare lyfthöjd analog	Sensor lift height analogue
B 7229	Givare tiltvinkel analog	Sensor tilt angle analogue
B 7230	Givare ultraljud last position	Sensor, ultrasonic load position
B 7231	Givare, Over Height, Ben uppe	Sensor, Over Height, Leg upper position
B 7232	Givare,IR Last position	Givare,IR Load position
B 7233	Givare lambda sond	Sensor lambda sond
B 7234	Givare vatten i bränsle	Transmitter water in fuel
B 7235	Givare temp avgaser	Sensor exhaust temperature
B 7236	Givare tryck avgaser	Sensor exhaust pressure
C 821	KONDENSATOR	CAPACITOR
D 740	FleetManager kontrollenhet	FleetManager control unit
D 742	FleetManager kortläsare	FleetManager card device
D 743	FleetManager accelerations givare	FleetManager acceleration sensor
D 744	Galvaniskt isolerad CAN brygga	Galvanic insulated CAN bridge
D 780	Reglersystem drivmotor	Control system traction motor
D 781	Reglersystem pumphmotor	Control system pump motor
D 790	Elektronisk kontrollenhet ECU, hytt	Electronic Control Unit ECU, cab
D 791	Elektronisk kontrollenhet aggregat	Electronic Control Unit, attachment
D 792	Elektronisk kontrollenhet styrning	Electronic Control Unit, steering system
D 793	Elektronisk kontrollenhet växellåda	Electronic Control Unit, gearbox
D 794	Elektronisk kontrollenhet motor	Electronic Control Unit, engine
D 796	Elektronisk kontrollenhet, lasthantering	Electronic Control Unit, Loadhandling
D 797	Elektronisk kontrollenhet, ram	Electronic Control Unit, frame
D 798	Elektronisk kontrollenhet, stolvändning	Electronic Control Unit, seat rotation
D 2000	Elektronisk kontrollenhet, proportionalventil	Electronic control unit, propotional valve
D 9001	Åkerströms fjärrkontroll	Åkerströms Remote Control
E 400	G-lampa vä fram	Light bulb, roading light left hand front
E 400	G-lampa hö fram	Light bulb, roading light right hand rear
E 401	G-lampa vä bak	Light bulb, roading light left hand front
E 401	G-lampa hö bak	Light bulb, roading light right hand rear
E 402	G-lampa fjärrljus	Light bulb, distance light
E 403	G-lampa lastljus	Light bulb, mast light
E 404	G-lampa arbetsljus	Light bulb, working light
E 405	G-lampa backljus	Light bulb, rear light
E 406	G-lampa cont belysning vänster	Container light left-hand
E 406	G-lampa cont belysning höger	Container light right-hand
E 408	G-lampa park ljus vä fram	Light bulb, parking light, left-hand forward
E 408	G-lampa park ljus hö fram	Light bulb, parking light, right-hand forward
E 429	G-lampa cigarettändare belysning	Light bulb, cigarett lighter illumination
E 431	G-lampa instrument belysning	Light bulb, instrument illumination

NUMBER	SVENSKA	ENGLISH
E 432	G-lampa handsfack belysning	Light bulb, glove pocket light
E 433	G-lampa instegs belysning	Light bulb, step-in lighting
E 434	G-lampa innerbelysning	Light bulb, interior lighting
E 435	G-lampa låsbelysning	Light bulb, reading lighting
E 436	G-lampa identifikationsljus	Light bulb, identification light
E 437	G-lampa identifikationsljus/takskylt	Light bulb, identification light/roof sign
E 438	G-lampa motorrumsbelysning	Light bulb, engine compartment light
E 439	Nummerskyltsbelysning	Light license plate
E 440	G-lampa värmeregler belysning	Light bulb, heating control light
E 456	G-lampa backljus blackout IR vänster	Light bulb, rear light blackout IR left-hand
E 456	G-lampa backljus blackout IR höger	Light bulb, rear light blackout IR right-hand
E 458	G-lampa fram blackout vänster	Light bulb, roading light blackout left-hand
E 458	G-lampa fram blackout höger	Light bulb, roading light blackout right-hand
E 459	G-lampa fram blackout IR vänster	Light bulb, roading light blackout IR left-hand
E 459	G-lampa fram blackout IR höger	Light bulb, roading light blackout IR right-hand
E 460	G-lampa arb.belysning hytt blackout IR vä	Light bulb, working light cab blackout IR left
E 460	G-lampa arb.belysning hytt blackout IR hö	Light bulb, working light cab blackout IR right
E 461	G-lampa arb.bel. bom 20' blackout IR vä	Light bulb, working light boom20' b.out IR left
E 461	G-lampa arb.bel. bom 20' blackout IR hö	Light bulb, working light boom20' b.out IR right
E 462	G-lampa arb.bel. bom 40' blackout IR vä	Light bulb, working light boom40' b.out IR left
E 462	G-lampa arb.bel. bom 40' blackout IR hö	Light bulb, working light boom40' b.out IR right
E 464	G-lampa cont belysning IR vänster	Light bulb, Container light IR left-hand
E 464	G-lampa cont belysning IR höger	Light bulb, Container light IR right-hand
E 669	Värmare kupe/ motor diesel	Heater compartment/engine diesel
E 802	Eluppvärmd backspegel	Electrical heated observation mirror
E 803	Eluppvärmd stol	Electrical heated seat
E 804	Cigarettändare	Cigarette lighter
E 805	Elvärme hytt	Electrical heating cab
E 808	Eluppvärmd lufttorkare	Electrical heater air dryer
E 835	Tändstift	Ignition plug
E 888	Lufttork, kompressor	Air Dryer, Compressor
E 962	Logik slitageind kol elmotor	Logic indication of wear, brush electrical motor
E 4370	Sökljus	Search light
E 8092	Eluppvärmd ruta	Electrical heated window
F 51	Säkringshållare 1-polig	Fuse holder, 1-pole
F 52	Säkringshållare 2-polig	Fuse holder, 2-pole
F 56	Säkringshållare 6-polig	Fuse holder, 6-pole
F 58	Säkringshållare 8-polig	Fuse holder, 8-pole
F 59	Säkringshållare 12-polig	Fuse holder, 12-pole
F 62	Batterihandske 2-polig	Battery connector, 2-pole
F 64	Batterihandske 4-polig	Battery connector, 4-pole
G 30	Batteri	Battery
G 658	Generator (extra)	Alternator extra
G 659	Generator utan laddregulator	Alternator without loading regulator

NUMBER	SVENSKA	ENGLISH
G 660	Generator med laddregulator	Alternator with loading regulator
G 662	Laddregulator	Loading regulator
H 410	G-lampa broms ljus vä fram	Light bulb, brake light, left-hand forward
H 410	G-lampa broms ljus hö fram	Light bulb, brake light, right-hand forward
H 411	G-lampa broms ljus vä bak	Light bulb, brake light, left-hand rear
H 411	G-lampa broms ljus hö bak	Light bulb, brake light, right-hand rear
H 412	G-lampa bak ljus vä bak	Light bulb, rear light, left-hand rear
H 412	G-lampa bak ljus hö bak	Light bulb, rear light right-hand rear
H 413	G-lampa bak ljus vä fram (VBFS)	Light bulb, rear light, left-hand forward (VBFS)
H 413	G-lampa bak ljus hö fram (VBFS)	Light bulb, rear light, right-hand forward (VBFS)
H 416	G-lampa sidomarkering vä fram	Light bulb, side position light, left-hand forward
H 416	G-lampa sidomarkering vä bak	Light bulb, side position light, left-hand rear
H 417	G-lampa sidomarkering hö fram	Light bulb, side position light, right-hand forward
H 417	G-lampa sidomarkering hö bak	Light bulb, side position light, right-hand rear
H 420	G-lampa positionsljus vänster	Light bulb, position light, left-hand
H 421	G-lampa positionsljus höger	Light bulb, position light, right-hand
H 422	G-lampa körvisare vä fram	Light bulb, direction indicator left-hand forward
H 423	G-lampa körvisare hö fram	Light bulb, direction indicator right-hand forward
H 426	G-lampa körvisare vä bak	Light bulb, direction indicator left-hand rear
H 427	G-lampa körvisare hö bak	Light bulb, direction indicator right-hand rear
H 428	G-lampa roterande varningsljus	Light bulb, flashing beacon lamp
H 445	G-lampa körvisare vä (extra)	Light bulb, extra direction indicator left
H 446	G-lampa körvisare hö (extra)	Light bulb, extra direction indicator right
H 451	G-lampa dimbakljus vänster	Light bulb, fog light rear left
H 452	G-lampa dimbakljus höger	Light bulb, fog light rear right
H 453	G-lampa bromsljus/körvisare vänster	Light bulb, brake light/dir. indicator left-hand
H 453	G-lampa bromsljus/körvisare höger	Light bulb, brake light/dir. indicator right-hand
H 454	G-lampa bromsljus blackout vänster	Light bulb, brake light blackout left-hand
H 454	G-lampa bromsljus blackout höger	Light bulb, brake light blackout right-hand
H 457	G-lampa positionsljus blackout vänster	Light bulb, position light blackout left-hand
H 457	G-lampa positionsljus blackout höger	Light bulb, position light blackout right-hand
H 463	G-lampa bak ljus vänster bak, blackout	Light bulb, rear light left-hand rear, blackout
H 463	G-lampa bak ljus höger bak, blackout	Light bulb, rear light right-hand rear, blackout
H 465	G-lampa röd saxagregat ute	Light-bulb, red extender extended
H 466	G-lampa orange vertikalhållning på	Light bulb, orange vertical hold on
H 467	G-lampa grön klämtryck OK	Light bulb, green clamp pressure OK
H 468	G-Lampa Röd Maxlast	Light bulb, Red Overload
H 500	Kont lampa körvisare	Indicating lamp, direction indicator
H 501	Kont lampa körvisare (extra)	Indicating lamp, direction indicator extra

