Hydraulic units

(Translation of the original operating instructions)
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1. Hazard classes

We distinguish between various categories of safety instructions. The table below gives you an overview of the assignment of symbols (pictograms) and key words to the specific hazard and possible consequences.

<table>
<thead>
<tr>
<th>Pictogram</th>
<th>Damage / injury to</th>
<th>Key word</th>
<th>Definition</th>
<th>Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>human</td>
<td>DANGER!</td>
<td>Immediate danger</td>
<td>Death or major injury</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WARNING!</td>
<td>Potentially dangerous situation</td>
<td>Potential death or major injury</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CAUTION!</td>
<td>Less dangerous situation</td>
<td>Minor or slight injury</td>
</tr>
<tr>
<td></td>
<td>device</td>
<td>CAUTION!</td>
<td>Danger of damage to device / environment</td>
<td>Damage to the equipment, damage to the environment, damage to surrounding materials</td>
</tr>
<tr>
<td></td>
<td></td>
<td>REMARK</td>
<td>Advice for application and other important / useful information and advice</td>
<td>No injury / damage to persons / environment / equipment</td>
</tr>
</tbody>
</table>

Wear helmet with face protection

Wear safety gloves

Wear safety shoes

Proper recycling

Observe principles of environmental protection

Read and observe operating instructions
2. Product safety

LUKAS products are developed and manufactured in order to guarantee the best performance and quality when used properly.
Operator safety is the most important aspect of the product design. Moreover, the operating instructions are intended to ensure LUKAS products are used safely.
The generally applicable legal and other binding regulations pertaining to the prevention of accidents and protection of the environment apply and are to be complied with in addition to the operating instructions.
The equipment may only be operated by persons with appropriate training in the safety aspects of such equipment – otherwise, there is a danger of injury occurring.
We would like to point out to all users that they should read the operating instructions carefully before using the equipment and comply with the instructions there without restriction.
We further recommend that a qualified instructor train you in the use of the product.

**WARNING / CAUTION!**
The operating instructions for the hoses, the accessories and the connected hydraulic equipment must also be observed.

Even if you have already received instructions on how to use the equipment, you should still read through the following safety instructions once again.

**WARNING / CAUTION!**
Ensure that the accessories and connected equipment used are suitable for the maximum operating pressure.

<p>| Please ensure that no body parts or clothing get stuck between the visibly moving parts. | The department responsible is to be informed immediately of any changes (including to the operating behaviour). If necessary, the equipment is to be shut down immediately and secured. |
| Wear protective clothing, safety helmet with visor, safety shoes and protective gloves. | Inspect the equipment before and after use for visible defects or damage. |
| It is prohibited to work under load if this load is lifted exclusively by hydraulic equipment. If this work is absolutely imperative, additional mechanical supports must be used. | Inspect all lines, hoses and screwed connections for leaks and externally visible damage. If necessary, repair immediately. Squirting hydraulic liquids can result in injuries and fires. |</p>
<table>
<thead>
<tr>
<th>Warning</th>
<th>Action</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the event of malfunctions, immediately shut down the equipment and secure it. The malfunction is to be repaired immediately.</td>
<td>Do not carry out any changes (additions or conversions) to the equipment without obtaining the prior approval of LUKAS.</td>
<td></td>
</tr>
<tr>
<td>Comply with all the instructions regarding safety and danger on the equipment and in the operating instructions.</td>
<td>All the instructions regarding safety and danger on the equipment are to be kept complete and in a legible condition.</td>
<td></td>
</tr>
<tr>
<td>Please ensure that all safety covers are present on the equipment and that they are in proper and adequate condition.</td>
<td>Any method of operation which impairs safety and/or stability of the equipment is prohibited.</td>
<td></td>
</tr>
<tr>
<td>Safety devices may never be deactivated.</td>
<td>The maximum operating pressure set on the equipment must not be changed.</td>
<td></td>
</tr>
<tr>
<td>Before the equipment is switched on / started up, and during its operation, it must be ensured that nobody is endangered by the operation of the equipment.</td>
<td>Comply with all specified dates or dates specified in the operating instructions pertaining to regular checks / inspections of the equipment.</td>
<td></td>
</tr>
<tr>
<td>When working close to live components and cables, suitable measures must be taken to avoid current transfers or high-voltage transfers to the equipment.</td>
<td>Only original LUKAS accessories and spare parts may be used for repairs.</td>
<td></td>
</tr>
<tr>
<td>The build-up of static charge with the potential consequence of spark formation is to be avoided when handling the equipment.</td>
<td>When working with combustion engine pumps, never touch the motor and exhaust system, since there is a risk of burning.</td>
<td></td>
</tr>
<tr>
<td>Motor pumps may not be used in explosion hazard areas.</td>
<td>Combustion engines are not permitted to be operated in enclosed spaces as there is a risk of poisoning and/or asphyxiation.</td>
<td></td>
</tr>
<tr>
<td>If the fuel of a combustion engine is spilled, this must be cleaned up before the engine is started.</td>
<td>Filling up during operation of the combustion engine is strictly prohibited.</td>
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<tr>
<td></td>
<td>Keep combustion engines and their fuel away from ignition sources, as otherwise there is the danger of an explosion.</td>
<td>All damaged electrical components e.g. scorched cables, etc. are to be replaced immediately.</td>
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<td>---</td>
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<tr>
<td></td>
<td>To avoid the risk of fire, ensure adequate ventilation during combustion engine operation and maintain a minimum safety distance of 1 m (39.4 in.) from walls and other shielding installations.</td>
<td>Damage to electrical components must be repaired only by a trained and qualified electrician in compliance with all applicable national and international safety rules and regulations.</td>
</tr>
<tr>
<td></td>
<td>To avoid fuel spillage, make sure that the combustion engine pumps are standing on as level and horizontal a surface as possible.</td>
<td>When setting up the units, it must be ensured that they are not impaired by the influences of extreme temperatures.</td>
</tr>
<tr>
<td></td>
<td>The equipment is filled with hydraulic fluid. These hydraulic fluids can be harmful to your health if swallowed or if their vapours inhaled. Direct contact with the skin is to be avoided for the same reason. Please also note that hydraulic fluids can also have a negative effect on biological systems.</td>
<td>When working with or storing the equipment, ensure that the function and the safety of the equipment are not impaired by the effects of extreme external temperatures and that the equipment is not damaged in any way. Please note that the equipment can also heat up over a long period of use.</td>
</tr>
<tr>
<td></td>
<td>Ensure adequate lighting when you are working.</td>
<td>Before transporting the equipment, always ensure that the accessories are positioned in such a way that they cannot cause an accident.</td>
</tr>
<tr>
<td></td>
<td>Always keep these operating instructions within reach where the equipment is used.</td>
<td>Ensure the proper disposal of all removed parts, leftover oil, hydraulic fluid and packaging materials.</td>
</tr>
</tbody>
</table>
The generally applicable, legal and other binding national and international regulations pertaining to the prevention of accidents and protection of the environment apply and are to be implemented in addition to the operating instructions.

