SCOPE OF LIABILITY

Information and data in this operational manual may be changed without prior notice.

Although compiled with all care, the manual may be incomplete.

KLEMM Bohrtechnik will not accept claims resulting from missing data in this manual.

Technical specifications and data subject to modifications.

In case of doubt, the German text shall prevail.

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When making enquiries or ordering spares, please specify the following data to ensure prompt and reliable delivery:

1. Number of Rig
2. Type of Rig
3. Quantity required
4. P/No.

For electrical components please state also:

5. Voltage (V)
6. Frequency (Hz)
7. Power (kW)

We reserve the right to modify equipment in the process of development.
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1 Declaration of Conformity

Original EG-Konformitätserklärung im Sinne der Maschinenrichtlinie 2006/42/EG (Anhang II A) 
Original EC-Declaration of Conformity according to European Machinery Directive 2006/42/EG (Annex II A)

Hersteller / manufacturer: KLEMM Bohrtechnik GmbH, Wintersohler Str 5
57489 Drönhagen

Dokumentationsbeauftragter / documentation representative: Jens Möllhaus
Wintersohler Str 5, 57489 Dröhnagen

Maschine / machine: Hydraulisches Bohrgerät / hydraulic drill rig
Typ / type: KR 702-2 + PP-95-DS
Serien-No. / serial-no.: M-19133 + PP-19033
Auftrags-Nr. / order-no.: 37209929
Baujahr, -monat / year, month of manufacture: 11/2011
Motorleistung / engine power: 95 kW
Motornennnendrehzahl / engine nominal rpm: 2300 1/min
Schalleistungspegel / sound power level
gemessener Wert / measured value: 103 dBA
garantieter Wert / declared value: 106 dBA

Konzeption und Bau der Maschine entsprechen folgenden Bestimmungen
Design and construction of the machine are in accordance with
Maschinenrichtlinie / Machinery Directive 2006/42/EC
Outdoor-Noise-Richtlinie / outdoor noise directive 2000/14/EC
EMV-Richtlinie / EMC-Directive 2004/108/EC
Druckgeräte-Richtlinie / pressure equipment directive 97/23/EC
Niederspannungs-Richtlinie / low voltage directive 2006/95/EC

Weitere angewandte harmonisierte europäische Normen
other applied harmonised european standards
Böhrgeräte-Sicherheit / drill rigs safety EN 791
Sicherheit von Maschinen / safety of machinery EN ISO 12100-1, -2
Erdbauemaschinen Sicherheit / safety of earth moving machinery EN 474-1

Angewandtes Konformitätsbewertungsverfahren gemäß Richtlinie 2000/14/EG
conformity assessment procedure according to directive 2000/14 EC
Internete Fertigungskontrolle nach Artikel 14, Abs. 2 in Verbindung mit Anhang V
Internal production control according to article 14, item 2 with annex V

Nationale technische Normen und Spezifikationen
national technical standards and specifications

Hinweis: Die Konformitätserklärung ist nur gültig für den Maschinentyp inklusive Spezifikation
gemäß Seriennummer und Auftragsnummer. Bei wesentlichen Änderungen an der
Maschine wird diese Konformitätserklärung ungültig. Im Zweifelsfall ist der deutsche
Wortlaut maßgebend.

Note: This conformity declaration is only valid for the machine including specification
according to serial number and order number. In case of substantial modifications
of this machine this declaration becomes invalid. In case of doubt the german text
is binding.

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Datum / Date: 26.10.2011

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2 Safety instructions

All personnel involved in operating and/or maintaining this equipment must first read and thoroughly understand the operating instructions before attempting to operate or perform maintenance on the drill rig. Non-authorised or untrained personnel must not under any circumstances attempt to operate or repair the machine.

Safety first must always be the primary consideration of all personnel while operating or maintaining the drill rig under normal and especially in unusual conditions.

Since these safety precautions cannot cover every possible situation, everyone is expected to exercise good judgement, foresight and common sense while operating or working with, on, or near the drill rig.

The signs CAUTION and PLEASE NOTE are to be defined as follows:

CAUTION

This word is used to point out that inadequate or non-compliance with operating manuals, working instructions, operational sequences etc. will substantially damage property or cause severe personal injury which could be fatal.

PLEASE NOTE

PLEASE NOTE is used to make people aware of installations and gives hints for operation and maintenance which are important but not hazard related. It generally indicates an operational aid.
2.1 General references to the avoidance of accidents, damages and excessive wear

1 Drill rig

The drill rig has multiplicity kinematic degrees of freedom for positioning of the basic rig and particularly the drill mast.
But not each kinematically possible configuration is meaningful or permissible. This particularly depends on the mounted drill mast, the drilling unit and drilling equipment.
Therefore among other things the permitted drilling positions given in the stability calculations, the setting-up sequences and the specific ground pressure as well as all other references in the manual must be observed.
KLEMM Bohrtechnik refers to the fact, that not each theoretically possible drilling position can be described.
If other drilling positions are to be aligned, then this lies in the technical discretion of the operator. Otherwise consultation with KLEMM Bohrtechnik must be taken.
The following points must be particularly considered:

1.1 Extreme displacement of the center of gravity

Special attention must be paid when setting-up the drill mast with far out overhanging center of gravity. The center of gravity of the drill mast with its attachments e.g. drill heads and hydr. drifters, drilling equipment and if necessary rod magazines must be placed as near as possible to the ground contact area of the drill rig. The ground contact area of the drill rig is defined by the tipping edges of the crawler tracks.

1.2 Collision

Causes of the multiplicity of kinematic possibilities, the setting-up of the drill rig has to be done with maximum attention, appropriate speed and if necessary with a second instructing person.
With inattentive setting-up operations, collisions e.g. between the drill mast and parts of the boom or the basic rig are possible.

1.3 Superposition of kinematic axis

The kinematic degrees of freedom are for example realized by hydraulic cylinders or slewing drive units. The degrees of freedom can be redundant in certain positions, that means for example, that a tilting motion around a certain spatial axle can be achieved by two or more methods. Within the methods, the most favorable method regarding endangerment and damage must always be selected.
2 Extreme environmental condition

If the drill rig is to be operated under extreme or outside the of KLEMM Bohrtechnik specified site conditions, previous clarification with KLEMM Bohrtechnik is necessarily. These are e.g.: 

- Extremely low or high temperatures and or humidity
- Special geographical altitudes
- Particularly high dusty condition
- Operations in tunnels or underground

3 Changeable equipment

3.1 Equipment from KLEMM Bohrtechnik

For the drill rigs of KLEMM Bohrtechnik many equipment components, which can be changed or additional mounted are available. For example these are rotary drill heads, hydr. drifters, rod magazines, drill masts and drill mast extensions, flushing pumps, lubricants and fuels and other components. All combinations of changeable equipment with the drill rig cannot be described. To avoid endangerments and damages, the following points must be strictly observed when self changes of the drill rigs equipment are made:

- permissible stabilities und strengths
- permissible pressures in the hydraulic system
- permissible flow rates in the hydraulic system
- permissible operation modes of hydraulical and electrical components
  (e.g. preferred rotation direction of hydraulic motors)
- electrical control- and monitoring functions
- use of safety devices or safety components
- permissible contamination for lubricants and operating materials
- conformity with the european regulation for machines when substantial changes are done (only in the marketing area of the European union).

3.2 Adaptation at or of equipment of other manufacturers

Fundamental the same points as being considered above are to be observed. The adaptations takes place in the discretion of the operator if they are not coordinated with KLEMM Bohrtechnik.