NUMBER	SVENSKA	ENGLISH
H 503	Varn lampa oljetryck motor	Warning lamp, oil pressure engine
H 504	Kont lampa helljus	Indicating lamp, main beam
H 505	Varn lampa laddning	Warning lamp, loading
H 506	Varn lampa laddning (extra)	Warning lamp, loading extra
H 507	Varn lampa färdbröms	Warning lamp, brake
H 508	Varn lampa parkerings broms	Warning lamp, parking brake
H 509	Varn lampa nivå kylvatten	Warning lamp, coolant level
H 510	Kont lampa diff spärr	Indicating lamp, diff. interlock
H 512	Varn lampa temp momentförst	Warning lamp, temperature converter
H 514	Kont lampa överväxel	Indicating lamp, overdrive clutch
H 519	Kont lampa halvljus	Indicating lamp, dipped lights
H 524	Kont lampa luftfilter	Indicating lamp, air filter
H 525	Kont lampa UNIKAT	Indicating lamp, UNIKAT
H 528	Kont lampa förvärmning	Indicating lamp, preheating
H 530	Kont lampa framhjuls styrning	Indicating lamp, forward wheel steering
H 531	Kont lampa 4-hjuls styrning	Indicating lamp, 4-wheel steering
H 532	Kont lampa crab styrning	Indicating lamp, crab steering
H 533	Kont lampa hyd.pump	Indicating lamp, emergency hyd. pump
H 547	Varn lampa centralvarning	Warning lamp, central warning
H 549	Varn lampa oljetryck v-låda	Warning lamp, oil pressure gear box
H 550	Varn lampa hyttlåsning	Warning lamp, cab lock
H 551	Varn lampa temp v-låda	Warning lamp, temperature gear box
H 552	Varn lampa bromstryck	Warning lamp, brake pressure
H 554	Varn lampa temp spolkets bromsar	Warning lamp, temp. cooling system brakes
H 555	Varn lampa temp kylvatten mot	Warning lamp, temperature coolant engine
H 556	Varn lampa låsning vändskiva	Warning lamp, interlocking of turntable
H 560	Varn lampa temp drivmotor el	Warning lamp, temperature, drive motor
H 561	Varn lampa temp pumpmotor el	Warning lamp, temperature, pump motor
H 562	Varn lampa öppen twistlock	Warning lamp, unlocked twist lock
H 563	Varn lampa låst twistlock	Warning lamp, locked twist lock
H 564	Varn lampa anliggning	Warning lamp, alignment
H 565	Varn lampa temp motor el	Warning lamp, temperature motor
H 569	Kont lampa elvärme	Indicating lamp, electric heater
H 569	Kont lampa elvärme	Indicating lamp, electric heater
H 570	Varn lampa överkoppling säkerhetssystem	Warning lamp, by-pass safety system
H 571	Kont lampa bränslenivå	Indicating lamp, fuel level
H 572	Varningslampa lyfthöjd	Warning lamp lifting height
H 573	Kontroll lampa motor information	Indicator lamp engine information
H 574	Kontroll lampa stödben nere	Indicator lamp support jacks down
H 575	Kontroll lampa stödben ur arb.läge	Indicator lamp support jacks out of working pos
H 576	Kontroll lampa anliggning främre ben	Indicator lamp, alignment front legs
H 577	Kontroll lampa anliggning bakre ben	Indicator lamp, alignment rear legs
H 578	Kontroll lampa klämläge främre ben	Indicator lamp, clamp position front legs
H 579	Kontroll lampa klämläge bakre ben	Indicator lamp, clamp position rear legs
H 580	Kontroll lampa främre ben uppe	Indicator lamp, front legs upper position
H 581	Kontroll lampa främre ben nere	Indicator lamp, front legs lower position
H 582	Varningslampa överlast	Warning lamp overload
H 583	Kontroll lampa anliggning ett ben	Indicator lamp, alignment one leg
H 584	Kontroll lampa anliggning alla ben	Indicator lamp, alignment all legs
H 599	Kont lampa option	Indicating lamp, option

NUMBER	SVENSKA	ENGLISH
H 850	Signalhorn	Horn
H 853	Summer	Buzzer
H 965	Backvarnare	Reversing alarm
H 5000	Kont lampa tryck lyfttång	Indicating lamp, pressure lift tong
H 5001	Varn lampa, Over Height ben uppe	Warn. Lamp, Over Height leg upper pos
H 9003	Varningssignal aut. rörelse	Warning alarm aut. movement
K 300	Relä hel/halvljus	Relay, main/dipped beam
K 301	Relä dimljus	Relay, fog light
K 302	Relä fjärrljus	Relay, distance light
K 303	Relä lastljus	Relay, mast light
K 304	Relä arbetsljus	Relay, working light
K 305	Relä backljus	Relay, reversing light
K 306	Relä helljus	Relay, main beam
K 307	Relä halvljus	Relay, dipped beam
K 308	Relä bromsljus	Relay, brake light
K 309	Relä parkeringsbroms	Relay, parking light
K 310	Relä körvisare vä	Relay, direction indicator left
K 311	Relä körvisare hö	Relay, direction indicator right
K 312	Relä startelement	Relay, element preheater
K 313	Relä vändbar förarstol	Relay, rotating driver's seat (VBFS)
K 314	Relä parkeringsbroms	Relay, parking brake
K 315	Relä tändningslås	Relay, ignition key
K 316	Relä torkare	Relay, wiper
K 317	Relä strålkastartorkare	Relay, roading lights wiper
K 318	Relä AT-regulator	Relay, AT-regulator
K 319	Relä varningsblinkers	Relay, hazard blinkers
K 320	Relä elektrisk stopp	Relay, electrical stop
K 321	Relä intervalltorkare	Relay, intermittent wiper
K 322	Relä kylvätskenivå	Relay, coolant level
K 323	Relä blinkers	Relay, blinkers
K 324	Relä rangelspärr	Relay, range interlock
K 325	Relä blinkande bromsljus (back)	Relay, flashing brake lights (reversing)
K 326	Relä blinkande bromsljus (runt)	Relay, flashing hazard brake lights
K 327	Relä växel neutral	Relay, gear neutral
K 328	Relä växelskifte	Relay, gear shift
K 329	Relä växel hög/låg	Relay, high/low gear
K 330	Relä startspärr	Relay, start interlock
K 331	Relä drivning fram	Relay, forward driving
K 332	Relä drivning bak	Relay, reversing driving
K 333	Tidrelä förvärmning	Time relay, automatically preheating
K 334	Relä frikoppling/drivbrytning	Relay, free wheel/drive disconnection
K 335	Relä växelventil 1:a (diesel, gas)	Relay, gear change valve 1-gear (diesel,LPG)
K 336	Relä växelventil 2:a (diesel, gas)	Relay, gear change valve 2-gear (diesel,LPG)
K 337	Relä drivriktning motor	Relay, motor drive direction
K 338	Relä kylfläkt drivmotor	Relay, cooling fan drive motor
K 339	Relä kylfläkt elskåp	Relay, cooling fan electrical box
K 340	Tidrelä fördröjt tillslag	Time relay, start delay
K 341	Tidrelä fördröjt frånslag	Time relay, stop delay
K 342	Relä drivning 2/4 hjul	Relay, switching 2/4 WD
K 343	Relä dimbakljus	Relay, fog light rear
K 344	Relä momentförstärkare	Relay, torque amplifier
K 345	Relä låsning vändskiva	Relay, interlocking of turntable

NUMBER	SVENSKA	ENGLISH
K 346	Relä frikoppling stollåsning	Relay, releasing of seat interlocking
K 347	Relä stolvändning/ljussignal	Relay, multifunction, seat rotation/light signal
K 348	Relä fläktmotor värmare	Relay, fan heating
K 349	Relä fartreglage	Relay, speed control
K 350	Relä pumpkontaktor/pumpkontroll	Relay, pump contactor/pump control
K 351	Relä hyttlyft upp	Relay, cab hoist up
K 352	Relä hyttlyft ner	Relay, cab hoist down
K 353	Relä säkerhetsslinga	Relay, safety loop
K 354	Relä styrsystem	Relay, signal control system
K 355	Relä sensorstyrning	Relay, sensor control
K 356	Skiftrelä längskörning/tvärskörning	Shift relay, length/sideways driving
K 357	Relä roterande varningsljus	Relay, hazard beacon
K 358	Relä kompressor luft	Relay, compressor air
K 359	Relä Hydrauloljekylare	Relay hydraulic oil cooler
K 360	Relä startsolenoid	Relay, starting solenoid
K 361	Relä kompressor AC	Relay, compressor air conditione
K 362	Relä vattenventil AC	Relay, water valve air conditioner
K 363	Relä kondensor AC	Relay, condenser air conditione
K 364	Relä stolsbrytare	Relay seat switch
K 365	Relä fönsterhiss upp	Relay, electrical screen elevator up
K 366	Relä fönsterhiss ner	Relay, electrical screen elevator down
K 367	Relä styrning	Relay, steerin
K 368	Relä lågt bromstryck	Relay, low brake pressure
K 369	Relä centralsmörjning	Relay, central lubrication
K 370	Relä centralsmörjning, aggregat	Relay, central lubrication, attachment
K 371	Relä lyfthöjd	Relay, liftheight
K 372	Relä blinkande varn.ljus, höjdbegränsn.	Relay, flashing beacon, lifting height limiter
K 373	Relä bakljus	Relay light
K 375	Huvudkontaktor reglersystem	Main contactor, operating control
K 376	Kontaktor fram reglersystem	Contactor, forward operating control
K 377	Kontaktor bak reglersystem	Contactor, reversing operating control
K 378	Kontaktor by-pass reglersystem/Fältförsvagning	Contactor, „by-pass“ operating control/Field weakening
K 379	Kontaktor pumpmotor	Contactor, pump motor
K 380	Kontaktor	Contactor
K 381	Kontaktor återladdning	Contactor, recharging
K 382	Relä, förbikoppling säkerhetssystem	Relay, by-pass safety system
K 383	Relä, Stolsvärme	Relay, heated seat
K 384	Relä vattenseparator	Relay, waterseparator
K 385	Relä bränslepump insprutning	Relay, fuel injection pump
K 386	Relä, hög motortemperatur.	Relay, high motor temperature
K 387	Relä alternativ gaspedal	Relay alternative throttle pedal
K 388	Relä, Extra färdriktningsväljare	Relay, Extra direction selector
K 389	Relä, Pausvärme	Relay, Paus heat
K 399	Relä option	Relay, option
K 3001	Relä rotation	Relay, rotation
K 3002	Relä tilt	Relay, tilt
K 3003	Relä sidoföring	Relay, side shifting
K 3004	Relä längdinställning	Relay, length adjustment
K 3005	Relä twist lock	Relay, twist lock
K 3006	Relä spridning	Relay, spreading
K 3007	Relä lyft/sänk	Relay, lifting/lowering