**WARNING / DANGER / CAUTION!**

The equipment is to be used exclusively for the purpose stated in the operating instructions (see chapter "Proper use"). Any form of use beyond this is not considered proper use. The manufacturer / supplier is not liable for any damages resulting from improper use. The user bears sole responsibility for such use. Observance of the operating instructions and compliance with the inspection and maintenance conditions are covered by the definition of proper use.

**Never work when you are overtired or intoxicated.**

### 3. Proper use

LUKAS hydraulic units are designed specifically for supplying hydraulic fluid to rerailing equipment manufactured by LUKAS in order that this equipment can be used to upright and rerail railway vehicles. While it is possible for the units to supply pressure/fluid to other makes of rerailing equipment, this shall require the technical inspection and approval of LUKAS.

**WARNING / DANGER / CAUTION!**

**Always** observe the safety notes of these operating instructions with regard to place of installation and type of installation. The units must not be used in all atmospheres, since there could be a danger of explosion.

Accessories and spare parts for the rerailing equipment are available from your authorised LUKAS dealer.

### 4. Labelling of the units

- **PC** - *Type group*
- **6** - *Motor variants*

**Motor variants:**

- PC = Electric motor
- GC = Petrol engine
- DC = Diesel engine
5. Functional description

5.1 General

The main components (see example illustration) of a LUKAS hydraulic unit are:

1. Fluid reservoir
2. Motor
3. Pump
4. Frame
5. Connecting block
6. Valve block
7. Carry handles
8. Fluid drain plug
9. Filler cap
10. Optional hose reel attachment

As a general principle on all LUKAS hydraulic units, a hydraulic pump is operated with a motor (combustion engine or electric motor) that feeds the fluid from the reservoir and builds up the pressure. The fluid distribution is then controlled by valves directly attached to the equipment or by external control units (e.g. control desks).

The mounted frame serves as a simple protective cage and as a mounting base for accessories that can be fitted. The hydraulic unit can also be carried by the frame or using carrying handles mounted on it.

CAUTION!
Where multiple implements are operated with the same hydraulic unit, it must be ensured that the usable volume of hydraulic fluid in the fluid reservoir is greater than the maximum possible operating fluid volume required for all connected implements combined.

If no external control unit (e.g. control desk) is to be connected, it is possible to order a LUKAS hydraulic unit with the valves or valve blocks directly attached.

If you are considering these optional valves or valve blocks, you should consult your authorised LUKAS dealer or LUKAS directly before you combine your rerailing equipment components. Only then can you be sure that the individual, combinable LUKAS components (unit, implements, etc.) of your system arrangement will continue to function correctly, and that risks to persons and equipment are eliminated.

Operation without an attached or external control unit is NOT permitted.
5.2 Motor variants

**WARNING / DANGER / CAUTION!**
For all motor variants, also comply with the separate operating instructions of each motor manufacturer.

5.2.1 Electrical
These hydraulic units are equipped with an electric motor. The electric motor is driven by electricity from the mains supply or by electricity produced by generators. In the case of operation with generators, make sure that voltage fluctuations do not occur, as these have a direct influence on the pumping capacity and stability of the hydraulic unit. For the supported operating voltage and current frequency, please refer to the “Technical data” chapter in the instruction manual for your unit.

5.2.2 Gasoline / petrol
These hydraulic units are equipped with a combustion engine driven by the fuel "gasoline / petrol". (For specific details, please consult the separate operating instructions of the engine manufacturer.)

5.2.3 Diesel
These hydraulic units are equipped with a combustion engine driven by the fuel "diesel". (For specific details, please consult the separate operating instructions of the engine manufacturer.)

5.3 Pumps
Depending on the model, LUKAS hydraulic units contain a single-flow or multi-flow pump.

- Single-flow pump 1 pump capacity
- Double-flow pump 2 pump capacities
- Triple-flow pump 3 pump capacities
  etc.

The pumps used are always equipped with two pressure levels for each pump capacity, one low-pressure and one high-pressure level.

- Low-pressure level (ND) = up to 16 MPa* *(1 MPa = 10 bar)
- High-pressure level (HD) = up to max. 53 MPa*

The changeover from low pressure to high pressure is carried out automatically in the pump. The maximum operating pressure is limited by a pressure limiting valve. For information on how to adjust this valve to work with your hydraulic unit model, please refer to the “Technical data” chapter.
5.4 Frames
All hydraulic units for the rerailing equipment are supplied with a frame. The frame enables optional accessories to be attached directly to it. In addition, the frame makes the unit easier to transport, thanks in particular to the integral carry handles.

5.5 Connection to the control unit
The unit is connected to the control unit by means of hoses or pairs of hoses. These are available in various lengths, coloured bend protections and with various connection options.
The individual hose lines in a hose pair are distinguishable by their different colour, which helps to prevent confusing the supply line for the return line.
(For specific details, please consult the LUKAS range of accessories or contact your LUKAS dealer).

5.6 Connection options
On the hydraulic unit, the supply and return lines are connected to a connecting block or valve block.
The standard range is designed to support only direct hose connections or quick-disconnect couplings.

5.7 Optional accessories
5.7.1 Hose reels
Some hydraulic unit frames allow hose reels to be fitted. The use of attachment reels makes it possible to route the optimum length of hose for a specific application and to keep the amount of hose needed in the work area to a minimum.
The hose reels are connected to the pump assembly mechanically and hydraulically. The hydraulic connection is achieved either by hose lines or by pipework.
(To find out whether suitable attachment reels are available for your unit, please consult your authorised LUKAS dealer or LUKAS directly.)