In principle the in the manual and further attached documentation contained safety and warning reference must be observed. If there is none or a contradictory information to a specified question in the documentation, KLEMM Bohrtechnik must be consulted before operation or conversion.
2.2 General safety instructions

- Intended use

The KLEMM drill rig must be used only as directed in DIN EN ISO 12100–1 (safety of machinery), and as described in the operators manual for drilling operations.

The drill rig must only be used for the following operations:

- Rotation and rotation–percussion drilling
- Double head drilling (rotation / rotation)
- Double head drilling (rotation / rotation–percussion)

Special tasks:

- High pressure injection (HPI)
- Heat probe drillings
- Micro pile drillings
- Exploration drillings
- Drillings for strand anchors or soil nails
- Drillings for freezing boreholes

- Not intended use of the machine

- The machine must not be used as transport, lifting device or as a crane for building site activities.
- The use of mounted rope winches is only permissible with vertically aligned and propped drill mast for handling of drill pipes, drilling accessories, and products, which are built into the borehole. Loads and diagonal course of the rope hoist are only permissible in the context of the limitations indicated in the operating instructions.
- It is absolutely not allowed to transport persons on the drill rig.
- It is forbidden to do grading works with the drill rig
- The drill rig must not be used as a recovery vehicle for other machines or objects.

- Make sure all persons are clear of the machine before moving or starting any drilling operation.

- All personnel involved in operating and maintaining this equipment must first read and thoroughly understand the operating instructions.
Operating instructions

Operating instructions for the KLEMM Bohrtechnik drill rig must be complied with for operation, maintenance, service, repairs and transport. The contractor is obliged to amend safety regulations to meet local requirements. Operating instructions and amendments must be kept securely on the working site.

Personal Safety Equipment

Wear Personal Safety Equipment
- Working gloves
- Safety boots
- Safety hat
- Hearing protection
- Safety glasses
- Nose mask (only if dust)

Wear tight clothes (protection clothes according to DIN).
Keep hands, arms, legs and clothing away from all moving parts.
Do not touch heated up parts with your bare hands. Wear protection gloves.

Vibrations

The weighted value of the vibrations of the body (feet, seat face) of 0.5m/s², which can shake the operator during the drilling work, is not exceeded. The value of the hand/the arm vibrations, which shake the operator during the drilling work, is under 2.5m/s².
2.3 Safety instructions for operation the drill rig

1. Operation and maintenance of KLEMM drill rig

Independent and unassisted operation (operator) and maintenance (fitter) is to be entrusted only to persons who:

1.1 Are at least 18 years of age (Check for local stipulations)
1.2 Are physically and mentally suited
1.3 Have been instructed in operating and maintaining the crawler drill rig and have proven their ability to the contractor/user
1.4 Can be expected to perform responsibly

And are designated for the job by the contractor/user.

2. Danger zone

Be sure that no one is within the drill mast’s danger zone. The danger zone is the area around the drill rig within which persons may be endangered by the rig’s slewing range or its components working movements. The operator must work the machine only if no one is within the danger zone. In case of danger the operator must give warning signals. Warning signals are generally given with horns.

Pre-determined hand warning signals must be used if on-site noise is liable to drown audible signals. If persons do not leave the danger zone despite having been warned the operator must stop working immediately.

3. Safety distance

A safety clearance of min. 0.5 metres must be kept from buildings, scaffolding and other equipment to prevent the danger of being squashed. Keep in mind the drill rig’s slewing facilities. If the safety clearance cannot be complied with the area must be cordoned off.

4. Safety devices

Safety devices and protective equipment of moving machine components must be opened, removed, or disabled only with the rig’s engine stopped and secured against inadvertent or unauthorised start-up. Safety devices are e.g. ESS-system (System KLEMM), engine cover doors, protective gratings, coatings. All safety devices and protective equipment must be reinstalled after completion of maintenance service and repairs.
5. **Transport of persons**

The transport of persons on the drill rig is strictly forbidden!!

6. **Step on the drill rig**

While operation the drill rig is forbidden to step on the machine. Before stepping on the machine the engine of the drill rig must be stopped and secured against inadvertent or unauthorised start-up.

7. **Stability**

The stability (according to DIN EN 791 “Drill rigs – safety”) of the crawler drill rig must **always** be assured.

Stability may be impaired by:
- Excessive load, unsecure ground, jerky acceleration and stopping of tramming and slewing movements, **slopes**.
- The operator is responsible for the rig’s stability, and must, if necessary, modify procedures to allow for special site conditions.

8. **Truck loading process**

In order to avoid chutes of the drill rig in the case of the loading process onto the truck, ramps must be coated with skid-proof materials (e.g. wood slats or rubber mats).

9. **Securing against fall**

To forestall danger of falling and crashing, the drill rig must at all times keep a safe distance from ledges, pits and slopes.

It is the contractor’s responsibility to assess the ground’s bearing capacity, and assert a safety distance for the rig.

Be sure of the bearing capacity of bridges, floors, and structures prior to moving the basic rig on to them.

10. **Alignment of the drill rig for drilling operations**

When drilling or pulling the drill string, the drill mast must be propped at the drilling point. Additional all propping cylinders must be pulled out laterally and be propped to the ground.

When propping the drill rig, the ground contact of the tracks must always be ensured. It is to be guaranteed by the building contractor that the underground exhibits a sufficient load-carrying capacity.
11. **Signalling**

If the operators vision is impaired during tramming and working, someone must give signals for assistance, or the tramming / working area must be cordoned off. Only reliable persons must be designated to give signals. They must be instructed as to their responsibility. Communication must be co-ordinated and exclusively used between operator and the person giving signals. The signalling person’s attention must not be diverted by additional tasks.

12. **Working in the area of utility lines (gas, water, electricity,...)**

The contractor is responsible to ascertain if utility or not visible lines are buried on the drilling site. The site’s owner is obliged to supply this information. If utility or not visible lines are present their location must be clearly marked. Plans clearly detailing the location (run and depth) of utility or not visible lines must be kept for reference on the working site. The operator must stop working immediately and inform the site manager if a utility line or its protective cover should be found or damaged. Uncovered utility lines must be secured against swaying or slipping.

13. **Working near overhead electrical lines**

The following minimal safety distances must be complied with if working near overhead power lines, unless local or national stipulations require otherwise:

Rated voltage:
- up to 1000 V ........................................... safety distance = 1 m
- above 1kV to 110 kV ................................. safety distance = 3 m
- above 110 kV to 220 kV .......................... safety distance = 4 m
- above 220 kV to 380 kV ......................... safety distance = 5 m
- or if rated voltage unknown ................ safety distance = 5 m

If a min. safety distance can not be respected, the contractor must arrange other safety steps (e.g. cut off or move the electr. line) in accordance with the owner or operator of the electr. lines.

14. Guards and safety devices are for your protection. Do not remove or disable them under any circumstances. The ESS requires particular attention. Malfunction of the Safety System may cause delays in switching the drill rig off, leading to severe or fatal injuries.

15. Replug the 2 mast slewing cylinders (option slew head 6 x 90°) only in horizontal mast position.
16. **Operational intervals**

The operator must park the crawler drill rig with Power Pack on bearing and level ground, and secure against inadvertent or unauthorised movement, prior to each operational break and at the end of each working day. If the drill rig must be parked on a slope or incline, the tracks of the Power Pack must be secured with wedges, in addition to the hydraulic brakes. Drill rigs should be parked only where they do not impede public or site traffic. If necessary they must be secured with warning triangle, signalling lines, or warning lights. During working breaks and at the end of each working day, the operator must rest drill mast and drill string on the ground, and secure them against inadvertent or unauthorised movement.