NUMBER	SVENSKA	ENGLISH
K 3008	Relä hydraulfunktion extra	Relay, extra hydraulic function
K 3009	Relä manöverbrytare hydr	Relay, operating switch
K 3010	Relä bromsljus vxl std/blackout	Relay, brake light shift std/blackout
K 3011	Relä backljus vxl std/blackout	Relay, reversing light shift std/blackout
K 3012	Relä arb.bel hytt vxl std/blackout	Relay, working light cab, shift std/blackout
K 3013	Relä arb.bel. bom 20' vxl std/blackout	Relay, working light boom 20' shift std/b.out
K 3014	Relä arb.bel. bom 40' vxl std/blackout	Relay, working light boom 40' shift std/b.out
K 3015	Relä vxl bromsljus/blinkers vä	Relay, shift brake light/direction indicator left
K 3015	Relä vxl bromsljus/blinkers hö	Relay, shift brake light/direction indicator right
K 3016	Relä signalhorn	relay, horn
K 3017	Relä containerbelysning	Relay, Container light
K 3018	Relä containerbelysning IR	Relay, Container light IR
K 3305	Relä VBFS, backljus	Relay, rotating driver's seat, reversing light
K 3306	Relä VBFS, helljus	Relay, rotating driver's seat, main beam
K 3307	Relä VBFS, halvljus	Relay, rotating driver's seat, dipped beam
K 3308	Relä VBFS, bromsljus	Relay, rotating driver's seat, brake light
K 3310	Relä VBFS, körvisare vä	Relay, rotating driver's seat, direction indicator left
K 3311	Relä VBFS, körvisare hö	Relay, rotating driver's seat, direction indicator right
K 3330	Relä, säkerhetsbälte	Relay, seat belt
K 3331	Relä VBFS, drivning fram	Relay, rotating driver's seat, forward driving
K 3332	Relä VBFS, drivning bak	Relay, rotating driver's seat, reversing driving
K 3349	Relä VBFS, fartreglage	Relay, rotating driver's seat, speed control
K 3404	Relä VBFS, mastljus	Relay, rotating driver's seat, mast light
K 3405	Relä, backalarm	Relay, reverse alarm
K 3412	Relä bak ljus	Relay, rotating driver's seat, rear light
K 3768	Relä oljetryck hydraulik	Relay, hydraulic pressure
K 3769	Relä, blockering av hyttilt	Relay, blocking of cab tilt
K 3770	Relä anliggning	Relay, alignment
K 3771	Relä Krok	Relay, Hook
K 3772	Relä laddsignal (D+)	Relay, charge signal (D+)
K 3773	Relä 12V för minne radio	Relay 12V for radio memory
K 3774	Relä kylfläkt olja	Relay, cooling fan oil
K 3776	Relä värmare ruta	Relay heated window
K 93774	Relä hållkrets	Relay, Holdcircuit
L 830	Tändspole	Ignition coil
M 608	Pumpaggregat hyttlyft	Pump unit, cab hoist
M 609	Ställmotor gaspådrag	Regulating motor, throttle
M 612	Ställmotor recirkulation	Regulating motor, re-circulation
M 650	Torkarmotor fram	
M 650	Torkarmotor fram	
M 650	Torkarmotor fram	
M 650	Torkarmotor fram	
M 651	Vindrutespolarmotor	Washer motor
M 652	Strålkastarmotor	Light motor
M 653	Strålkastarspolarmotor	Light washer motor
M 654	Startmotor	Starter motor

NUMBER	SVENSKA	ENGLISH
M 655	Kylfläkt drivmotor (EC)	Cooling fan, main motor (EC)
M 656	Kylfläkt elskåp (EC)	Cooling fan, electrical box (EC)
M 657	Fläktmotor värme	Heating fan
M 661	Fönsterhissmotor	Screenelevator motor
M 663	Doseringspump klimatanläggning	Dosage pump, air condition
M 664	Cirk pump klimatanläggning	Circulating pump, air condition
M 666	Fläktmotor cirkulation	Circulation fan
M 667	Cirkulationspump värmesystem	Circulation pump heating system
M 668	Kylfläkt hydraulolja	Cooling fan, hydraulic oil
M 670	Kompressor	Compressor
M 671	Doseringspump diesel	Dosage pump diesel
M 672	Spjäll motor, ECC	Draught valve motor, ECC
M 674	Kylfläkt bromsolja	Cooling fan, brake fluid
M 675	Motor, Stolsvändning	Motor, Seat rotation
M 677	Motor Låsning stolsvridning	Motor Locking revolving seat
M 693	Pump centralsmörjning	Pump, central lubrication
M 694	Styrmotor	Steering motor
M 695	Drivmotor (EC)	Drive motor (EC)
M 696	Pumpaggregat nödstyrning	Pump, emergency steering
M 698	Pumpmotor (EC)	Pump motor (EC)
M 9000	Motor höj/sänkbar stolspelare	Motor rise/lower seat column
P 700	Hastighetsmätare	Speedometer
P 701	Mätare oljetemp v-låda	Gear box oil temperature gauge
P 702	Klocka	Clock
P 703	Varvtalsmätare	Engine rev meter
P 704	Tryckluftsmätare	Air pressure gauge
P 705	Mätare oljetryck v-låda	Gear box oil pressure gauge
P 706	Termometer temp kylvätska motor	Temperature gauge, engine coolant
P 707	Bränslemätare	Fuel gauge
P 708	Timräknare	Hour meter
P 709	Kapacitetsmätare batteri	Capacity gauge, battery
P 710	Tidur motor/kupevärmare	Timer, engine- and cab heater
P 711	Räknare, impuls	Counter, impulse
P 712	Mätare oljetryck motor	Motor oil pressure gauge
P 714	Mätare, temp. Hydraulolja	Hydraulic fluidtemperature, guage
P 715	Extra instrument allm	Extra instrument, general
P 795	Display	Display
Q 144	Batterifrånskiljare	Battery disconnecting switch
R 807	Potentiometer	Potentiometer
R 820	Motstånd	Resistor
R 825	Reglage spakstyrning	Controls, (steering with control levers).
R 828	Shuntmotstånd	Shunt-resistor
R 8071	Potentiometer lyft/sänk	Potentiometer lift/lower
R 8072	Potentiometer tilt	Potentiometer tilt
R 8073	Potentiometer sidoföring	Potentiometer side shifting
R 8074	Potentiometer spridning	Potentiometer spreading
R 8075	Potentiometer extra	Potentiometer extra
R 8076	Potentiometer mast in/ut	Potentiometer reach in/out
R 8077	Potentiometer höger framhjul	Potentiometer right front wheel
R 8078	Potentiometer vänster framhjul	Potentiometer left front wheel
R 8079	Potentiometer höger bakhjul	Potentiometer right rear wheel
R 8080	Potentiometer vänster bakhjul	Potentiometer left rear wheel
R 8081	Potentiometer tiltvinkel	Potentiometer tilt angle
R 8082	Potentiometer fläkthastighet, ECC	Potentiometer fan speed, ECC