5.7.2 Drain valves
Some hydraulic units can be equipped with a drain valve instead of the connecting block. The advantage of the drain valve is that, when it is opened (handwheel turned clockwise to the stop), the hydraulic unit is switched to depressurised circulation. It is only when the valve is closed (handwheel turned anti-clockwise to the stop) that the connected control unit and the associated implements are made ready for operation.
It is possible to have the connecting block replaced by a drain valve at a later time.
The hose lines or pipework are connected to the drain valve in the same way they are connected to the connecting block.
(To discuss the purchase of a drain valve, please contact your authorised LUKAS dealer or LUKAS directly.)
6. Connection of the hoses

**CAUTION!**
When connecting the hose assemblies, always ensure that the connection components are not soiled; clean beforehand if necessary.

**REMARK:**
Before you attempt to connect or disconnect hose lines to or from the hydraulic unit, including hose lines with quick-disconnect couplings, always make sure that the pump assembly is switched off. Electric pumps must be disconnected from the power supply.

**WARNING / DANGER / CAUTION!**
Before connecting equipment, make sure that all the components used are suitable for the maximum operating pressure of the hydraulic unit. In cases of doubt, you must consult LUKAS directly before connecting the equipment.

6.1 Connection of quick-connect couplings

The equipment is connected to the hydraulic pump via quick-disconnect coupling halves (male and female).

Before coupling, remove the dust protection caps, then pull back and hold the locking sleeve of the female coupling (position X). Fit the socket and plug together and release the locking sleeve. Then turn the locking sleeve to position Y. The connection has now been made and locked. Disconnection is made in the reverse order.

**CAUTION!**
Always couple the return hose first and then the supply hose. On disconnecting, you should always disconnect the supply line first and then the return pipe.

**REMARK:**
Coupling of the devices is only possible when the hoses are depressurised.

To protect against dust, the accompanying dust protection caps must be replaced.

**WARNING / DANGER / CAUTION!**
Some quick-disconnect couplings have special functions. Therefore it is not permitted to screw them off the hoses or to swap them.
6.2 Direct connection

**REMARK:**
To be able to screw the hoses onto the connecting block directly, you must check first whether the corresponding connection nipples are fitted inside the connecting block.

The hydraulic hoses are screw-connected to the connecting block of the hydraulic unit. The connecting block must contain the necessary connection nipples. The hoses are fastened to these connection nipples directly by union nuts. To do this, you need to remove the dust protection caps or screw plugs and the steel balls underneath before connecting the hydraulic hose and securing the hose to the connection nipple by tightening the union nut. The specified tightening torque of 35 Nm must be observed. At the connecting block, the return line is labelled “T” and the supply line is labelled “P”.

**CAUTION!**
Always connect the return hose first and then the supply hose.

7. Set-up and start-up

7.1 Installation

**WARNING / DANGER / CAUTION!**
Combustion engine units and most electrical units must not be used in a potentially explosive situation (danger of the formation of sparks). Units with combustion engines must not be used in enclosed spaces, as there is a danger of poisoning and/or asphyxiation.

The unit is to be set up in a suitable location (safe location / flat surface / sufficient distance from vehicles, loads, sources of ignition, etc.). LUKAS units work perfectly at an angle of up to 30°. However, in order to guarantee maximum safety and fluid withdrawal, they should be operated in as horizontal a position as possible.
7.2 Start-up

Please proceed as follows:

1. First of all, check the hydraulic fluid level of the unit. Depending on the unit model, the fluid level is indicated by a fluid sight glass (maximum = centre of sight glass; refill required if fluid level no longer visible in the sight glass) or a dipstick (usually attached to a filler screw). If necessary, you should top up the fluid to the maximum level.

2. Now connect the external control unit, if this is not already permanently connected to the hydraulic unit.

3. For hydraulic units with an electric motor, you should now connect the plug to the power supply.

4. Then vent the hydraulic unit. Make sure that the control unit is switched to depressurised circulation. If you cannot be absolutely sure that this is the case, take appropriate measures to enforce depressurised circulation, e.g. by connecting the supply and pressure lines together (observe the separate operating instructions for the control unit concerned). The actual venting is carried out in the units in a different manner, depending on the drive motor:
   a) **Gasoline / petrol engine:**
      - Remove plug connector from the spark plug.
      - Slowly turn the starter rope several times. For a motor with electric starter, activate the starter several times.
      - Then replace the plug connector.
   b) **Diesel engine:**
      - Slowly turn the starter rope several times in such a way that the engine does not start.
   c) **Electric motor (power and accumulator operation):**
      - Switch on the motor and switch it off again after approximately 10 seconds. Repeat this procedure several times. (Before switching back on, the motor must be at a standstill.)
      This procedure means that the pump can slowly extract and be well vented. The hydraulic fluid reservoir is equipped with automatic venting, which means no further venting measures are required.

5. Check the level of the fluid in the reservoir once more. If necessary, top up the fluid.

6. Return the control unit to operational condition, i.e. reconnect the control unit correctly.
8. Operation

**CAUTION!**
Before the motor is started, the hydraulic unit and the control unit must be switched to *depressurised circulation* (for the hydraulic unit, this means connecting the supply and return lines together, for example). Only in this way is it possible to start the unit without a hydraulic load.

8.1 Starting the motors

8.1.1 Gasoline / petrol and diesel engines
Before starting the combustion engines, check that the fuel tank is full and that the engine oil level is within the permitted tolerances. If necessary, top up the relevant fluid.

*Procedure for starting Briggs & Stratton engines:*
1. Open gasoline / petrol tap
2. Move the lever from switch position A to switch position C
3. Pull the starter rope or activate the E starter

*Procedure for starting Intek engines:*
1. Open gasoline / petrol tap
2. Move top lever from switching position E to switching position F
3. Move bottom lever (choke) from switching position G to switching position H
4. Pull the starter rope or activate the E starter
5. When the motor is running, switch bottom lever back to switching position G.

*Procedure for starting Honda engines:*
1. Open gasoline / petrol tap
2. Switch the ON/OFF switch to ON.
3. Move lever from switching position J to switching position K (choke)
4. Pull starter rope
5. When the motor is running, switch lever back to switching position J

*Please consult the separate operating instructions of the motor manufacturer for the precise procedure for starting the combustion engine.*
An electric starter is available from the LUKAS range of accessories for some units. *(For specific details, please consult the LUKAS range of accessories or contact your LUKAS dealer).*

On these units, after checking the fluid levels, proceed as follows:
1. Switch to "START ENGINE"
2. Turn the ignition key clockwise.

Charge the accumulator of the electric starter:
1. Switch to "CHARGE BATTERY"
2. Connect the supplied charger to the mounted socket.