The operator must:
- not leave the site if drill rig and tools are not secured
- set all operating levers in "O" position prior to leaving the control panel
- stop the drill rig’s engine and secure it against inadvertent or unauthorised start-up, prior to leaving the drill rig.

Inadvertent or unauthorised start-up is avoided, if the engine is stopped, the starter key taken out of the ignition lock, and cover doors and lids are locked.

17. Always operate the basic rig from the operators platform when tramming.

18. Before tramming the drill rig, the drill mast must be placed on the drill mast support in horizontal transport position.

19. All operations must be activated directly from the corresponding control positions only.

20. The drill rig shall be used in areas, where no down-falling items cause danger. The drill rig is **not** equipped with a protection system FOPS (Falling object protective structures).

21. The drill rig must only be driven within ranges, in which is no risk to cant over! The drivers position of the drill rig is **not** equipped with a rollover protection system (ROPS).

22. For the shifting the drill rig through darkness, a lighting with a minimum luminous intensity of 10 lux must be given in a distance of 7m from the drill rig towards shifting direction.

23. The point of drill hole shall be illuminated, if necessary from the job site.

24. While working in a closed room a exhaust hose shall be used. Otherwise it can cause intoxication.

25. If you must operate the rig underground or in a confined area, consult your KLEMM Representative for assistance in safe operation.

26. Use only the purpose-made craneage lugs when lifting the rig. For loading the drill rig with help of a crane please contact **KLEMM** comp.
2.3.1 Safety Instructions for rope winches mounted on drill masts

The max. load admission area of the winch with drill mast in **vertical** position is limited to operations at **maximum 2,0m** distance from the drilling axis line of drill mast (drill hole) in tramming direction. The sidewise load admission area is limited to the tipping edges of the crawler tracks (see sketch below).

Cause of safety reasons this limitations of the rope winches load admission area must strikly been observed, otherwise accidents and heavy damages on the drill rig can result. In that case **Klemm Bohrtechnik** can **not** take over responsibility!

While operation the rope winch at least three rope windings has to be left on the rope drum. The max. load capacity of the winch has to be taken out of the spare part catalogue.

**CAUTION:**

Never misuse the winch cable to trail / traction heavy weights (i.e. bars, barrels, heavy pipes, reinforcement cages) to the drill rig.

The purpose of the winch is to mount accessories for drilling **only** within the max. load admission area and **only** with drill mast in **vertical** position. The drill mast with mounted rope winch is definitly **not** a crane.

**Sketch for Safety Instructions for rope winches mounted on drill masts (Limitations of load admission area!)**
2.3.2 Safety instructions for operation the drill rig with trailer

- Trailer coupling

The trailer coupling is located at the rear end of the drill rig's base frame and bolted with 4 screws. The trailer coupling is used to connect the drill rig with a trailer (e.g., Power Pack, dust collector on trailer). The trailer is connected to the drill rig by inserting the approved lock bolt with handle and safety chain with split pin into the trailer coupling.

**CAUTION**

The mounted trailer coupling is approved for a max. traction force of 26kN = 2,6 to

**PLEASE NOTE**

Check always before tramming the trailer coupling system with mounted and secured lock bolt! **Never** replace the genuine block bolt by normal pin or other non-approved materials.

- Filling pressure of the trailer tyres

Both tyres which are mounted on the trailer need a constant filling pressure of 3,5bar. The filling pressure must be checked every 100 operation hours or if the filling pressure is visibly to low.
Support wheel

The support wheel is connected at the drawbar of the single axle trailer. To avoid a tipping of the uncoupled trailer over the wheel axle, the trailer must be propped to the ground by using the support wheel. The trailer must be leveled horizontally by using the crank handle of the support wheel.

Crank handle

Support wheel

Stop for unlocking device

Lever of unlocking device

Support wheel

Support wheel with automatic unlocking device (part no.: 0000593864)

Support wheel with manual unlocking device (part no.: 0000554352)

CAUTION

- Lift down the support wheel of the trailer. Ensure the wheel is pushed into the fully locked position before uncoupling the drill rig.
- For support wheels with automatic unlocking the following is to be observed: The unlocking is operated automatically when the support wheel reaches the stop of the unlocking device (see picture above).
  
  Never turn the lever of the unlocking device on the stop when the support wheel is standing under load! DANGER OF ACCIDENT!!

Tramming mode

The trailer (e.g. Power Pack, dust collector on trailer) is connected to the drill rig with hoses and electric connection cables.

CAUTION

Before tramming and before starting the drill rig, check all cable and hose couplings mounted on the drill rig and the trailer; if loose, tighten them correctly.

Avoid tramming and unstable slopes and grounds. In the case of bad ground conditions use wood, mats or special sheets to stabilize the drill rig and trailer position.

Drilling mode

- On site you must make sure that the ground is stable (observe the stability calculations of the drill rig).
- The trailer must be connected to the drill rig by the trailer coupling.
- Connection hoses must be connected correct and firmly to the drill rig and the dust collector on trailer.
- For any drilling operations, the drill mast must be propped at the drilling point. Additionally all hydr. proppings of the drill rig must be driven out laterally and be propped to the ground. When propping the propping cylinders to the ground, the crawler tracks of the drill rig must not loose the soil contact.
- For drilling tasks in narrow spaces, the Power Pack can be disconnected from the drill rig. The Power Pack must be secured against rolling off by blocking the wheels of the trailer with the two provided drag shoes.

CAUTION

Diesel engines cause vibrations, which can lead to uncontrolled moving of the Power Pack. The Power Pack must always be secured against rolling off by blocking the wheels of the trailer with the two drag shoes.
Instructions for parking

- The drill rig must be parked on plain terrain. Avoid uneven and soft terrains.
- The wheels of the trailer must be secured against moving with drag shoes (see pictures on the following page).
- The drill mast must be aligned in transport position and the drill head unit must be positioned in the middle of the drill mast.

Shut off the drive unit of the Power Pack:
- stop the electric Power Pack, switch off the main switch and secure it with a padlock against switching on.

or

- pull out the start key of the diesel Power Pack.
2.3.2.1 Disconnecting the Power Pack from the drill rig

It is important to work after the following points in the right order!

1. Block the tracks of the Power Pack with the drag shoes.
2. Lift down the propping wheel of the Power Pack. Ensure the wheel is pushed into the fully locked position before uncoupling the drill rig.
3. Take the split pin out of the bolt of the trailer coupling.
4. Take the bolt out of the trailer coupling.
5. Move the drill rig forward until the hitch of the Power Pack is not in contact with the trailer coupling anymore.
6. Switch off the engine of the Power Pack and pull out the start key.
7. Screw off the connecting hoses and the connecting cable from the Power Pack.
8. To avoid a tipping of the uncoupled trailer over the wheel axle, the trailer must be propped to the ground by using the support wheel. The trailer must be leveled horizontally by using the crank handle of the support wheel.
2.3.3 Hazards when tramming the combination of the units drill rig and Power Pack with crawler undercarriage

Both units can be moved with different tramming speeds and in different directions

**ATTENTION:**
- Acute squeezing danger for the “driver” of the drill rig in the case of rear-end collision of the Power Pack (e.g. with cramped conditions).
- When the units remove from each other, hydraulic hoses and electrical cables can be damaged or torn off.