NUMBER	SVENSKA	ENGLISH
R 8083	Potentiometer temperatur, ECC	Potentiometer temperature, ECC
R 8084	Potentiometer spjäll, ECC	Potentiometer draught valve, ECC
R 8085	Potentiometer rotation	Potentiometer rotation
R 8086	Potentiometer sax	Potentiometer extender
R 8087	Potentiometer klämma	Potentiometer clamp
R 8088	Potentiometer skevning	Potentiometer levelling
R 8089	Potentiometer krokålsning	Potentiometer flaps
S 100	Strömställare ljus	Switch, light
S 101	Strömställare omk hel/halvljus	Switch, main/dipped beam
S 102	Strömställare dimljus	Switch, fog light
S 103	Strömställare fjärrljus	Switch, distance light
S 104	Strömställare lastljus	Switch, mast lights
S 105	Strömställare arbetsljus	Switch, working lights
S 106	Strömställare containerljus	Switch, container light
S 107	Strömställare park broms	Switch, parking brake
S 108	Strömställare centr smörjning	Switch, central lubricator
S 109	Strömställare varningsljus	Switch, hazard lights
S 110	Strömställare rot varningsljus	Switch, rotating hazard beacon
S 111	Strömställare fönsterhiss	Switch, window regulator
S 112	Strömställare kylanläggning (AC)	Switch, air conditioner (AC)
S 113	Strömställare styrning alt	Switch, alternative steering
S 114	Strömställare läsbelysning	Switch, reading light
S 115	Strömställare instr belysning	Switch, instrument illumination
S 116	Strömställare innerbelysning	Switch, interior lighting
S 117	Strömställare värme	Switch, heating
S 118	Strömställare fläktm värme	Switch, heater fan
S 119	Strömställare vindrutetorkare	Switch, wiper
S 120	Strömställare spolare	Switch, washer
S 121	Strömställare blackout	Switch, blackout
S 122	Strömställare nöd hydraulpump	Switch, emergency hydraulic pump
S 123	Strömställare backspegel	Switch, observation mirror
S 124	Strömställare kallstart	Switch, cold start
S 125	Strömställare avgasbroms	Switch, exhaust brake
S 126	Strömställare diff spärr/broms	Switch, diff. Block
S 127	Strömställare värmesystem diesel	Switch, heating system diesel
S 128	Strömställare kraftuttag sida	Switch, power take off side
S 129	Strömställare kraftuttag bak	Switch, power take off rear
S 130	Strömställare hög/lågväxel	Switch, high/low gear
S 131	Strömställare färdväljare fram	Switch, gear selector forward
S 132	Strömställare färdväljare bak	Switch, gear selector rear
S 135	Strömställare växelväljare	Switch, gear shift
S 136	Strömställare framhjuls styrning	Switch, forward wheel steering
S 137	Strömställare 4-hjuls styrning	Switch, 4-wheel steering
S 138	Strömställare crab styrning	Switch, crab steering
S 139	Strömställare defroster	Switch, defroster
S 141	Strömställare Stegbelysning	Switch, Steplight
S 142	Strömställare fot	Switch, foot
S 143	Strömställare sitsvärme	Switch, seat heater
S 145	Strömställare AT-regulator	Switch, AT-regulator
S 147	Strömställare körvisare	Switch, direction indicators
S 149	Strömställare signalhorn	Switch, horn
S 150	Strömställare startlås/ellas	Switch, main key switch
S 152	Strömställare intervalltorkare	Switch, intermittent wiper
S 156	Strömställare kupevärmare	Switch, cab heating

NUMBER	SVENSKA	ENGLISH
S 157	Strömställare stoltilt	Switch, seat tilt
S 158	Strömställare dimbakljus	Switch, rear fog light
S 159	Strömställare extra fram/back väljare	Switch, extra direction selector
S 160	Strömställare komb fram/back	Switch, combi-forward/reverse
S 161	Strömställare komb signal, ljus hel/halv spol, torkare m intervall körvisare	Switch, combi-horn, light main/dipped beam, washer, wiper (intermittent), direction indicator
S 162	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
S 163	Strömställare start på 2-an	Switch, start 2nd gear
S 165	Strömställare stolvärme	Switch, seat heater
S 166	Strömställare låsning vändskiva	Switch, interlocking of turntable
S 167	Strömställare luftfjädring	Switch, pneumatic springing
S 168	Strömställare låsn stol	Switch, interlocking of seat
S 169	Strömställare stolsvändning	Switch, reversible seat
S 170	Strömställare förångare (LPG)	Switch, evaporator (LPG)
S 171	Strömställare v-skiva upp/ner	Switch, fifth wheel up/down
S 172	Strömställare v-skiva fr/back	Switch, fifth wheel forward/reverse
S 173	Strömställare v-skiva skevning	Switch, fifth wheel, levelling
S 174	Strömställare, utskjut	Switch, projecting
S 175	Strömställare hyttlyft upp	Switch, cab hoist up
S 176	Strömställare hyttlyft ner	Switch, cab hoist down
S 177	Strömställare hyttskjutning	Switch, cab movement
S 178	Strömställare nollställning	Switch, reset
S 179	Strömställare Aut/man växling	Switch Aut/man gearshifting
S 180	Strömställare fyrhjulsdraft	Switch, 4-WD
S 190	Strömställare klimatanläggning	Switch, air conditioner
S 191	Strömställare recirkulation	Switch, re-circulation
S 192	Strömställare vattenavskiljare	
S 195	Strömställare joy-stick X	Switch, joy-stick X
S 196	Strömställare joy-stick X+Y	Switch, joy-stick X+Y
S 197	Strömställare längs/tvärskörning	Switch, length/sideways driving
S 198	Strömställare flytläge skevning	Switch, equalizing fifth wheel
S 199	Strömställare option	Switch, option
S 200	Brytkontakt lampa park broms	Contact, breaking, warning lamp, parking brake
S 201	Brytkontakt lampa färdbröms	Contact, breaking, warning lamp, brake
S 202	Brytkontakt lampa oljetryck motor	Contact, breaking, warning lamp, oil pressure engine
S 204	Brytkontakt tryck ackumulator	Contact, breaking, pressure accumulator tank
S 205	Brytkontakt innerbelysning	Contact, breaking, interior lighting
S 206	Brytkontakt handskfack belysning	Contact, breaking, glove
S 207	Slutkontakt diff spärr	Contact, making, diff. interlock
S 208	Slutkontakt lampa temperatur spolrets bromsar	Contact, making, warning lamp temperature brake
S 214	Slutkontakt överväxel	Contact, making, over drive
S 215	Slutkontakt temp motor	Contact, making, temperature engine
S 216	Slutkontakt bromsljus	Contact, making, brake lights
S 217	Slutkontakt backljus	Contact, making, reversing light
S 218	Slutkontakt AT-regulator	Contact, making, AT-control
S 219	Slutkontakt lampa luftfilter	Contact, making, indicating light air filter
S 220	Brytkontakt drivning	Contact, breaking, drive cut off

NUMBER	SVENSKA	ENGLISH
S 221	Slutkontakt temp växellåda	Contact, making, temperature gear box
S 222	Slutkontakt lampa temp moment - förstärkare	Contact, making, warning lamp temperature torque amplifier.
S 223	Släpkontakt signal	Contact, brush, horn
S 224	Slutkontakt insprutningspump	Contact, making, injection pump
S 225	Brytkontakt säkerhetsbälte	Contact, breaking, seat belt
S 228	Slutkontakt hyttlåsning	Contact, making, cab locking
S 229	Slutkontakt stolslåsning	Contact, making, seat locking
S 230	Brytkontakt stol	Contact, breaking, seat
S 231	Slutkontakt fotkontroll stolvändning	Contact, making, seat rotation, foot switch
S 232	Brytkontakt lampa luftanslutning släp	Contact, breaking, warning lamp air connection
S 233	Slutkontakt lampa låsning vändskiva	Contact, warning, interlocking of turntable
S 235	Slutkontakt sidoskjutning stol	Contact, making, side shifting of seat
S 236	Slutkontakt vattennivå	Contact, water level
S 239	Brytkontakt termisk	Contact, breaking, thermic
S 240	Slutkontakt termisk	Contact, making, thermic
S 241	Brytkontakt lampa luftmatning släp	Contact, breaking, warning lamp air supply to trailer
S 242	Slutkontakt lampa oljetryck v-låda	Contact, making, warning lamp, oil pressure gear box
S 243	Brytkontakt tryck kylmedia AC	Contact, breaking, coolant pressure (air condition)
S 244	Slutkontakt hydraulik aktiverad	Contact, making, hydraulics
S 245	Slutkontakt hydraultryck styrning	Contact, making, hydraulic pressure control
S 246	Slutkontakt tryck kylmedia	Contact, pressure refrigerant
S 250	Manöverbrytare	Operating Switch
S 251	Slutkontakt vändbar förarstol	Contact, making, VBFS
S 260	Slutkontakt lyft steg 1	Contact, making, hoist step 1
S 261	Slutkontakt lyft steg 2	Contact, making, hoist step 2
S 262	Slutkontakt tilt	Contact, making, tilting
S 263	Slutkontakt gaffelspridning	Contact, making, fork positioning
S 264	Slutkontakt sidoföring	Contact, making, sideshift
S 265	Slutkontakt stativ in/ut	Contact, making, lifting mast in-out
S 266	Brytkontakt hytt dörr	Contact, breaking cab door
S 267	Slutkontakt bromstryck	Contact, making, brake pressure
S 268	Slutkontakt kompressor	Contact, making, Compressor
S 269	Slutkontakt sax inne	Contact, making extender in
S 270	Slutkontakt överlastskydd	Contact, making, overload protection
S 271	Slutkontakt, filter växellåda	Contact, making, filter gearbox
S 299	Slut/brytkontakt option	Contact, making/braking option
S 720	Givare vändbar förarstol	Transmitter, revolving driver's seat (VBFS)
S 800	Startelement	Start element
S 815	Manöverspak	Control lever
S 840	Strömfördelare	Distributor
S 1001	Strömställare, TW	Switch, TW
S 1002	Strömställare, lossa TW	Switch, unlocking of TW
S 1003	Strömställare, låsa TW	Switch, locking of TW
S 1004	Strömställare, stopp vid 30'-35'	Switch, stop at 30 -35'
S 1005	Strömställare, förbikoppling av säkerhetssystem	Switch, overriding of the safety system
S 1006	Strömställare, fällning främre ben	Switch, front legs down