### 8.1.2 Electric motors

Before starting the electric motors, check that all electrical connections and cables are in proper order. First of all, connect the power cable (for motors with power supply) to the supply socket.

The motor is started by turning the ON/OFF switch to the **ON** position.

#### CAUTION!

Electric motors need a brief, very high starting current. When using a generator, you should therefore check to see that it can also supply the relevant current strength.

*For motors rated up to 1.5 kW, the power supply must be protected by a fuse with a minimum rating of 25 A (slowblow). For motors rated over 1.5 kW, the minimum fuse rating is 30 A (slowblow). As the information above may vary depending on individual circumstances and on the type of motor used, you should always consult your dealer or LUKAS directly in case of doubt.*

### 8.2 Stopping the motors

#### 8.2.1 Gasoline / petrol and diesel engines

The gasoline / petrol and diesel engines stop automatically when the fuel tank is empty. Should they stop moving beforehand, the following procedure is required:

**Procedure for stopping Briggs & Stratton engines:**
1. Move the lever from switch position C to switch position A
2. When the engine has come to a standstill, close the fuel tap.

**Procedure for stopping Intek engines:**
1. Move the top lever from switching position F to switching position E
2. When the engine has come to a standstill, close the fuel tap.

Procedure for stopping Honda engines:
1. Set the ON / OFF switch to the OFF position.
2. When the engine has come to a standstill, close the fuel tap.

Please consult the separate operating instructions of the motor manufacturer for the precise procedure for stopping combustion engines.

WARNING / CAUTION!
Never touch the hot motor / engine parts: this could result in severe burns.

8.2.2 Electric motors
The movements of the electric motors are stopped by changing the ON/OFF switch to the OFF position. This also stops the pumping output of the connected hydraulic pump.

9. Dismantling the equipment / deactivation following operation

Once work has been completed, all connected equipment is to be reset to its base position before the unit is shut down. You can now stop the motor of the unit / switch it off and, if using an electric motor (without accumulator), disconnect it from the mains supply.

Quick-disconnect couplings:
If the connected hose assemblies have to be dismantled during shut-down, decouple as described in chapter "Coupling the quick-disconnect couplings". Ensure that you replace the dust protection caps onto the mono-coupling halves.
Clean heavy soiling caused during use of the hydraulic unit before storage.

Direct connection:
This connection should only be unscrewed when it is absolutely necessary, e. g. when you have a longer storage time, when decommissioning, for maintenance tasks, etc.
If the connected hose assemblies have to be dismantled during shut-down, first of all disconnect the pressure hose and then the return hose. Ensure that you replace the dust protection caps onto the screw-in sleeves and onto the hoses. Clean heavy soiling caused during use of the hydraulic unit before storage.

CAUTION!
Depending on the size and the weight of the hydraulic unit, it should be transported to the storage site by one person or several people.

If the equipment is to be stored for a longer period of time, the exterior is to be cleaned completely and the mechanical moving parts are to be lubricated. If storing a unit with combustion engine, you should also remove the fuel from the fuel tank.
Avoid storing the hydraulic units in a damp environment.
The guidelines in the separate operating instructions for the hose lines must also be observed.
10. Maintenance and service

The hydraulic units are subject to very high mechanical loads. For this reason, visual inspections and function tests must be carried out at regular time intervals. These inspections and tests enable signs of wear to be identified in good time. Prompt replacement of wear parts can then prevent damage to the equipment. Also check regularly that all fastening screws are tightened securely (observe tightening torques where applicable).

You must observe all applicable national and international laws, rules, regulations and standards relating to the maintenance intervals of rerailing equipment.

**CAUTION!**
Clean off any dirt before checking the equipment.

**WARNING / DANGER / CAUTION!**
In order to carry out maintenance and repair work, tools appropriate for the job and personal protection equipment obligatory (including protective covers).

10.1 Recommended inspection intervals

10.1.1 Visual inspection

A visual inspection must be carried out after each use and once a year regardless of use.

10.1.2 Function test

<table>
<thead>
<tr>
<th>Operating time per day</th>
<th>Function test</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 1 hour</td>
<td>1 x annually</td>
</tr>
<tr>
<td>up to 8 hours</td>
<td>1 x per quarter</td>
</tr>
<tr>
<td>up to 24 hours</td>
<td>1 x per month</td>
</tr>
</tbody>
</table>

In addition to these inspection intervals, a function test should be performed if the unit is making suspicious noises or if there is reason to suspect that the unit has been damaged internally.

If these noises or signs of possible damage arise more than once in a month, or if the nominal pressure (75% of maximum pressure) is not achieved during the function test itself, you must contact the LUKAS Customer Service department immediately. You will find the relevant contact information in the “Troubleshooting” chapter.
10.2 Hydraulic units with combustion engine

**Visual inspection**

*Hydraulic units*

- Check that all hydraulic connections are tightened
- General tightness, no leakage (the hot oils do not have any influence on the function)
- Is there damage to the motor, connecting block or housing?
- Frame present, undamaged and securely assembled?
- Are type plate, all activation plates, signs, identification marks and warning labels are present and legible?
- Are all covers (e.g. protective roof, exhaust cover) present and undamaged?
- Are all liquid levels within the specified tolerances?
- Are the starters in proper working order and undamaged?
- Couplings must be easy to couple (where present)
- Dust protection caps must be available
- All necessary accessories (such as spark plugs, plug socket and fuel canister must be present.

*Connected hoses*  
*(also observe the separate operating instructions for the hydraulic hoses)*

- Visual check for visible damage
- Check for leaks.

**Function test**

- No suspicious noises
- Checks at nominal pressure (75% of maximum pressure).  
  *(Recommendation: Carry out the load test with a fully assembled rerailing system. LUKAS also offers a range of appropriate test equipment.)*

10.3 Hydraulic units with electric motor

**Visual inspection**

*Hydraulic units*

- Check that all hydraulic connections are tightened
- General tightness, no leakage (the hot oils do not have any influence on the function)
- Is there damage to the motor, connecting block or housing?
- Frame present, undamaged and securely assembled?
- Are type plate, all activation plates, signs, identification marks and warning labels are present and legible?
- Are all covers (e.g. protective roof, fan cover) present and undamaged?
- Are all liquid levels within the specified tolerances?
- ON/OFF switch in proper working order, undamaged
- Couplings must be easy to couple (where present)
- Dust protection caps must be available
- All electrical attachments (such as cables and plugs) must be present and undamaged

*Connected hoses*  
*(also observe the separate operating instructions for the hydraulic hoses)*

- Visual check for visible damage
- Check for leaks.
Function test
• No suspicious noises
• Checks at nominal pressure (75% of maximum pressure)
  (Recommendation: Carry out the load test with a fully assembled rerailing system. LUKAS also offers a range of appropriate test equipment.)