Tramming of the combination of the units drill rig and Power Pack with crawler undercarriage is only allowed with two operators (one “driver” for the drill rig and one “driver” for the Power Pack”) and one additional supervisor!
2.4 Safety instructions for maintenance of the drill rig

1. Service and maintenance intervals must be adhered to as specified. Non-compliance leads to immediate loss of all warranty entitlements.

2. The setting of pressure limiting valves and safety valves in the hydraulic circuits of the drill rig must be changed only by KLEMM Bohrtechnik approved personnel.

3. Welding of static and bearing components on the machine is to be carried out only by the manufacturer or KLEMM Bohrtechnik approved personnel.

4. The rig’s hydraulic plant must be checked regularly.

Replacement hoses or hydraulic components must be ORIGINAL spare parts of KLEMM Bohrtechnik.
This requirement must be complied with for safety reasons and applies also for all static and bearing components, such as

* Screws
* Bolts
* Springs and washers
* Boom components
* Drill mast components
* Undercarriage components

5. Replacement of wear parts

Repairs and replacement of wear parts can be carried out by qualified personnel in addition to standard maintenance and service intervals which must be complied with.

If in doubt contact KLEMM for assistance.

6. Be sure to bleed accumulators before repair (see chapter 8.10 on page 116 in this manual) and be sure to make them completely pressure-free before opening.
7. Please, do not pressure wash the new drill rig within the first two weeks. Do not use cleaning agents with solvent or degreasing substances. Do not use aggressive chemical cleaning agents, e.g. concrete remover. This can spoil the paint work and chromed parts. Do not direct the pressure washer onto electric components and seals.

8. During the engine cleaning by water or steam jet, electrical / electronic construction units, e.g. oil pressure switch (sensor), electronic controllers, electronic control members etc., must not be exposed to a direct jet stream. Otherwise penetrating humidity can lead to contact corrosion and to the loss of measuring –/ and control functions. E.g. oil pressure switches cannot be waterproof cause of the necessary diaphragm ventilation; therefore caution when hosing down. If plugs are nevertheless inadvertent cleaned with a jet steam, the plug connection is to be opened, to dry with compressed air and to spray with contact spray.
Safety requirements for hydraulic lines

1. Markings:

   a) Hydraulic hoses must carry continuous markings at intervals not greater than 50 cm. These markings must be clearly readable and supply the following data:

      - Name of manufacturer
      - Type
      - Nominal diameter
      - Date of manufacture

      Example: "1 Q 11"
      = 1st. Quarter 2011

   b) Hose lines must carry the following data in durable markings:

      - Name of the manufacturer
      - Date of manufacture
      - max. permissible
dynamic operat. pressure

2. Storage

   Hydraulic hoses must be stored tension-free, in a dry and clean environment.

   Direct sunlight and UV-irradiation must be avoided.
   Storage time should not exceed four years.

3. Maintaining the hose conduits

   a) Hose lines must be examined by an authorized person at least once a year. Hose lines must be replaced if damages, embrittlements, deformations, leakages, damage to the armatures etc. are determined by the examination. Hose lines should be treated according to the “Safety rules for hydraulic hoses ZH 1/74” of the professional association and the standard DIN 20066. The storage and using should not exceed 6 years.

   b) Hoses which have been operated as part of a hydraulic line must not under any circumstances be reprocessed

4. Inspection

   Hydraulic lines must be inspected by qualified personnel to assess their operational safety before the initial start-up, and subsequently at least once every year.
   Defective and faulty lines must be exchanged immediately.
3 Danger zones of the drill rig

The following danger zones of the drill rig are arranged depending upon activity into the zones A–F. Only persons who are trained and told to do the corresponding job are allowed to be in the danger zones. These persons are:

- Drill rig driver / operator
- Drill rig assistants
- mechanics and service personnel

Legend to the following representations of the danger zones:

H = Height of the erected drill mast
S = Safety clearance: half machine width
B = Radius drilling range: half machine width

Danger zone A (Setting up and HPI–drilling with drill mast in vertical position with mounted lattice mast elements)
Danger zone B
(Setting up and drilling with drill mast in vertical position)

Danger zone C
(Moving and maintenance of the drill rig without or with attached Power Pack)
Danger zone D
(Moving and maintenance of the drill rig with self driving Power Pack)
4 Preface

This manual describes the KR 702-2 hydraulic crawler drill rig, manufactured by the Company KLEMM Bohrtechnik, the assembly of technical components, operational procedure as well as service recommendations and preventive maintenance requirements.

Hints and instructions for repairs and trouble shooting are also included.

The manual comes complete with a parts catalogue, which depicts and describes modules and individual components. Use the catalogue to identify part number of the required component prior to ordering.

Your KLEMM KR 702-2 drill represents "State of Art" in mobile drilling equipment. Apart from flushing water or air supply required for flushing purposes, the rig operates fully independently, ready to tackle the most extreme ground conditions in almost any location.

The rig’s boom is adjustable on two planes and – together with the special slewing mechanism and mast carrier – allows vertical and horizontal drill mast alignment, which is particularly advantageous when spotting in areas with limited access, e.g. corners and recesses.

The rig is powered by a separate power pack which is driven either by an electric motor or a diesel engine. An open hydraulic system with max. operating pressure of 250 bar (3626 psi) supplies hydraulic power for all (tramming, alignment and drilling) of the rig's function.

The rigs crawler tracks are non oscillating, which means that both tracks are attached to a fixed axle. The drill rig KR 702-2 has a telescopic crawler frame base, which can be extended from 750 mm up to 1250 mm.

Attention:
Tramming must be done with spreaded crawlers of 1250 mm (fully telescopic mode). It is permitted to retract the crawlers to 750 mm if the rig passes small openings under confined spaces. After passing doors and limited openings the crawler base must be spreaded to full telescopic range immediately. Do not operate the tramming functions with retracted crawlers due to stability reasons.

The drill mast is fitted in guiding strips on the mast carrier and supports all drilling accessories.

A clamping device (accessory) ensures rapid rod changes.

All operating levers of the drill rig are conveniently positioned and clearly labeled with symbols indicating their functions.

The control console for mast alignment, hydr. propping and spreading of the tracks is fixed on the left side of the base frame.

All drilling functions are activated from a slewable control panel. The control elements for the tramming functions are mounted on the rear side of the rig.
The 2 EMERGENCY switches are mounted on the slewable control panel and at the rear side of the rig. Activation of these switches stops all of the rig's functions immediately.

The EMERGENCY switch is composed of a red button with electrical shut-off of the diesel engine; this reaction is immediate!!

**ATTENTION:**
You must check daily the correct function of the EMERGENCY switches. Do not operate the machine if the EMERGENCY switches fail and shows no function.

The KLEMM Company reserves the right to modify the drill rig and technical documentation without prior notice, in the interest of development.

KR 702-2 with Power Pack PP-95-DS
5 Technical description

5.1 Base frame with crawler tracks and boom

The base frame with fixed crawler tracks carries control and monitoring elements. The uppercarriage carries a boom, consisting of slewing mechanism and mast carrier. The mast carrier guides and supports the drill mast. Two telescoping propping jacks are attached to the back of the drill rig. Be sure to always extend these prior to any attempt at drilling, to ensure adequate lateral stability. Never drill without those stabilizing propping cylinders!

Useful options are hydr. front stabilizers and the installation of a rope winch.