NUMBER	SVENSKA	ENGLISH
S 1007	Strömställare, fällning bakre ben	Switch, rear legs down
S 1008	Strömställare, klämma/lossa ben	Switch, clamping/-releasing legs
S 1009	Strömställare, Motor information	Switch, Engine information
S 1010	Strömställare, tilt av hytt	Switch, tilt of cab
S 1011	Strömställare IR ljus	Switch IR light
S 1012	Strömställare utskjut 20ꝫ-40ꝫ	Switch, Extension 20ꝫ-40ꝫ
S 1013	Strömställare stödben	Switch, Support jacks
S 1014	Strömställare förbikoppling rotationstopp	Switch, over ride rotation stop
S 1015	Strömställare förbikoppling höjdbeg/tp-beg	Switch, over ride height limit/tp-limit
S 1017	Strömställare diagnostik öka/minska	Switch, diagnostics increase/decrease
S 1018	Strömställare diagnostik on/off	Switch, diagnostics on/off
S 1019	Strömställare rastvärme	Switch, paus heat
S 1020	Strömställare automatisk släpp/kläm funktion	Switch automatic release/clamp funktion
S 1021	Strömställare sax	Switch extender
S 1022	Strömställare vertikalhållning	Switch, vertical position
S 1023	Strömställare låsning övre arm	Switch, lock upper arm
S 1024	Strömställare Korta Armen av/på	Switch, Short Arm on/off
S 1025	Strömställare pappersfunktioner av/på	Switch, paper funktions on/off
S 1026	Strömställare omkoppling pappers/klämmagregat	Switch, switch papper/bale clamp
S 1027	Strömställare lyfthöjdsförval	Switch, lift height selection
S 1028	Strömställare lyfthöjdsförval öka	Switch, lift height selection increase
S 1029	Strömställare lyfthöjdsförval minska	Switch, lift height selection decrease
S 1030	Strömställare läraringång givare ultraljud	Switch, teaching ultrasonic sensor
S 1031	Strömställare, Over Height Upp/Ned	Switch, Over Height Up/Down
S 1032	Brytare backljus	Switch reverse light.
S 1033	Flytta korta armen	Move short arm
S 1034	Strömställare förbikoppling startspärr	Switch Override Start interlock
S 1035	Strömställare Val av klämtryck	Switch, Clamp pressure selection
S 1036	Strömställare Korta Armen av/på	Switch , Short Arm on/off
S 1037	Strömställare låsning skevning	Switch, lock levelling
S 1038	Strömställare Övre armpar/Sidoföring	Switch Upper arms/Sideshift
S 1039	Strömställare Inching	Switch, Inching
S 1040	Switch stopp motor	Switch, Stop engine
S 1041	Strömställare motorrumsbelysning	Switch, light engine compartment
S 1042	Strömställare höjjustering stol	Switch, Seat height level
S 1043	Strömställare längdjustering stol	Switch, Seat for/aft adjustment
S 1044	Strömställare Tankväljare	Switch, Tankselector
S 1045	Strömställare Avstängning backalarm	Switch, Rev. Alarm on/off
S 1046	Strömställare eluppvärmd ruta	Switch electrical heated shield
S 1047	Henrik testar en brytare!	
S 1048	Strömställare fjärrstyrning	Switch remote control
S 1049	Strömställare styrning spegel	Switch mirror control
S 1440	Huvudströmbrytare	
S 7200	Givare, axeltryck höger	Sensor, axle pressure right
S 7201	Givare, axeltryck vänster	Sensor, axle pressure left
S 7202	Givare, anliggning vänster fram	Sensor, alignment left front
S 7202	Givare, anliggning höger fram	Sensor, alignment right front
S 7203	Givare, anliggning vänster bak	Sensor, alignment left rear
S 7203	Givare, anliggning höger bak	Sensor, alignment right rear
S 7204	Givare, öppen vänster twistlock	Sensor, unlocked twistlock left
S 7204	Givare, öppen höger twistlock	Sensor, unlocked twistlock right
S 7205	Givare, låst vänster twistlock	Sensor, locked twistlock left

NUMBER	SVENSKA	ENGLISH
S 7205	Givare, låst höger twistlock	Sensor, locked twistlock right
S 7206	Givare, gaffel aggregat	Sensor, fork attachment
S 7207	Givare, 2WD/4WD	Sensor, 2WD/4WD
S 7208	Givare, hytt i körläge	Sensor, Cab in drive position
S 7209	Givare, oljefilter indikering	Sensor, Oil filter indication
S 7210	Givare, hytt i transportläge	Sensor, Cab in transportation position
S 7211	Givare, lyfthöjd	Sensor, lifting height
S 7212	Givare, körläge	Sensor, driving position
S 7213	Givare, Anliggning främre ben	Sensor, Alignment front legs
S 7214	Givare, Anliggning bakre ben	Sensor, Alignment rear legs
S 7215	Givare, kläm främre ben	Sensor, Clamp front legs
S 7216	Givare, kläm bakre ben	Sensor, Clamp rear legs
S 7217	Givare, främre knä	Sensor, front knee
S 7218	Givare, bakre knä	Sensor, rear knee
S 7219	Givare, främre ben	Sensor, front legs
S 7220	Givare, bakre ben	Sensor, rear legs
S 7221	Givare, styraxel	Sensor, steering axle
S 7222	Givare, stödben uppe	Sensor, brace up
S 7223	Givare, stödben nere	Sensor, brace down
U 741	FleetManager batterifilter	FleetManager battery filter
U 823	Signalomvandlare höger	Signal amplifier, right
U 824	Signalomvandlare vänster	Signal amplifier, left
U 901	Spänningsomvandlare	Voltage converter
U 910	Spänningsomvandlare 80V/24V	Voltage converter 80 V / 24 V
U 941	Laddningsutjämnare	Even charger
V 665	Diod	Diode
V 8090	Laser, pappersaggretgat	Lase, Pulp an Paper
W 903	Antenn radio	Aerial, radio
W 906	Antenn kommunikationsradio	Aerial, communication radio
W 8093	Genomföring, kablage	Lead-through, harness
X 37	Terminal stomanslutning	Earthing terminal on chassis
X 39	Terminal minusanslutning	Terminal, negative terminal
X 72	Stickuttag 2-polig	Outlet, 2-pole
X 77	Stickuttag 7-polig	Outlet, 7-pole
X 78	Stickuttag extra 7-polig	Outlet, extra, 7-pole
Y 600	M-ventil avgasbroms	Solenoid valve, exhaust brake
Y 601	M-ventil diff spärr	Solenoid valve, diff. interlock
Y 602	M-ventil broms	Solenoid valve, brake
Y 603	M-ventil värme	Solenoid valve, heater
Y 604	M-ventil kraftuttag sida	Solenoid valve, power take off, side
Y 605	M-ventil kraftuttag bak	Solenoid valve, power take off, rear
Y 606	M-ventil 2/4 hjulsdrift	Solenoid valve, 2/4WD
Y 607	M-ventil hög/låg växel	Solenoid valve, high/low gear
Y 610	M-ventil hydraulsystem allm	Solenoid valve, hydraulics, general
Y 611	M-ventil flödesbegränsning	Solenoid valve, flow restriction
Y 613	M-ventil momentförstärkare	Solenoid valve, torque amplifier
Y 614	M-ventil rangespärr	Solenoid valve, ranging interlock
Y 615	M-ventil hjulvridning	Solenoid valve, wheel turning
Y 616	M-ventil kallstart	Solenoid valve, cold start aid
Y 617	M-ventil AT-regulator by-pass	Solenoid valve, AT-regulator ¿by-pass¿
Y 618	M-ventil vatten klimatanläggning	Solenoid valve, water air conditioner
Y 620	M-ventil vändskiva upp	Solenoid valve, fifth wheel up
Y 621	M-ventil vändskiva ner	Solenoid valve, fifth wheel down
Y 622	M-ventil vändskiva fram	Solenoid valve, fifth wheel forward

NUMBER	SVENSKA	ENGLISH
Y 623	M-ventil vändskiva bak	Solenoid valve, fifth wheel rear
Y 624	M-ventil skevning hö	Solenoid valve, levelling right hand
Y 625	M-ventil skevning vä	Solenoid valve, levelling left hand
Y 626	M-ventil AT-regulator	Solenoid valve, AT-regulator
Y 627	M-ventil vakuum	Solenoid valve vacuum
Y 628	M-ventil bränsleblandning	Solenoid valve fuelmixture
Y 630	M-ventil v-låda fram	Solenoid valve, gear box, forward gear
Y 631	M-ventil v-låda back	Solenoid valve, gear box, rear gear
Y 632	M-ventil v-låda spole 1	Solenoid valve, gear box, 1 gear
Y 633	M-ventil v-låda spole 2	Solenoid valve, gear box, 2 gear
Y 634	M-ventil v-låda spole 3	Solenoid valve, gear box, 3 gear
Y 635	M-ventil klämtryck	Solenoid valve, clamping pressure
Y 636	M-ventil styrning	Solenoid valve, steering
Y 637	M-ventil flytläge skevning	Solenoid valve, equalizing fifth wheel
Y 638	M-ventil stopp insprut pump	Solenoid valve, stop injection pump
Y 639	M-ventil låsning orbitrol ls	Solenoid valve, locking LS orbitrol
Y 640	M-ventil gasol	Solenoid valve, LPG
Y 641	M-ventil förångare (LPG)	Solenoid valve, evaporator (LPG)
Y 642	M-ventil park broms	Solenoid valve, parking brake
Y 643	M-ventil låsning stol (VBFS)	Solenoid valve, seat locking (VBFS)
Y 644	M-ventil låsning vändskiva	Solenoid valve, fifth wheel locking
Y 645	Magnetkoppling komp AC	Magnetic clutch, compressor AC
Y 646	M-ventil stolsvändning	Solenoid valve, seat rotation
Y 647	M-ventil stolstilt	Solenoid valve, seat tilt
Y 648	M-ventil luftfjädring	Solenoid valve, pneumatic springing
Y 673	Vatten ventil motor, ECC	Water valve motor, ECC
Y 676	M-ventil Broms stolsvändning	Solenoid valve Brake seat turning
Y 699	M-ventil option	Solenoid valve, option
Y 826	Ventil spakstyrning	Valve, (steering with control levers).
Y 6001	M-ventil blockering höger	Solenoid valve, blocking right
Y 6002	M-ventil blockering vänster	Solenoid valve, blocking left
Y 6003	M-ventil inkoppling av hydraulik till topplyft	Solenoid valve, activation of toplift hydraulics
Y 6004	M-ventil sänk	Solenoid valve, lower
Y 6005	M-ventil lyft	Solenoid valve, lift
Y 6006	M-ventil bom ut	Solenoid valve, boom out
Y 6007	M-ventil bom in	Solenoid valve, boom in
Y 6008	M-ventil vridning medsols	Solenoid valve, rotation clockwise
Y 6009	M-ventil vridning motsols	Solenoid valve, rotation counter-clockwise
Y 6010	M-ventil tilt ut	Solenoid valve, tilt out
Y 6011	M-ventil tilt in	Solenoid valve, tilt in
Y 6012	M-ventil tilt	Solenoid valve, tilt
Y 6013	M-ventil fällning främre ben	Solenoid valve, lowering front legs
Y 6014	M-ventil fällning bakre ben	Solenoid valve, lowering rear legs
Y 6015	M-ventil klämma/lossa ben	Solenoid valve, clamping/releasing legs
Y 6016	M-ventil Hyttskjutning fram	Solenoid valve, cab movement forward
Y 6017	M-ventil Hyttskjutning bak	Solenoid valve, cab movement reverse
Y 6018	M-ventil spridning ut	Solenoid valve, spreading out
Y 6019	M-ventil spridning in	Solenoid valve, spreading in
Y 6020	M-ventil sidoföring vänster	Solenoid valve, side shift left
Y 6021	M-ventil sidoföring höger	Solenoid valve, side shift right
Y 6022	M-ventil extra hydraulfunktion ut	Solenoid valve, extra hydraulic function out
Y 6023	M-ventil extra hydraulfunktion in	Solenoid valve, extra hydraulic function in