11. Repairs

11.1 General

Servicing may only be carried out by the manufacturer or personnel trained by the manufacturer and by authorised LUKAS dealers. Only LUKAS spare parts may be used to replace all components (see spare parts list) since special tools, assembly instructions, safety aspects, inspections might have to complied with (see also chapter "Maintenance and service").

During all installation work, pay particular attention to the cleanliness of all components as contaminants could cause damage to the hydraulic unit.

WARNING / DANGER / CAUTION!
Protective clothing must be worn when repairs are being carried out, since parts of the units can also be pressurised in an idle state.

REMARK:
Before you use couplings from a different company, you must contact LUKAS or an authorised dealer.

CAUTION!
Since LUKAS hydraulic units are designed for top performance, only those components in the spare parts lists of the relevant unit may be replaced. Further components in the unit may only be replaced if:
- You have participated in appropriate LUKAS service training,
- You have the explicit permission of the LUKAS customer service (on request, check for granting permission. Check is necessary in each individual case.)

REMARK:
Do not carry out any repairs without the relevant LUKAS spare parts list, since this contains the necessary torques for screws and / or important additional information.

CAUTION!
Attention must be paid to ensuring that no fuel can escape from units with combustion engines during repair work.
11.2 Preventive service

11.2.1 Care instructions
The exterior of the equipment is to be cleaned from time to time in order to protect it from external corrosion. Oil is to be applied to the metallic surfaces.

11.2.2 Replacing the hydraulic fluid
- After approx. 200 deployments, but after three years at the latest, replace the hydraulic fluid
- The fluid should be replaced when it is warmed up.
- The motor must be switched off.
- The old hydraulic fluid must be disposed of properly.

Procedure:
1. Place the collection basin underneath the drain plug of the unit.
2. Loosen filler screw “C” or “D”, drain plug “A” and seal ring B” on the unit and collect the fluid in the prepared receptacle. This enables easy cleaning of the hydraulic unit.
3. We recommend that you remove the frame before you open the hydraulic fluid reservoir. To do this, remove bolts “E”, nuts “H” and washers “F” and “G”.

![Diagram of equipment with labeled parts A, B, C, and D.]}
4. Then loosen fastening nuts “J” on the hydraulic fluid reservoir and remove them along with retaining washers “K”.
5. Remove pump carrier plate “L” and tank seal “M” underneath.
Take care not to lose spacer rings “N”.
6. Free the entire reservoir of dirt using a smooth cloth.
7. When you refit the reservoir, exchange the reservoir seal and fasten the securing bolts (for tightening torque, see spare parts list).

8. Also replace the seal ring of the drain plug and fit it as specified in the spare parts list.

9. Add the new hydraulic fluid to the reservoir through the filling plug.

10. Finally, the unit must be vented as described in the chapter entitled "Start-up"
11.3 Repairs

When carrying out permitted repairs, please observe the relevant spare parts lists with the remarks and drawings they contain. Should there be any uncertainties regarding the repairs, please contact your authorised LUKAS dealer or LUKAS Customer Service.

CAUTION!
As LUKAS hydraulic units are designed for extremely heavy loads, it is prohibited to attempt any repairs other than those described in the operating instructions. Repairs not described in the operating instructions require the approval of LUKAS Hydraulik GmbH.

11.3.1 Frame replacement

Replace the frame if it is broken or seriously deformed. To replace the frame, loosen the securing bolts, remove the frame and fit the new one. Tighten the fastening screws. Please consult the appropriate spare parts lists for any torques and additional assembly instructions.

11.3.2 Quick-disconnect couplings

The quick-disconnect couplings must be replaced in the event of:
- external damage
- the locking device not working
- hydraulic fluid continually leaking in a coupled/uncoupled state.

WARNING / DANGER / CAUTION!
Never repair couplings: they are to be replaced by original LUKAS parts.

Procedure when mounted on hoses:
1. Loosen the union nut of the hose assembly and remove the coupling.
2. Position the new coupling and tighten the union nut of the hose assemblies with a torque of $M_A = 35 \, \text{Nm}$.

Procedure when mounted in the connecting block:
1. Remove the coupling from the valve block.
2. Screw the new coupling into the connecting block with a torque of $M_A = 40 \, \text{Nm}$.

CAUTION with (quick-disconnect-system).
As the case may be, make sure that reservoir port 'T' or 'T1' of the unit is always equipped with a female quick-disconnect coupling. On the other hand, the supply ports must be equipped with a male quick-disconnect coupling.
11.3.3 Direct connection
The screw-in sleeves must be replaced in the event of:
- external damage
- hydraulic fluid continually leaking in connected / unconnected state.

Procedure:
1. Remove the screw-in sleeve from the valve block.
2. Position the new screw-in sleeve and tighten it with a torque of $M_A = 40$ Nm.

11.3.4 Replacing hoses (if fitted)
Replace hoses if they are leaky or defective, and if they are older than 10 years. To replace the hoses, undo the union nuts of the hose connections, remove the hose to be replaced and replace it with a new hose. Tighten the union nut during the assembly with a torque of $M_A = 40$ Nm.

Also observe the separate operating instructions for the hydraulic hoses.

11.3.5 Replacing the engines / motors
Replace the engines / motors if they are defective and direct repair of the valve block by a dealer or the manufacturer is no longer possible. The engine / motor may only be replaced with the hydraulic motor switched off. Electric motors must be disconnected from the power supply.
Engines / motors may only be replaced as a complete component. Empty the fuel tanks of combustion engines beforehand and make sure that no engine oil escapes when you are removing the engine.

Procedure for replacing the engine / motor:
1. Loosen securing bolts and nuts “A” on the engine and remove them along with washers “B” and “C”.
   Studs “D” should be exchanged only if they are damaged.
   Also observe the relevant spare parts list.
2. Pull the engine / motor off. Please ensure that you do not damage the engine / motor shaft mount.
3. Equip the shaft of the new engine / motor with an appropriate adjusting key (provided it is not already in place).
4. Grease the shaft of the new engine / motor and push the shaft of the new engine / motor into the engine / motor shaft mount. Ensure that the adjusting key of the engine / motor shaft is inserted into the correct guide of the engine / motor shaft mount.
5. Refit the engine / motor in reverse order and fasten the securing bolts and nuts. Please consult the spare parts list for the necessary torques.
6. For combustion engine pumps, top up the necessary liquid levels (e.g. engine oil, fuel). For electric motor pumps, connect the necessary electrical cables.
7. Perform a function test with the hydraulic unit (as described in the chapter entitled "Maintenance and service").