Attention:
Before starting tramming operations the spreaded crawlers of the drill rig KR 702–2 must be fully extended to 1250 mm.
5.1.1 **Crawler undercarriage**

Each crawler consists of base frame, track chain, sprocket drive wheel, guide wheel and four idlers, as well as a track tensioning device and the transmission. The transmission consists of a planetary gear box with hydraulic motor. The gear box is equipped with a multi-disc brake on the motor. This multi-disc brake is activated by constant spring pressure, and acts as parking brake only. The brake is opened by oil pressure, e.g. oil flow of approx. 12–15 bar or greater, releases the brake. Special axial seal rings protect the transmission from dirt and contamination.

5.1.2 **Boom assembly**

The boom assembly features allow a perfect setting-up and alignment of the drill mast, and consist basically of swivel head and mast carrier, completed by hydraulic cylinders.

The mast carrier in combination with the swivel head arrangement allows the entire drill mast to be slewed from vertical to horizontal.

The swivel head (6x90°) is constructed to slew the drill mast in anchor drilling positions by using both slewing cylinders.

Swivel head movement is such that for tramming and transport purposes the mast complete with drill head is "shouldered" parallel to the boom.

| All hydraulic cylinders are equipped with load-bearing valves, which maintain the cylinder in a fixed position in the event of a sudden loss of hydraulic pressure (pump failure or hose damage). |
| Additional all hydraulic cylinders are equipped with special load holding valves (parachute valves) which permit a controlled and low speed movement of the boom and drill feed in case of a hose/pipe rupture. |
5.1.2.1 Special swivel head (6 x 90°)

The design of the special swivel head allows 6 different sidewise slewing ranges (±45°) of the drill mast to the left and to the right. The sidewise slewing range can be changed by different positioning of the rod heads of the two slewing cylinders which are mounted between the mast carrier and the swivel head.

The conversion of the rod head position of the two hydraul. cylinders **must** be done one by one. Cause of the stopcocks which are installed in the hydraul. lines to retract the cylinder rods of the two slewing cylinders, it is possible to extract only one cylinder rod by shutting of the retraction line of the second cylinder.

Do only demount the bolt of one rod head connection and extract the cylinder rod into desired slewing range position of the swivel head. After correct installation of the bolt connection, the second slewing cylinder can be converted.

**ATTENTION!**
Cause of safety reasons, the conversion of the cylinder rod heads is only allowed with drill mast in horizontal (transport) position and rotary drill head in middle position of the drill mast carrier.
5.2 Drill mast 164 and attachments

The drill mast consists of square sectioned steel profiles. The bottom end is fitted with a centraliser, a clamping device and a toothed support plate. The drill mast is attached to the mast carrier. The drill unit is mounted on a glide slide which is guided on the drill mast. Axial movement is assured by a feed chain driven by a hydraulic cylinder.

Caution: Ensure that no one is within the danger zone of the drill mast during drilling operation. Operating the drill rig when drilling personnel is within the danger zone is forbidden, because persons are endangered by slewing parts of the drill mast. When drilling mast has to be pressed and fixed to ground or to the wall in order to prevent mast from damages.

Safety Instructions for preparing to install or remove the feed chain.

1. Mast in horizontal position and in working height.
2. Block slide carriage.
3. Shut off the diesel engine and the starter key is taken out of the ignition lock.
4. Place both feed control levers to 0–position (neutral).
5. Installing or Removing of feed chain has to be made only by trained technical personnel.
6. Before operating the feed chain, you must ensure that the feed chain is slackened by the chain–tension–device.

PLEASE NOTE:
Mast with feed chain mechanism:
The tension of the chain is controlled by a special cylinder at the front of the drill mast. This is a high pressure cylinder. Do never disassemble it yourself.
5.2.1 Tensioning of feed chain for drill mast with feed cylinder

To tension the feed chain the slide with drill heads has to be moved to the front position and the drill mast shall be positioned into horizontal. The tensioning screws at the rear end of the drill mast shall be even tightened. The necessary initial tension is achieved, when the chain is tensioned with a max. sag of 2–3% of the distance between the center of the rear guide roller and the connection point of the feed chain. A locking sheet avoids loosening by vibrations due to drilling operation and is mandatory. A frequent check of feed chain tension is necessary to avoid damages at feed cylinder and feed chain.

**Chain tension system**

It is not allowed to tension the feed chain by using a impact wrench or extended tools.
5.2.2 Safety instructions for roller chains for drill feed system

(only for drill masts with feed chain)

CAUTION

"The 3.5-time security factor versus rupture of the roller feed chain, according to DIN EN 791 (drill rigs–safety), is only ensured when the feed chain will be regularly controlled.

Please notice, that the allowed tensile strain of the chain on pitch length as a result of wear shall be checked according to the manufacturers guide line and to keep the records of the check."

General rules:

Roller chains have to be checked daily for cracks and fissures. Pins and links with wear marks and grooves or mechanical deformations must be replaced. Roller chains have to be checked weekly for elongation.

The permitted elongation should not exceed 2%. The elongation test is realised on a grease–free and clean chain.

If the permitted elongation is exceeded, the chain is not usable any more and must be replaced.

Elongation test procedure:

The gauge distance must consider at least 17 double–links in the working range of the chain and should be done as follows:

a) Fix the total length of 17 double–links of a new chain within the pitch distance (roller to roller / link to link)

b) The test procedure compares the total length of the new chain and the used chain and if the used chain shows increased lengths of 16 1/2 double–link gauge, the chain must be replaced.

Nominal length values:

Drill feed type 164

<table>
<thead>
<tr>
<th>1 double link</th>
<th>19.05 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 double links</td>
<td>323.85 mm</td>
</tr>
</tbody>
</table>
5.3 Engine and central hydraulics (Power Pack PP-95-DS)

The main power source, which is a kind of the separate Power Pack PP-95-DS, is an fluid-cooled 4-cylinder four-stroke diesel engine with an output of 95 kW at 2300 rpm (for details see engine manual).

All operating functions (tramming, alignment and drilling), are powered by a four-circuit hydraulic system with a max. system pressure of 250 bar (3626 psi).

The open centre hydraulic system is supplied from a hydraulic oil tank with a capacity of approx. 400 litres.

The entire system is sealed-off to forestall contamination.

In order to hold the hydraulic fluid in a optimal working temperature range, a temperature sensor is installed in the cooling circuit. If the hydraulic fluid reaches a temperature of 40°C the fan motor of the oil cooler is switched on by a hydr. valve. The fan motor will be switched off automatically after reaching a hydraulic fluid temperature of 40°C.

Cooling of the hydraulic fluid is required to maintain the right operational temperature and retain optimum viscosity. This is assured by a hydraulic oil cooling device, consisting of the cooler with hydraulically driven fan motor.
6 Operation

6.1 Measures to start-up

Absolutely check before the start-up:

- To ensure a correct function, check all cable and hose couplings which are connected between the drill rig and the Power Pack (see description of connection plates KR 702-2 and Power Pack on following pages). If loose, tighten them correctly.

- Make sure that all operating levers are in neutral "OFF" position.

- Make sure that all ball-valves in hydraulik pump suction line and diesel engine fuel line are opened.

- Check the EMERGENCY STOP switches and the safety device for the rotation and feed functions (Safety system) at the drill mast.

- Check diesel tank filling, engine oil level, oil level of gears, hydraulic oil tank filling level by using indicators and devices, and refill if necessary.

- Make sure that all hydraulic fittings are securely tightened (leaks !), and that lines show no kinks or are jammed.

- Make sure, that the battery disconnecting switch is in closed position (see sketch).

The battery disconnecting switch must be turned to the left side (anticlockwise) to interrupt the electric circuit before you start with service or repair works or in case of danger. At the end of operation, the disconnecting switch must be turned to the right side (clockwise). The electric circuit is closed.
Absolutely check when start-up the drill rig:

- Start diesel engine as described under "Engine start-up" (see chapter 6.3.5 on page 58).