NUMBER	SVENSKA	ENGLISH
Y 6024	M-ventil stativ ut	Solenoid valve, mast out
Y 6025	M-ventil stativ in	Solenoid valve, mast in
Y 6026	M-ventil höger framhjul styrning vänster	Solenoid valve, right front wheel, steering left
Y 6027	M-ventil höger framhjul styrning höger	Solenoid valve, right front wheel, steering right
Y 6028	M-ventil vänster framhjul styrning vänster	Solenoid valve, left front wheel, steering left
Y 6029	M-ventil vänster framhjul styrning höger	Solenoid valve, left front wheel, steering right
Y 6030	M-ventil höger bakhjul styrning vänster	Solenoid valve, right rear wheel, steering left
Y 6031	M-ventil höger bakhjul styrning höger	Solenoid valve, right rear wheel, steering right
Y 6032	M-ventil vänster bakhjul styrning vänster	Solenoid valve, left rear wheel, steering left
Y 6033	M-ventil vänster bakhjul styrning höger	Solenoid valve, left rear wheel, steering right
Y 6034	M-ventil skevning	Solenoid valve, levelling
Y 6035	M-ventil skevning höger	Solenoid valve, levelling right
Y 6036	M-ventil skevning vänster	Solenoid valve, levelling left
Y 6037	M-ventil kylfläkt	Solenoid valve, Cooling fan
Y 6038	M-ventil frikoppling koppling	Solenoid valve, lockup clutch
Y 6039	M-ventil öppna twistlock	Solenoid valve, unlocked twist lock
Y 6040	M-ventil låsa twistlock	Solenoid valve, locked twist lock
Y 6041	M-ventil nöd, twistlock	Solenoid valve, emergency, twistlock
Y 6042	M-ventil mellan bom	Solenoid valve, middle boom
Y 6043	Magnetventil, fällning torn (RTCH)	Solenoid valve, boom lowering (RTCH)
Y 6044	M-ventil blockering twistlock	Solenoid valve, blocking twistlock
Y 6045	M-ventil blockering lyft	Solenoid valve, blocking lift
Y 6046	M-ventil utskjut	Solenoid valve, projecting
Y 6047	M-ventil, hyttillt upp	Solenoid valve, cab tilt up
Y 6048	M-ventil, hyttillt ner	Solenoid valve, cab tilt down
Y 6049	M-ventil, kylkrets broms	Solenoid valve, cooling circuit brake
Y 6050	M-ventil blockering utskjut	Solenoid valve, blocking projecting
Y 6051	M-ventil, regenerering höger	Solenoid valve, regeneration right
Y 6052	M-ventil, regenerering vänster	Solenoid valve, regeneration left
Y 6053	M-ventil, köräge	Solenoid valve, driving position
Y 6054	M-ventil, klämma ihop	Solenoid valve, clamping in
Y 6055	M-ventil, klämma isär	Solenoid valve, clamping out
Y 6056	M-ventil, främre knä ut	Solenoid valve, front knee out
Y 6057	M-ventil, främre knä in	Solenoid valve, front knee in
Y 6058	M-ventil, bakre knä ut	Solenoid valve, rear knee out
Y 6059	M-ventil, bakre knä in	Solenoid valve, rear knee in
Y 6060	M-ventil, främre ben upp	Solenoid valve, front legs up
Y 6061	M-ventil, bakre ben upp	Solenoid valve, rear legs up
Y 6062	M-ventil, urkoppling hydraulpump	Solenoid valve interruption hydraulic pump
Y 6063	M-ventil, stödben upp	Solenoid valve, brace up
Y 6064	M-ventil, stödben ner	Solenoid valve, brace down
Y 6065	M-ventil, frikoppling vridbroms	Solenoid valve, lockup rotation brake
Y 6066	M-ventil, v-låda, drivning	Solenoid valve, gearbox, drive
Y 6067	M-ventil, v-låda, oljetryck till 1:a/3:e växeln	Solenoid valve, gearbox, oil pressure to 1st/3rd gear
Y 6068	M-ventil sax/rotation	Solenoid valve extender/rotation

NUMBER		SVENSKA	ENGLISH
Y	6069	M-ventil, v-låda, oljetryck till 2:a/4:e växeln	Solenoid valve, gearbox, oil pressure to 2nd/4th gear
Y	6070	M-ventil Over Height upp	Solenoid valve, Over Height up
Y	6071	M-ventil Over Height ner	Solenoid valve, Over Height down
Y	6072	M-ventil klämtryck	Solenoid valve clamp pressure
Y	6073	Proportional ventil, Opti speed	Proportional valve, Opti speed
Y	6074	M-ventil, v-låda, växelväljare för 2:a/4:e växeln	Solenoid valve, gearbox, gearswitch for 2nd/4th gear
Y	6075	M-ventil, v-låda, växelväljare för 1:a/3:e växeln	Solenoid valve, gearbox, gearswitch for 1st/3rd gear
Y	6076	M-ventil blockering sänk	Solenoid valve, blocking lower
Y	6077	M-ventil Inching	Solenoid valve, Inching
Y	6078	M-ventil, Avstängning Övre klämarm	Solenoid valve, upper arm off
Y	6079	M-Ventil, Sidoföring/Övre armar	Solenoid valve, Sideshift/Upper arms
Y	6080	M-ventil, aktivering hyttkörning	Solenoid valve, activate sliding cab
Y	6081	M-ventil, ackumulatorladdning	Solenoid valve, accumulator charge
Y	6082	M-ventil tryckbegränsning	Solenoid valve, pressure restriction
Z	822	Signalfilter	Signal filter

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F Technical data

Data

The machine's weights and dimensions vary depending on how the machine is equipped. Detailed information regarding this is given in the product specification and data sheet for the machine in question.

1 Engine	Yuchai YC6M360-30	Cummins QSM11 ⁺
Power acc. to ISO 3046 (net power)	243kW at 2000 rpm	224 kW at 2000 rpm
Torque ISO 3046	1550 Nm at 1100 rpm	1575 Nm at 1400 rpm
Max. rotation speed	2000 rpm	2000 rpm
Number of cylinders	6 cylinders	6 cylinders
Alternator	1960 W (28 V / 70 A)	2400 W (24 V / 100 A)
System voltage	24 V (2 x 12 V / 135 Ah)	24 V (2x12 V / 135 Ah)

2 Transmission	Dana HR36000
No. of gears, forward - reverse	4 – 4

3.3 Power transmission, drive axle	Merritor PRC7534
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4 Brakes	Wet Disc Brakes - Drive wheel
Parking brake	Spring brake - Drive wheel

5 Steering	Hydraulic servo
-------------------	-----------------

6 Suspension	
Dimensions front-rear	18.00x25, PR40 E4
Tyre pressure (also see pressure plate)	1.0 MPa
Tyre type front and rear	Air-filled. Spare and replacement tyres should be of brand names approved by Cargotec.

9 Cab	Spirit Delta
Equivalent sound pressure level in cab according to EN12053 with measurement uncertainty $\sigma_R=2.5$ dB. Measurement value with standard engine.	L_{pAZ} 73 dB(A)
Whole-body vibrations according to EN13059 with measurement uncertainty $k=0.3$ x measured value.	0,5 m/s ²

9.6 Frame, body, cab and accessories, lighting system

Lamp	Output (W)	Socket
Check lamps	1.2	W2x4.6d
Interior lighting	10	S8.5
Tail lights	5	BA15s
Brake light	21	BA15s
Direction indicators	21	BA15s
Position lamps	5	W2.1x9.5d
Headlights (high and low beams)	75/70	P43t-38 (H4)
Back-up lights	70	PK22s (H3)
Work lights	70	PK22s (H3)
Xenon working lights 	35	D1S Xenon tube. Cartridge and ballast are replaced completed.
Revolving beacon	70	PK22s (H3)

Volumes

Any deviation from this table must be approved in writing by Cargotec.

1.2 Engine, fuel system	Yuchai YC6M360-30	Cummins QSM11 
Fuel tank	550 l	
Fuel quality	Diesel acc. to EN590	

1.7 Engine, cooling system	Yuchai YC6M360-30	Cummins QSM11 
Cooling system	35 l	40 l
Coolant, refilling and changing	Volvo Penta Coolant VCS, ready-mixed.	ES Compleat, Premix
	See <i>Oils and lubricants, recommendation</i> , page F:7.	
	 CAUTION Different types of coolant may not be mixed. Risk of engine damage and damage to the cooling system if different types of coolant are mixed. When changing and topping up coolant, the same type of coolant must be used as was used before.	