11.3.6 Labels
All damaged and/or illegible labels (safety notices, type plate, etc.) must be renewed.

Procedure:
1. Remove damaged and/or illegible labels.
2. Clean the surfaces using industrial alcohol.
3. Attach new labels.

Make sure that the labels are attached in the right position. If you are no longer sure about this, contact your authorised LUKAS dealer or LUKAS directly.
11.4 Installation and repair of optional accessories

11.4.1 Fitting attachment hose reels to the frame
Attachment hose reels usually come prefitted and do not need to be removed unless the complete hose reel is to be exchanged. A retrofit kit is available and it contains all the necessary fasteners. The hose reels differ depending on which side they are to be fitted (left or right). Be sure to fit the hose reels to the correct side. The hoses should be pulled out in the working direction from the bottom of the reel.

Procedure for fitting an attachment hose reel:
1. Place the carrier plate on the unit frame in such a way that the holes in the carrier plate are aligned with the holes in the frame.
2. Fit the supplied bolts “A” through the frame and the plate. The bolt head must finish inside the frame.
3. First fit washers “B” onto the bolt threads from the outside.
4. Then screw nuts “C” onto the bolt threads and fasten them.

11.4.2 Hydraulic connection of attachment hose reels with hoses
The hydraulic connection of the attachment hose reels is established in the same way as for hoses connected directly to the connecting block or valve block of the hydraulic unit. *For instructions on how to connect the hose lines, refer to the procedure described under “Direct connection” in the “Repairs” chapter*
11.4.3 Connection of attachment hose reels with pipework
Before you connect the pipework, you must check that suitable connection nipples (GE-08) are present inside the connecting block and attachment hose reels. In case of doubt, please contact your authorised LUKAS dealer or LUKAS directly.

Procedure:
1. Lay out the necessary, preformed pipe.
2. If not present, screw a “G” (GE-08) connection nipple into the connecting/valve block or attachment reel. (tightening torque $M_A = 40$ Nm)
3. Slot union nut “D” onto the pipe with the thread facing towards the end of the pipe.
4. Slot olive “E” fully onto the pipe.
5. Fit the pipe with coupling sleeve into connection nipple “G”.
6. Slide the union nut up to the connection nipple and screw it on. (tightening torque $M_A = 40$ Nm)
7. Proceed in the same way for the other end of the pipe.
11.4.4 Replacing the connecting block or drain valve

The connecting block or drain valve must be exchanged if the assembly is damaged, if continued and correct function is no longer guaranteed or if a permanent leak has developed in the assembly. It is possible to convert from a connecting block to drain valve arrangement and vice versa.

Procedure:

1. Much of the procedure is identical to the procedure involved in changing the hydraulic fluid including removal of pump carrier plate “O” with engine / motor. For this reason, we recommend that you carry out this replacement as part of the fluid change. The work required to replace the connecting block or drain valve is performed at pump carrier plate “O”.

2. Loosen union “N” securing the pipes to the connecting block or drain valve and unscrew return line “M” from the connecting block.

3. Loosen securing screws “L” from the connecting block or drain valve and remove the screws along with washers “K” underneath.

4. Now you can remove the connecting block or drain valve along with the seal underneath and fit the new connecting block or drain valve. It is possible here to convert from a connecting block to drain valve arrangement and vice versa.

5. The new connecting block or drain valve is fitted and connected to the pump carrier plate in reverse order

6. To finish assembly, proceed as described in the “Replacing the hydraulic fluid” chapter.
### 12. Troubleshooting

For malfunctions directly related to combustion engines, please refer to the separate operating instructions issued by the engine manufacturer.

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric motor does not start following activation of the switch</td>
<td>Power cable not connected</td>
<td>Connect power cable correctly</td>
</tr>
<tr>
<td>Electric motor defective or overloaded due to another defect in the unit</td>
<td>Shut down immediately and have repaired by authorised dealer, motor / engine manufacturer or directly by LUKAS</td>
<td></td>
</tr>
<tr>
<td>Switch not or only partly pressed through</td>
<td>Operate the switch again and press it through fully. Shut down immediately and have repaired by authorised dealer, motor / engine manufacturer or directly by LUKAS</td>
<td></td>
</tr>
<tr>
<td>Switch switched on and off too rapidly in succession (switching time &lt; 5 seconds).</td>
<td>Switch on the motor and wait until the start capacitor has charged. The motor will then start on its own.</td>
<td></td>
</tr>
</tbody>
</table>