- Let the hydraulic system cycle to "warm-up" (see page 59).
  The optimum operating temperature for hydraulic oil depends on the viscosity class of the used hydr. oil (see chapter 8.2). By warming up the hydraulic system, the regular sensitivity of the hydraulic system is reached.
  If the drill rig is operated at lower oil temperatures without accomplished warming-up phase, the retarded responding of the hydraulic functions occur.

**PLEASE NOTE**

In order to hold the hydraulic fluid in a optimal working temperature range, a temperature sensor is installed in the cooling circuit. If the hydraulic fluid reaches a temperature of 40°C the fan motor of the oil cooler is switched on by a hydr. valve. The fan motor will be switched off automatically after reaching a hydraulic fluid temperature of 40°C.
### 6.1.1 Hydr. rapid couplings on connection plate KR 702–2

**Connecting hoses / -cabel KR 702–2 with PP–95–DS**

<table>
<thead>
<tr>
<th>Position</th>
<th>Function</th>
<th>Dimension</th>
<th>Total length (m)</th>
<th>KLEMM part-no.</th>
</tr>
</thead>
<tbody>
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<td>Tank 1</td>
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<td>1 x 0000058834</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35L / DN32</td>
<td>5</td>
<td>1 x 0000267135</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35L / DN32</td>
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<tr>
<td></td>
<td></td>
<td>35L / DN32</td>
<td>40</td>
<td>2 x 0000545817</td>
</tr>
<tr>
<td>2</td>
<td>Pump 2</td>
<td>30S / DN25</td>
<td>2</td>
<td>1 x 0000545558</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30S / DN25</td>
<td>5</td>
<td>1 x 0000545688</td>
</tr>
<tr>
<td></td>
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<tr>
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<td></td>
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<td></td>
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<td>30S / DN25</td>
<td>40</td>
<td>2 x 0000545742</td>
</tr>
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### Connecting hoses / -cable KR 702-2 with PP-95-DS

<table>
<thead>
<tr>
<th>Position</th>
<th>Function</th>
<th>Dimension</th>
<th>Total length (m)</th>
<th>KLEMM part-no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Tank 2</td>
<td>35L / DN32</td>
<td>2</td>
<td>1 x 0000058834</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35L / DN32</td>
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<td>1 x 0000543243</td>
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<td></td>
<td></td>
<td>10L / DN8</td>
<td>5</td>
<td>1 x 0000543516</td>
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<td>10L / DN8</td>
<td>25</td>
<td>2 x 0000543582</td>
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<td></td>
<td></td>
<td>10L / DN10</td>
<td>40</td>
<td>2 x 0000675831</td>
</tr>
</tbody>
</table>

---

**CAUTION**

The **maximally permissible hose lengths** of the hydraulic connection hoses between the drill rig KR 702-2 and the Power Pack PP-95-DS are **40 meters**. The extension of the hydr. hoses or a connection of the hydr. hoses by using quick-couplers is absolutely forbidden. By using of longer hydraulic connection hoses or decreasing of the hose cross section by installation of quick-couplers, an increase of the dynamic pressures results, which can lead to damages in the hydraulic system.
6.1.2 Hydr. rapid couplings on connection plate Power Pack
PP–95–DS

**Electr. connection plug**
(For checking or tramming the Power Pack without any connected hydr. devices, a dummy plug must be connected to the free electr. plug.)

- **Leak oil**
- **Tank T2**
- **Tank T1**
- **Pump P1**
  \( (Q = 115 \text{ l/min}) \)
- **Pump P2**
  \( (Q = 90 \text{ l/min}) \)
- **Pump P3**
  \( (Q = 20 \text{ l/min}) \)
- **Pilot control P4**
  \( (Q = 15 \text{ l/min}) \)

**CAUTION**

For connection other hydr. devices to the Power Pack the corresponding hydr. circuits must be considered!
6.2 Control elements on drill rig KR 702–2

The control of the different operational functions is possible from three control places:

1. Control elements for **tramming functions** are placed on left side at the back of the rig.

2. Controls for **setting-up and alignment** of the boom are placed on the left side of the rig.

3. All controls for **drilling functions**, safety device and main power unit (diesel engine) are mounted on the slewable control panel – during transport placed parallel to boom and tracks– which can be slewed out to the left in several steps.

**CAUTION**

In case of danger the complete drill rig can be stopped suddenly from each control place by using the emergency stop switch.
6.3 Control elements on Power Pack PP-95-DS

All controls of Power Pack are located in clearly isolated sections. The control elements for diesel engine (engine control box, rpm control potentiometer, emergency off ...) are mounted at the left front side on the Power Pack. The positioning of ball valves for “warm-up”, drilling and tramming operations are described on the following pages.

![Diagram of control elements on Power Pack PP-95-DS](image1.png)

**engine control box**

**rpm control potentiometer**

**EMERGENCY OFF**

![Diagram of control elements on Power Pack PP-95-DS](image2.png)

**cooler of diesel engine**

**battery disconnecting switch**

**electronic engine regulator (EMR 3)**
6.3.1 Operation elements on Power Pack PP–95–DS with crawler undercarriage (option)

If the Power Pack is equipped with a crawler undercarriage, the operation elements for the tramming functions are located on a console, which is mounted on the rear end of the base frame. An emergency stop button and a tracer for the horn is also located at this console.

**Console for tramming operation of Power Pack**

- Operation lever for tramming function (see page 61)
- Way–valve for switching tramming or drilling function
- horn
- EMERGENCY OFF
6.3.2 Engine control box PP–95–DS

It is forbidden to clean the start and control element with strong water pressure or with a high pressure cleaner.

Indications and diagnostic opportunities on the display of the engine control box

Standard screen:

- first line: diesel engine rpm
- second line: coolant temperature (if overheated a warning is indicated behind the temperature value)
- third line: indication of hydr. oil temperature
- fourth line: diesel fuel indicator (at 15% filling = warning)
Key assignment

1 - not in use
2 - arrow up
3 - arrow down
4 - choose / enter

Here you can use both middle buttons for the "Cursor-function". The lower button is in use to choose or enter items. Several submenus are selectable over the items "next" and "back". Additional special values are adjustable with the buttons.

To adjust a value:

1. Move the cursor with the arrow-buttons (Buttons 2 and 3) to the value.
2. Enter the value with the ENTER-button (Button 4) (Value is blinking).
3. Change actual value with the arrow-buttons (Button 2 and 3)
4. Enter the new value with ENTER-button (Button 4) (Value will stop blinking).
Service–Menu

Main screen

By pushing both middle buttons together, the service menu is selectable. There are also submenus selectable.

Additional the language is selectable.

<table>
<thead>
<tr>
<th>Service</th>
<th>Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Einhänge</td>
<td>ESS perm/inciping</td>
</tr>
<tr>
<td>Aussänge</td>
<td>ESS inching/reset</td>
</tr>
<tr>
<td>Motor Daten</td>
<td>ESS mast</td>
</tr>
<tr>
<td>Display</td>
<td>Hydr. oil level</td>
</tr>
<tr>
<td>Öltemp.: 63 °C</td>
<td>Diag_IN 1</td>
</tr>
<tr>
<td>Sprache: deutsch</td>
<td>Alternator</td>
</tr>
<tr>
<td>Version: 3.0</td>
<td>Generator</td>
</tr>
<tr>
<td>System zurück</td>
<td>Display</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Submenu Inputs

The screen will show the states of inputs.