1.8 Engine, lubrication system	Yuchai YC6M360-30	Cummins QSM11 
Oil engine, volume	28 l	34 l
Oil type, quality	See <i>Oils and lubricants, recommendation</i> , page F:7.	

2.6 Transmission, lubrication system	Dana HR36000	
Oil transmission, volume	50 l	
Oil type, quality	See <i>Oils and lubricants, recommendation</i> , page F:7.	

3.3 Power transmission, drive axle	Merritor PRC7534
Differential	50 l
Hub reduction	2x10 l
Oil type, quality	See <i>Oils and lubricants, recommendation</i> , page F:7.

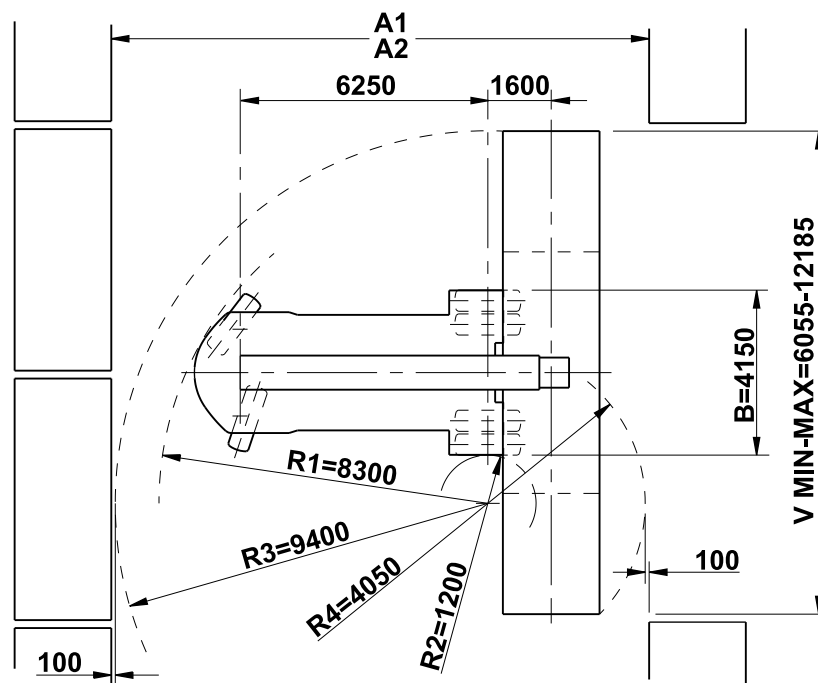
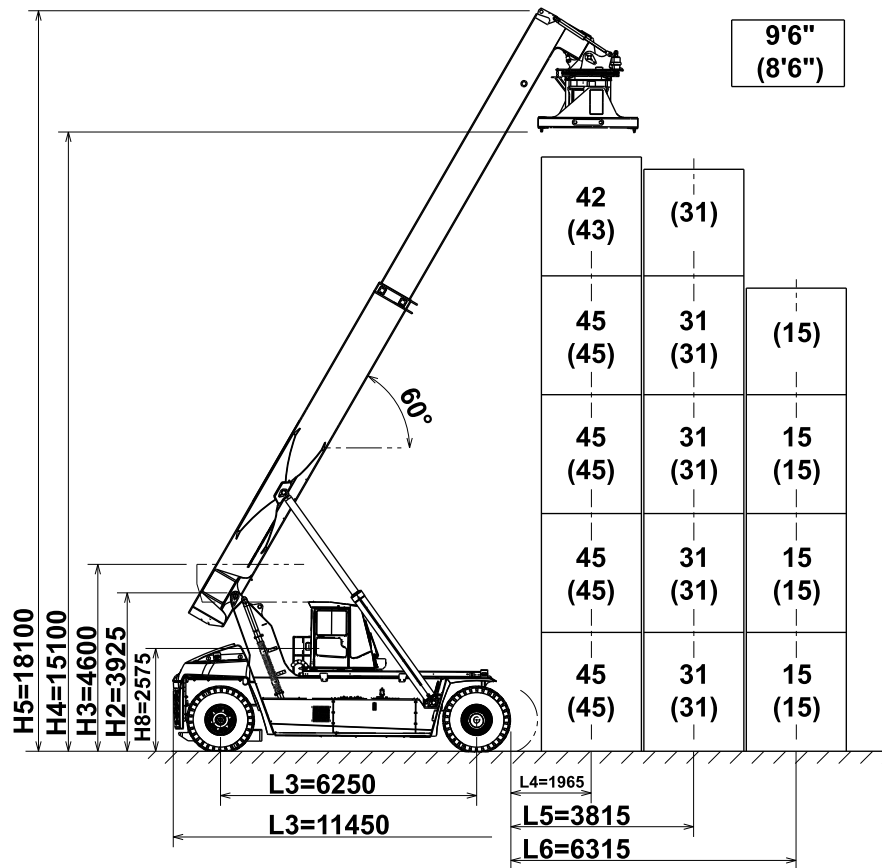
4 Brakes	
Brake system	140 l
Oil type, quality	See <i>Oils and lubricants, recommendation</i> , page F:7.

7 Load handling	Spreading (positioning) motor	Rotation motor
Planetary gear hydraulic motor	2.3 l	2.45 l
Brake hydraulic motor	-	0.6 l
Oil type, quality	See <i>Oils and lubricants, recommendation</i> , page F:7.	

9 Frame, body, cab and accessories	Yuchai YC6M360-30	Cummins QSM11 
Refrigerant, volume	2000 g	
Refrigerant air conditioning	R134a	
Air conditioning, lubricants	Zexel PAG oil (pre-filled with correct volume.)	1,7 dl ZXL100 PAG oil
Washer fluid	5 l	

10 Common hydraulics	
Hydraulic oil tank, volume	600 l
Hydraulic system, volume	940 l (total, incl. tank)
Oil type, quality	See <i>Oils and lubricants, recommendation</i> , page F:7.

Lift capacity and dimensions



Oils and lubricants, recommendation

The service intervals specified by Cargotec in the maintenance manual only apply if oils are selected in accordance with the table below. The table indicates recommended viscosity for different oil types, and grades, depending on the outdoor temperature.

Any deviation from this table must be approved in writing by Cargotec, and may mean changed service intervals.

Oil type, quality	°C	-20	-10	0	+10	+20	+30	+40
	°F	-4	+14	+32	+50	+68	+86	+104
1.8 Engine, lubrication system Yuchai YC6M360-30 API CH-4 or ACEA E5 Cummins QSM11  API CH-4 or ACEA E5								
						SAE 15W-40 (motor oil)		
						SAE 15W-30 (motor oil)		
						SAE 10W-30 (motor oil)		
						SAE 5W-30 (motor oil)		
						SAE 15W-40 (motor oil)		
						SAE 5W-30 (motor oil)		
2.6 Transmission, lubrication system GM Allison C-4 John Deere J20 C, D Caterpillar TO-4 MIL-PRF-2104G NOTE <i>Engine oil or GL-5 oil must not be used.</i>								
						SAE 50		
						SAE 40		
						SAE 30		
						SAE 20		
						SAE 10W		
						SAE 0W-20		
3.3 Power transmission, drive axle API GL-5								
						SAE 80W-140		
						SAE 75W-90		
4 Brakes (UTTO oil) *) GM Allison C-4 John Deere J20 C, D Caterpillar TO-4								
						SAE 5W-30 (transmission oil)		
7 Load handling Planetary gear hydraulic motor, hypoid oil API GL-5 Disc brake hydraulic motor, see "10 Common hydraulics" below.								
						SAE 80W-140		
						SAE 75W-90		
10 Common hydraulics DIN 51524 Part 3 HVLP								
						ISO VG 68		
						ISO VG 46 HV		
						ISO VG 32		

NOTE

Oil filters shall always be changed in connection with oil change.

Change interval for engine oil requires that the sulphur content in the fuel does not exceed 0.5%.

*) The oil in the brake system must meet one of the quality requirements as well as be a UTTO oil (Universal Tractor Transmission Oil).

ACEA = Association des Constructeurs Européenne d'Automobiles

API = American Petroleum Institute

Lubricating grease

Use a universal grease type EP according to NLGI Grade 2 (EP2) for all lubrication points except hoisting equipment and slide plates.

For hoisting equipment use a universal grease type EP according to NLGI Grade 2 (EP2) with 3-5% molybdenum sulphide content.

For slide plates use a lubricant approved by Cargotec. Order from Cargotec Spare Parts Department. 0.65 kg cartridge for grease gun, part no. 923110.0360 and 5 kg can part no. 923595.0003.

NOTE

Select lubrication class according to the prevailing climate.

Contact grease

Contact grease 923836.0552.

Sealant silicone

Sealant silicone 923107.0308.

Silicone adhesive

Silicone adhesive 923854.0100.

Coolant

Use ready-mixed recommended coolant. Choose the mixture of coolant that is adapted for the right temperature.

NOTE

It is important that the coolant is mixed correctly all year round to ensure adequate corrosion protection. The corrosion-protective properties decline with time which is why the coolant has to be changed in accordance with specified intervals.



CAUTION

Different types of coolant may not be mixed.

Risk of engine damage and damage to the cooling system if different types of coolant are mixed.

When changing and topping up coolant, the same type of coolant must be used as was used before.

Tightening torques, recommendations

The tightening torques in the following table are recommendations when tightening bolts and nuts.

When torque-tightening using a machine, for example, bolt runner, the tightening torque should be reduced by approx. 5%.