### Combiustion engine will not start

<p>| Fuel tank empty | Top up fuel |
| Electric starter battery flat | Charge electric starter battery |
| Fuel tap not open | Open the fuel tap |
| Starting switch is not at “ON” | Switch starting switch to “ON” |
| Lever not set to choke | Set lever to choke |
| Combustion engine defective or overloaded due to another defect in the unit | Have repaired by authorised dealer, motor / engine manufacturer or directly by LUKAS |
| Too low ambient temperature | For the solution, consult the separate operating instructions of the engine / motor manufacturer. Use another hydraulic fluid that is suitable for the corresponding ambient temperatures (see chapter “Technical data”) |</p>
<table>
<thead>
<tr>
<th>Trouble</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor runs but connected implement does not move in response to control command.</td>
<td>Hose assembly not connected properly or is damaged</td>
<td>Inspect the connection of the hose assembly and, if necessary, reconnect</td>
</tr>
<tr>
<td></td>
<td>Defective pump unit</td>
<td>Have repaired by authorised dealer or directly by LUKAS</td>
</tr>
<tr>
<td></td>
<td>Defective hydraulic coupling (if fitted)</td>
<td>Replace hydraulic coupling</td>
</tr>
<tr>
<td></td>
<td>Problem with the control unit</td>
<td>Consult the separate operating instructions for the control unit.</td>
</tr>
<tr>
<td></td>
<td>Problem with the implement</td>
<td>Consult the separate operating instructions for the implement.</td>
</tr>
<tr>
<td>Connected implement moves in response to control command but only very slowly or unevenly.</td>
<td>Air in the hydraulic supply</td>
<td>Vent the hydraulic system</td>
</tr>
<tr>
<td></td>
<td>Defective pump unit</td>
<td>Have repaired by authorised dealer or directly by LUKAS</td>
</tr>
<tr>
<td></td>
<td>Defective hydraulic coupling (if fitted)</td>
<td>Replace hydraulic coupling</td>
</tr>
<tr>
<td></td>
<td>Pressure relief at control unit still active (depressurised circulation)</td>
<td>Consult the separate operating instructions for the control unit.</td>
</tr>
<tr>
<td>Connected implement does not reach its end position</td>
<td>Insufficient fluid in the hydraulic reservoir</td>
<td>Top up hydraulic fluid to the maximum filling level</td>
</tr>
<tr>
<td></td>
<td>Usable hydraulic fluid volume of the unit is insufficient</td>
<td>Use a different implement with a usable volume below the maximum usable volume of the hydraulic unit</td>
</tr>
<tr>
<td>Connected implement does not produce its rated force</td>
<td>Maximum permitted operating pressure of the pump is not reached</td>
<td>Have the pressure limiting valve reset or repaired by authorised dealer or directly by LUKAS</td>
</tr>
<tr>
<td></td>
<td>Defective hydraulic unit</td>
<td>Have repaired by authorised dealer or directly by LUKAS</td>
</tr>
<tr>
<td>Trouble</td>
<td>Cause</td>
<td>Solution</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
<td>----------</td>
</tr>
<tr>
<td>Fluid leaks from the hydraulic fluid reservoir (especially from the filler screw)</td>
<td>Due to hydraulic fluid returning from the implement, the maximum capacity of the tank is exceeded</td>
<td>Reduce the level in the hydraulic fluid reservoir to the mark on the dipstick or inspection glass</td>
</tr>
<tr>
<td></td>
<td>Defective seal</td>
<td>Have repaired by authorised dealer or directly by LUKAS</td>
</tr>
<tr>
<td>Leaking fluid between engine and flange bearing</td>
<td>Radial shaft seal on the drive shaft is defective</td>
<td>Have repaired by authorised dealer or directly by LUKAS</td>
</tr>
<tr>
<td>Hydraulic fluid milky and cloudy</td>
<td>Water / condensation in the system</td>
<td>Immediately replace hydraulic fluid</td>
</tr>
<tr>
<td><em>With quick-disconnect coupling system:</em> hose assembly cannot be coupled</td>
<td>Pressurised</td>
<td>Switch the control unit to depressurised circulation</td>
</tr>
<tr>
<td></td>
<td>Defective hydraulic coupling</td>
<td>Hydraulic coupling needs to be replaced immediately</td>
</tr>
<tr>
<td><em>With quick-disconnect coupling system:</em> Leak in the coupling (male)</td>
<td>Safety valve reacted</td>
<td>After pressure release, there is no more leakage.</td>
</tr>
<tr>
<td></td>
<td>Defective hydraulic coupling</td>
<td>Hydraulic coupling nipple needs to be replaced immediately</td>
</tr>
<tr>
<td><em>With quick-disconnect coupling system:</em> Leak in the coupling (female)</td>
<td>Defective hydraulic coupling</td>
<td>Hydraulic coupling sleeve needs to be replaced immediately</td>
</tr>
<tr>
<td>Hydraulic fluid leak on the hoses or the connections</td>
<td>Leak, possible damage</td>
<td>Replace hoses</td>
</tr>
<tr>
<td>Damage on the surface of the hydraulic hoses</td>
<td>Mechanical damage or contact with aggressive agents</td>
<td>Replace hoses</td>
</tr>
</tbody>
</table>

If it is not possible to rectify the malfunctions, inform an authorised LUKAS dealer or the LUKAS Customer Service department immediately.

The address of the LUKAS Customer Service Department is:

**LUKAS Hydraulik GmbH**

Weinstraße 39, D-91058 Erlangen
Postfach 2560, D-91013 Erlangen

Tel.: (+49) 09131 / 698 - 348
Fax.: (+49) 09131 / 698 - 353
13. Technical data

As all values are subject to tolerances, there may be minor differences between the data achieved by your equipment and the data specified in the following table.

13.1 Hydraulic power pack

13.1.1 Basic data

<table>
<thead>
<tr>
<th>type</th>
<th>PC-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref.no.</td>
<td>840729316</td>
</tr>
<tr>
<td>dimensions</td>
<td>560 x 540 x 695 [mm] 22.04 x 21.26 x 27.36 [in.]</td>
</tr>
<tr>
<td>motor type</td>
<td>electric motor</td>
</tr>
<tr>
<td>motor power</td>
<td>2.2 kW, 2.95 HP</td>
</tr>
<tr>
<td>rotation speed</td>
<td>2850 [min⁻¹], 2850 [rpm]</td>
</tr>
<tr>
<td>max. operating pressure (HP)</td>
<td>53 [MPa], 7,687 [psi]</td>
</tr>
<tr>
<td>max. operating pressure (LP)</td>
<td>23 [MPa], 3,336 [psi]</td>
</tr>
<tr>
<td>flow rate (HP)</td>
<td>2.3 [l/min], 0.61 [gal.-US/min]</td>
</tr>
<tr>
<td>flow rate (LP)</td>
<td>5.3 [l/min], 1.40 [gal.-US/min]</td>
</tr>
<tr>
<td>max. fill-up quantity</td>
<td>42 [l], 11.10 [gal.-US]</td>
</tr>
<tr>
<td>max. useable quantity</td>
<td>35 [l], 9.25 [gal.-US]</td>
</tr>
<tr>
<td>weight (incl. all max. fluid fill-up quantities)</td>
<td>61 [kg], 134.5 [lbs.]</td>
</tr>
<tr>
<td>ambient temperature</td>
<td>-20 … + 55 °C, -4 … + 131 °F</td>
</tr>
<tr>
<td>max. options to connect devices</td>
<td>1</td>
</tr>
</tbody>
</table>