<table>
<thead>
<tr>
<th>Einhänge</th>
<th>Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.U. Dauer/Tipp en</td>
<td>ESS perm/inciping</td>
</tr>
<tr>
<td>U.U. Tipp en/Reset</td>
<td>ESS inching/reset</td>
</tr>
<tr>
<td>U.U. Lafette</td>
<td>ESS mast</td>
</tr>
<tr>
<td>Hydraulikölstand</td>
<td>Hydr. oil level</td>
</tr>
<tr>
<td>Luftpfilter</td>
<td>Diag_IN 1</td>
</tr>
<tr>
<td>Blitzkontrolle</td>
<td>Alternator</td>
</tr>
<tr>
<td>Dia IN 1</td>
<td>Generator</td>
</tr>
<tr>
<td>Steuerstand 0,000</td>
<td>Operatorpanel 0,000</td>
</tr>
<tr>
<td>Fahrerstand 0,000</td>
<td>Travelpanel 0,000</td>
</tr>
<tr>
<td>Dieseltank 0,000</td>
<td>Fuel 0,000</td>
</tr>
<tr>
<td>Öltanktemperatur 0,000</td>
<td>Oil temp. 0,000</td>
</tr>
<tr>
<td>zurück</td>
<td>back</td>
</tr>
</tbody>
</table>

Input 1 = permanent/inching (ESS):
If the selector switch perm/inching is in “permanent” position, “1” is indicated. In position “inciping” the input is “0”.

Input 2 = inching/reset (ESS):
If the button inching/reset is pressed, “1” is indicated. If this button is not activated, the input is “0”.

Input 3 = ESS drill mast (limit switch ESS):
If the limit switch, the rope tension and the electr. cable to the drill mast are ok, “1” is indicated. If one of these conditions is failed, the Input is “0”.

Input 4 = Hydr. oil level:
If there is enough hydr. oil in the oil tank, “0” is indicated. If the hydr. oil level is to low, the input is “1”.

Input 5 = Air filter:
If the air filter is contaminated, the input setting is “1”. If the air filter is clean, the input is “0”.

Input 6 = Start:
If the start button or the ignition lock to start the engine is activated, the input setting is “0”. If none of these conditions is fulfilled, the input stays in “1” setting.

Input 7: Option

Input 8 = Alternator:
If the alternator charges, the input stays in “1” setting (V-belt is ok).
If the alternator don’t charge, the input stays in “0” setting.

Input 9 = Operator panel
This value refers to the potentiometer for the speed adjustment of the diesel engine “RPM” at the control panel. Value depending upon potentiometer position approx.. 2... 23V.

Input 10 = Travel panel (Power Pack)
This value refers to the potentiometer for the speed adjustment of the diesel engine “RPM” at the drivers stand (Power Pack). Value depending upon potentiometer position approx.. 2... 23V.

Input 11 = Fuel tank level:
The indicator for the fuel tank level has an output signal from 4....20mA.
If an output signal of 4mA is clearly exceeded, it can be expected that a cable break has already happened.
If an output signal of 20mA is clearly exceeded, a short-circuit can be expected.

Input 12 = Oil temperature:
The sensor for the oil temperature has an output signal of 4....20mA. If the 4mA limit is under-run clearly, a cable break must be the cause. If the 20mA limit is exceeded clearly, a short-circuit must be the cause.
Submenu Outputs

The screen will show the states of outputs.

Output 1 = Solenoid valve ESS:
If the conditions of the ESS (limit switch, activating, ...) are fulfilled, the output for the solenoid valve will be set (=1) and the hydr. pilot control is activated.
If one of these conditions is not fulfilled, the input stays in “0” setting.
In addition this output is used, to switch off the power necessity when problems with the diesel engine occur.

Output 2 = Solenoid cooler:
If the hydr. oil temperature is $< 40^\circ$C, the output stays in “1” setting (cooler fan is not working). If the hydr. oil temperature is $> 40^\circ$C, the output stays in “0” setting (cooler fan is working).

Output 3 = Warning:
This output is used for acoustic warnings when error messages of the diesel engine occur ($1 =$ Warning signal).

Outputs 4, 5, 7, 8: Option
Submenu Engine data

Here the following engine data can be interrogated.

In detail:

- working hours of engine
- actual r.p.m. of engine
- r.p.m. target of engine (these value will send to the EMR)
- temperature (coolant temperature)
- oil pressure of engine
- fuel rate Liter/hour (Attention! These value is arithmetical...)
- power (arithmetical actual Power of engine)
- air inlet (intercooler temperature)

Submenu Display

In this menu contrast and brightness can be adjusted (contrast from 0 up to 15 and brightness from 0 up to 7).

If the contrast value is out of the KLEMM adjusted limits, the values for contrast and brightness are set back to a standard value after new switching on of the ignition.
Submenu System

The access to the area **System** is only released after consultation with KLEMM Bohrtechnik and input of a special code.

Error messages:

In the left part of the display different error messages can be indicated. This error messages can not be received. After error correction and a new start of the diesel engine, the messages are distinguished.

The following errors can be indicated:

1. Missing engine oil pressure (at running diesel engine)
2. Overheating of the coolant
3. Fuel tank level under 15% filling
4. Air filter contaminated
5. Hydr. oil level to low
6. Cooling fluid level to low
7. V-belt torn resp. the alternator don’t charge with a motor speed of >1000 rpm
8. Overheating of the hydraulic oil
### 6.3.3 Engine control system Power Pack PP–95–DS

<table>
<thead>
<tr>
<th>Cause of errors</th>
<th>Reaction of the engine control system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of cooling fluid</td>
<td>• Warning in the display (text),</td>
</tr>
<tr>
<td></td>
<td>• Switching−off hyd. pilot control</td>
</tr>
<tr>
<td></td>
<td>• Switching−off diesel engine</td>
</tr>
<tr>
<td>To high cooling fluid temperature</td>
<td>• When temperature is &gt;= 111°C Warning in the display (text)</td>
</tr>
<tr>
<td></td>
<td>• Switching−off hyd. pilot control</td>
</tr>
<tr>
<td></td>
<td>• If temperature of cooling fluid is higher than 111°C, the power of the diesel engine will be</td>
</tr>
<tr>
<td></td>
<td>reduced up to 50% by the ECM system</td>
</tr>
<tr>
<td></td>
<td>• When temperature is &gt;= 119°C Switching−off diesel engine</td>
</tr>
<tr>
<td>To low oil pressure</td>
<td>• Warning in the display (text),</td>
</tr>
<tr>
<td></td>
<td>• Switching−off hyd. pilot control</td>
</tr>
<tr>
<td></td>
<td>• Switching−off diesel engine</td>
</tr>
<tr>
<td>Air filter contaminated</td>
<td>• Warning in the display (text),</td>
</tr>
<tr>
<td></td>
<td>• Switching−off hyd. pilot control</td>
</tr>
<tr>
<td>Lack of hyd. oil</td>
<td>• Warning in the display (text),</td>
</tr>
<tr>
<td></td>
<td>• Switching−off hyd. pilot control</td>
</tr>
<tr>
<td></td>
<td>• Switching−off diesel engine</td>
</tr>
<tr>
<td>V−belt torn resp. the alternator don’t charge</td>
<td>• Warning in the display (text),</td>
</tr>
<tr>
<td>with a motor speed of &gt;1000 rpm</td>
<td>• Switching−off hyd. pilot control</td>
</tr>
<tr>
<td></td>
<td>• Switching−off diesel engine</td>
</tr>
<tr>
<td>Overheating of the hydraulic oil</td>
<td>• Warning in the display (symbol),</td>
</tr>
<tr>
<td></td>
<td>• Switching−off hyd. pilot control</td>
</tr>
<tr>
<td></td>
<td>• Acoustic warning signal</td>
</tr>
</tbody>
</table>
6.3.4 Electronic engine regulator (EMR)

The electronic engine regulator (EMR) (pic. 1) is located at the rear side of the power pack and can be reached through the rear cover door. The engine control distribution (pic. 2) can be reached through the engine cover door on the left side of the power pack.