For soft surfaces (lower hardness than 200 HB), use washer under both bolt head and nut. As an alternative, flange bolt or flange nut can be used.

Tighten to the prescribed torque without stopping.

Recommended tightening torque may vary depending on surface treatment. Certain combinations of nut and bolt require lubrication in accordance with the table below.

Condi- tion	Bolt	Nut	Lubrication
1	untreated	untreated	oil
2	bright galvanised	untreated or bright galvanised	dry or oil
3	hot-galvanised	untreated	dry or oil

Quality	8.8			10.9	12.9
Condition	1	2	3	1	1
Fine M-thread					
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
M-thread					
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
UNC-thread					
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

Quality	8.8			10.9	12.9
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	-	180-200
30	-	
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

Material fitting

UNF-UN		Metric-ISO		BSSP	
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		

Tightening torque, connections for air conditioning

O-ring couplings cooling hoses

Hose diameter		Thread	Tightening torque
mm	inch	inch	Nm
6	1/4"	7/16"	7-13 Nm
10	3/8"	5/8"	14-20 Nm
10	3/8"	11/16"	14-20 Nm
12	1/2"	3/4"	14-26 Nm
16	5/8"	7/8"	27-41 Nm
19	3/4"	1 1/16"	34-46 Nm
Pressure switch		3/8"	7-13 Nm
		7/16"	

The above values should be considered guidelines and may vary depending on installation.

Unit explanations

Unit	Abbreviation
Newton metre	Nm
Kgf/m	kpm
Kilo pascal	kPa
Mega pascal	MPa
Kilowatt	kW
Kilojoule	kJ
British thermal unit	Btu
Calorie	ca
Inch	in
Feet	ft
Yard	yd
Mile	mile
Centimetre	cm
Metre	m
Kilometre	km

Conversion SI-units

SI-unit	Recalculation factor	Non-SI	Recalculation factor	SI
Torque				
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
Pressure (Pa = N/m ²)				
kPa	x 4.0	= in.H ₂ 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 ²	x 14.22	= psi	x 0.070	= kp/cm ²
N/mm ²	x 145.04	= psi	x 0.069	= bar
MPa	x 145	= psi	x 0.00689	= MPa
Power (W = J/s)				
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
Energy (J = Nm)				
kJ	x 0.948	= Btu	x 1.055	= kJ
J	x 0.239	= calorie	x 4.19	= J
Speed and acceleration				
m/s ²	x 3.28	= ft/s ²	x 0.305	= m/s ²
m/s	x 3.28	= ft/s	x 0.305	= m/s
km/h	x 0.62	= mph	x 1.61	= km/h
Horsepower/torque				
Bhp x 5252 rpm= TQ (lb·ft)			TQ x rpm 5252 = bhp	
Temperature				
°C = (°F – 32)/1.8	°F = (°C x 1.8) + 32			
Flow factor				
l/min (dm ³ /min)	x 0.264	= US gal/min x 3,785		= litre/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 ²	m ²	km ²	a	ft ²	yd ²	in ²
cm ²	1	0.0001	-	0.000001	0.001076	0.000012	0.155000
m ²	10000	1	0.000001	0.01	10.764	1.1958	1550.000
km ²	-	1000000	1	10000	1076400	1195800	-
a	0.01	100	0.0001	1	1076.4	119.58	-
ft ²	-	0.092903	-	0.000929	1	0.1111	144.000
yd ²	-	0.83613	-	0.008361	9	1	1296.00
in ²	6.4516	0.000645	-	-	0.0006943	0.000771	1
1 ha = 100 a – 1 mile ² = 259 ha = 2.59 km ²							

Conversion table volume

Unit	cm ³ = cc	m ³	l	in ³	ft ³	yd ³
cm ³ = ml	1	0.000001	0.001	0.061024	0.000035	0.000001
m ³	1000000	1	1000	61024	35.315	1.30796
dm ³ (l)	1000	0.001	1	61.024	0.035315	0.001308
in ³	16.387	0.000016	0.01638	1	0.000578	0.000021
ft ³	28316.8	0.028317	28.317	1728	1	0.03704
yd ³	764529.8	0.76453	764.53	46656	27	1
1 gal (US) = 3785.41 cm ³ = 231 in ³ = 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 tonne (metric) = 1.1023 ton (US) = 0.9842 ton (UK)					

Conversion table pressure

Unit	kp/cm ²	bar	Pa = N/m ²	kPa	lbf/in ²	lbf/ft ²
kp/cm ²	1	0.98067	98066.5	98.0665	14.2233	2048.16
bar	1.01972	1	100000	100	14.5037	2088.6
Pa = N/m ²	0.00001	0.001	1	0.001	0.00015	0.02086
kPa	0.01020	0.01	1000	1	0.14504	20.886
lbf/in ²	0.07032	0.0689	6894.76	6.89476	1	144
lbf/ft ²	0.00047	0.00047	47.88028	0.04788	0.00694	1
kg/cm ² = 735.56 Dry (mmHg) = 0.96784 atm						

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G Terminology and index

Terminology

Explanations

Term	Description
Accumulator	Reservoir that stores (accumulates) pressure for, i.e. hydraulic functions.
Attachment	Part of the machine that grips the load when lifting.
Anti-corrosion agent	Prevents oxidation, in simple terms, rustproofing.
Working hydraulics	All load handling functions, that is, lift and lower, tilt, side shift, spreading (extension) and levelling.
Wheelbase	Distance between drive axle and steering axle.
Bar	Unit to express pressure.
Battery disconnecter	Cuts off power supply from battery.
Boom	Lifting member moveable vertically and longitudinally. Bracket for attachment.
Daily inspection	Actions that should be performed daily to ensure the machine's functionality.
Decitonne	Tenth of a tonne, measure of machine's lift capacity.
Display	"Window" showing digital information, i.e. on steering wheel panel in the cab.
Operating time	Number of hours machine has been in operation, shown on hour meter in cab.
Drive axle	Driving axle that receives the torque from the drive-train.
Drive-train	Parts in machine involved in power transmission; engine, torque converter, transmission, propeller shaft, and drive axle with differential and hub reduction.
ECC	Electric Climate Control. Air conditioning system with thermostat-controlled cooling, dehumidification and heating.
EHC	Electric Heat Control. Heating system with thermostat-controlled heating.
Electrolyte level	Fluid level in battery cells.
Expansion tank	Tank for coolant.
Fixed displacement	Non-adjustable volume (capacity) in a pump.
Hanging load	Lifted load.
FMI	Fault Message Identifier.
Main fuse	Located by battery. Breaks the current to all systems in the whole machine.
Hydraulic oil	Oil for hydraulic system. See specifications in operator's manual.
Hydraulic oil pump	Pump in hydraulic system.
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.
Refrigerant	Fluid/gas in air conditioning. Must only be handled by authorised trained personnel.
Low-emission engine	Engine with low emissions of hazardous substances. Manufactured in accordance with regulations.
LC	Load centre.
Lift capacity	Indicates machine's maximum lift capacity.
Lifting point	Attaching point for lift device when lifting an object.
Solenoid valve	An electro-magnetically controlled valve. See also proportional valve.
Control valve	Valves that can be used to control something, for example, to release pressure and thus lower a boom or a fork.

Term	Description
Machine model	Machine type. Specified, for example: DRT 450. See also Type designation.
Environmental waste	Used oils, filters, etc., must be handled according to governing national laws and regulations.
Torque converter	Hydraulic, variable clutch.
Hub reduction	Type of final drive (often next to drive wheel) that reduces rpm and increases torque from the drive-train.
OP	Overload Protection. Overload system to warn in the event that the machine is overloaded.
Pilot oil pressure	A low control pressure to, for example, a valve.
Planetary gear	Type of transmission with the gears in constant mesh.
Product alternative	One of several alternatives is selected for a machine, e.g. engine alternative.
Proportional valve	An electro-magnetically controlled valve. If a voltage is applied, the valve is activated in proportion to the voltage amplitude. In simple terms, infinitely variable valve, as opposed to on/off valve. For example, found on transmission's valve housing.
Reachstacker	Machine with special lift boom and top lift attachment for containers.
Serial number	Unique machine designation. On the machine plate.
Service position	How machine should be safely positioned before service may be started.
Servo	A small movement by the user results in a large angle, i.e. servo steering.
Servo pressure	A low control pressure to control a higher pressure, for example, to a valve.
Side shift	Parallel sideways movement of attachment.
Levelling	Attachment is tilted, for example if load stands on uneven ground.
Spirit Delta	Enclosed type of cab.
SPN	Suspect Parameter Number.
Spreading (positioning)	Widening of attachment.
Dust reservoir	The air filter collects the coarsest particles in a dust reservoir, which is emptied automatically during operation.
Steering axle	Wheel axle with steering.
Buzzer	Acoustic alarm to catch the operator's attention.
Option	Extra equipment for machine.
Tilting	Load is leaned forward or backward.
Transmission oil	Oil for transmission and torque converter. See specifications in operator's manual.
Securing machine for transport	Actions before transporting machine.
Twistlocks	Four locking 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.
Maintenance	Periodic maintenance actions so that machine functions safely and for a long service life.
UTTO oil	Universal Tractor Transmission Oil.
Variable pump	Pump with adjustable flow rate.
Variable displacement	Adjustable volume (capacity) of a pump.
Wet brakes	Brake discs in oil bath.
Valve slide	Moveable part in valve. Determines oil's path.
Rotation bar	Rotating unit on attachment, rotates attachment in relation to lift boom.
Overload system	A warning system, LLMC (Longitudinal Load Moment Control). The system is used for stationary load handling, to not jeopardise the machine's forward stability. LLMC is not designed to control lateral stability or stability when operating.

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Cargotec Sweden AB
Torggatan 3
SE-340 10, Lidhult, Sweden
tel. +46 372 260 00
fax +46 372 263 90
www.cargotec.com