1) HP = High pressure  2) NP = Low pressure  3) 1 MPa = 10 bar
<table>
<thead>
<tr>
<th><strong>type</strong></th>
<th>GC-6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ref.no.</strong></td>
<td>840729317</td>
</tr>
<tr>
<td><strong>dimensions</strong></td>
<td></td>
</tr>
<tr>
<td>l x w x h</td>
<td>[mm] 560 x 540 x 665 [in.] 22.04 x 21.26 x 26.18</td>
</tr>
<tr>
<td><strong>motor type</strong></td>
<td>4-stroke gasoline engine</td>
</tr>
<tr>
<td><strong>motor power</strong></td>
<td>[kW] 3.5 [HP] 4.69</td>
</tr>
<tr>
<td><strong>rotation speed</strong></td>
<td>[min⁻¹] 3100 [rpm.]</td>
</tr>
<tr>
<td>**max. operating pressure (HP)³)</td>
<td>[MPa] 53 [psi.] 7,687</td>
</tr>
<tr>
<td>**max. operating pressure (LP)²)</td>
<td>[MPa] 23 [psi.] 3,336</td>
</tr>
<tr>
<td>**flow rate (HP)¹)</td>
<td>[l/min] 2.5 [gal.-US/min] 0.66</td>
</tr>
<tr>
<td>**flow rate (LP)²)</td>
<td>[l/min] 5.9 [gal.-US/min] 1.56</td>
</tr>
<tr>
<td><strong>max. fill-up quantity</strong></td>
<td>[l] 42 [gal.-US] 11.10</td>
</tr>
<tr>
<td><strong>max. useable quantity</strong></td>
<td>[l] 35 [gal.-US] 9.25</td>
</tr>
<tr>
<td><strong>weight (incl. all max. fluid fill-up quantities)</strong></td>
<td>[kg] 55 [lbs.] 121.3</td>
</tr>
<tr>
<td><strong>ambient temperature</strong></td>
<td>[°C] -20 ... +55 [°F] -4 ... +131</td>
</tr>
<tr>
<td><strong>max. options to connect devices</strong></td>
<td>1</td>
</tr>
</tbody>
</table>

¹) HP = High pressure  
²) NP = Low pressure  
³) 1 MPa = 10 bar
<table>
<thead>
<tr>
<th>Type: DC-6</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ref. No.:</td>
<td>840729319</td>
</tr>
<tr>
<td>Dimensions: l x w x h</td>
<td>550 x 480 x 742 mm 21.65 x 18.90 x 29.21 in.</td>
</tr>
<tr>
<td>Motor Type:</td>
<td>4-stroke diesel engine</td>
</tr>
<tr>
<td>Motor Power:</td>
<td>[kW] 5.0 [HP] 6.7</td>
</tr>
<tr>
<td>Rotation Speed:</td>
<td>[min⁻¹] 2500 [rpm.]</td>
</tr>
<tr>
<td>Flow Rate (HP):</td>
<td>[l/min] 2.5 [gal.-US/min] 0.66</td>
</tr>
<tr>
<td>Flow Rate (LP):</td>
<td>[l/min] 5.3 [gal.-US/min] 1.40</td>
</tr>
<tr>
<td>Weight (incl. all max. fluid fill-up quantities):</td>
<td>[kg] 81 [lbs.] 178.6</td>
</tr>
<tr>
<td>Ambient Temperature:</td>
<td>[-20 °C] ... [+55 °C] [-4 °F] ... [+131 °F]</td>
</tr>
<tr>
<td>Max. Options to Connect Devices:</td>
<td>1</td>
</tr>
</tbody>
</table>

1) HP = High pressure 2) NP = Low pressure 3) 1 MPa = 10 bar
13.1.2 Noise emissions (in accordance with EN ISO 3744):

<table>
<thead>
<tr>
<th>type</th>
<th>PC-6</th>
<th>GC-6</th>
<th>DC-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref.no.</td>
<td>840729316</td>
<td>840729317</td>
<td>840729319</td>
</tr>
<tr>
<td>idle running (measuring distance: 1m) [dB(A)]</td>
<td>73</td>
<td>85</td>
<td>93</td>
</tr>
<tr>
<td>full load (measuring distance: 1m) [dB(A)]</td>
<td>78</td>
<td>89</td>
<td>93,7</td>
</tr>
<tr>
<td>idle running (measuring distance: 5m) [dB(A)]</td>
<td>65</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>full load (measuring distance: 5m) [dB(A)]</td>
<td>67</td>
<td>85</td>
<td>83,5</td>
</tr>
</tbody>
</table>

13.2 Recommended hydraulic fluid

Mineral oil DIN ISO 6743-4 for LUKAS hydraulic equipment and others

<table>
<thead>
<tr>
<th>Oil temperature range</th>
<th>Oil code</th>
<th>Viscosity rating</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-24 .... +30°C</td>
<td>HL 5</td>
<td>VG 5</td>
</tr>
<tr>
<td>B</td>
<td>-18 .... +50°C</td>
<td>HM 10</td>
<td>VG 10</td>
</tr>
<tr>
<td>C</td>
<td>-8 .... +75°C</td>
<td>HM 22</td>
<td>VG 22</td>
</tr>
<tr>
<td>D</td>
<td>+5 .... +80°C</td>
<td>HM 32</td>
<td>VG 32</td>
</tr>
<tr>
<td>E</td>
<td>-8 .... +70°C</td>
<td>HF-E15</td>
<td>VG 15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Oil temperature range</th>
<th>Oil code</th>
<th>Viscosity rating</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-11.2 .... +86°F</td>
<td>HL 5</td>
<td>VG 5</td>
</tr>
<tr>
<td>B</td>
<td>-0.4 .... +122°F</td>
<td>HM 10</td>
<td>VG 10</td>
</tr>
<tr>
<td>C</td>
<td>+17.6 .... +167°F</td>
<td>HM 22</td>
<td>VG 22</td>
</tr>
<tr>
<td>D</td>
<td>+41.0 .... +176°F</td>
<td>HM 32</td>
<td>VG 32</td>
</tr>
<tr>
<td>E</td>
<td>+17.6 .... +158°F</td>
<td>HF-E15</td>
<td>VG 15</td>
</tr>
</tbody>
</table>

recommended viscosity range: 10...200 mm²/s (10…200 cSt.)

Supplied with HM 22 DIN ISO 6743-4.

13.3 Hoses

See separate operating instructions for the hydraulic hoses.

13.4 Operating temperature and storage temperature ranges

| Ambient temperature (device in operation) [°C] | -20 … +55 |
| Storage temperature (device not in operation) [°C] | -30 … +60 |
14. Notes
WARNING / DANGER / CAUTION!
Before connecting equipment, make sure that all the components used are suitable for the maximum operating pressure of the hydraulic unit. In cases of doubt, you must consult LUKAS directly before connecting the equipment.

Please dispose all packaging materials and dismantled parts properly.

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