At the engine control distribution there is a control lamp (1), a battery charge lamp (2), an emergency rpm–potentiometer for the Diesel engine (3) as well as an interface for a diagnostic computer (4).
Self-diagnosis of diesel engine by control lamp EMR

The EMR possesses numerous protection functions for the engine – depending on the available measuring points or sensors. Depending on the seriousness of the recognized fault, the engine may run on in reduced mode (limp home), whereby the fault indicator lamp is continuously lit, or the engine is switched off, whereby the fault indicator lamp flashes.

A lit fault indicator lamp indicates an error in the wiring (short circuit, cable break) or a defect in the displays of the corresponding sensors. A further source of faults could be falling below or exceeding the measuring value limits.

Faults in the electronics are registered or stored in the control unit and shown by the fault indicator lamp. The fault indicator lamp is extinguished as soon as the fault has been removed. Only when the electronics has been switched to emergency running (−speed), need the engine be switched off briefly with the key-operated switch in order to extinguish the fault indicator lamp. Also corrected or non-current faults remain stored in the control unit and can be read out or deleted by the customer service of KLEMM Bohrtechnik.

Important notes for EMR-System

Electrical welding

In order to prevent damage when carrying out ELECTRIC welding of the installation, the plug connections of the EMR and ESX-calculator shall first be pulled out! They are located at the left hand side of the Diesel engine inside the sound proof cover.

The ignition must be switched off when working on the EMR.

Remove plug

Removing the 25-pole control apparatus plug when the control apparatus is on, i.e. when the voltage supply is on is not permitted.

1. Voltage supply off
   – only then –
2. pull out plug

Damage

The plug connections of the control units are only dust and watertight when plugged into mating connection! Until the mating connector has been plugged in, the control units must be protected against spray water!
6.3.5 Engine start-up

1. Set rpm control potentiometer to approx. quarter speed (on the left front side of the Power Pack or on slewable control panel of the drill rig). The potentiometer with the higher setting controls the engine speed.

2. Insert starter key into ignition lock and turn clockwise to position 1. The display of the engine monitoring light up.

3. Turn starter key in ignition lock to position 2, and release as soon as engine starts firing.

4. Do not activate the starter for more than 10 seconds at a time. If the engine does not fire, repeat starting procedure after 1 minute.

The ignition lock is fitted with a repeat-starter prevention lock. This means that the key must be returned to "O", before restarting attempts.

**Attention:** Always ensure that the engine and starter motor are stationary before the starter motor is engaged again.
6.3.6 Starting procedure of an KR 702–2 in cold ambient temperature conditions

To “warm up” the hydraulic system at cold outside temperatures all three shut-off valves at the Power Pack (see picture) must be shifted in the position, in which the hyd. oil can flow back into the tank without pressure build-up. This is ensured with opened shut-off valves (see sticker at the Power Pack and the description on following page). The shut-off valves can be closed after a warming-up phase of approx. 10–15 minutes.

**Ball valves on Power Pack PP–95–DS**

---

**Ball valve position in warm-up phase**

- **Anlassen-Kaltstart** **Starting-Cold Start**
  - Kugelhahn offen
  - Ball valve open

- **Bohrbetrieb** **Drilling**
  - Kugelhahn zu
  - Ball valve closed

- **Achtung!!** **Attention!!**
  - Alle 3 Kugelhähne sind zu betätigen!
  - Operate together the 3 ball valve!

---

**CAUTION**

For drilling operations the ball valves must be closed after reaching the working oil temperature!

Upon non-compliance of the warm-up phase there is a danger of cavitation inside the pumps as well as delayed responsivity of the hydr. functions.
6.4 Tramming the crawler drill rig

**CAUTION**

Be sure to check for adequate clearance prior to each start-up and before tramming, setting-up and drilling operations.

Do not apply levers fully to begin with, but activate as if accelerating a car. Lever position determines the degree of opening of the control valves and therewith the quantity of oil supplied.

Never activate one track only dragging the other one behind when turning or changing direction. always let both tracks turn clockwise / anti-clockwise.

1. Activate control levers in corresponding direction.
2. The crawler drill rig is steered by counter-activation of the control levers.
3. Parking brakes are automatically applied on recentering the control levers.
4. While tramming the rig be sure to align the drill mast horizontally resting on the mast support bracket.
5. Drill head unit must be positioned between mast carrier and mast support bracket.
6. Never attempt to turn the drill rig on the spot in swampy muddy or any soft ground conditions. Try to free the tracks by tramming and turning slowly at the same time.
6.5 Tramming the Power Packs with crawler undercarriage

CAUTION

Be sure to check for adequate clearance prior to each start-up and before tramming.

Do not apply levers fully to begin with, but activate as if accelerating a car. Lever position determines the degree of opening of the control valves and therewith the quantity of oil supplied.

Never activate one track only dragging the other one behind when turning or changing direction. Always let both tracks turn clockwise / anti – clockwise.

1. Switch lever of way-valve in “tramming” position.
2. Activate control levers in corresponding direction.
3. The crawler drill rig is steered by counter-activation of the control levers.
4. Parking brakes are automatically applied on recentering the control levers.
5. Never attempt to turn the power pack on the spot in swampy muddy or any soft ground conditions. Try to free the tracks by tramming and turning slowly at the same time.
6.6 Tramming the drill rig on slopes

When tramming and working on slopes with a slope angle of more than 20°, the drill rig must be equipped and secured with a rope winch (it is forbidden to use free fall winches) to avoid sliding down or rollover of the machine on slopes. The winch must be equipped with a safety brake system. The cable connector point must be designed and tested for dynamical loading forces. **Pull force f on third layer of winch**

\[
f > 0.50 \text{ for a slope angle of } < 40°
\]

\[
f > 0.40 \text{ for a slope angle of } < 35°
\]

\[
f > 0.30 \text{ for a slope angle of } < 30°
\]

\[
f > 0.20 \text{ for a slope angle of } < 25°
\]

\[
f = \frac{\text{pull force}}{\text{mass of machine}}
\]

Example:

If the pull force \( f \) is lesser than shown in the upper sketch, the corresponding winch must not be used for securing the drill rig. A winch with an adequate pull force \( f \) according the upper calculation must be used.

6.7 Manoevrability

To ensure maximum manoevrability and steering of the crawler tracks, it is important to keep the track chains clean and free from build ups. Dirt and mud build up in the crawler tracks make the chain stiff and difficult to pass over the sprockets. This impairs the steering capacity and may cause ruptures and breakages of the crawler chains.
6.8 Setting up and alignment

The control console for boom alignment is located on the left side of the drill rig, and consists of three adjacent operating levers. The fourth lever is optionally used for sidewise shifting of drill head unit. These can be activated forward or backward from the centre setting. Push or pull the levers to activate the corresponding hydraulic cylinders.

All cylinders are fitted with load bearing valves, locking the cylinder in position even when the control lever is released and centres automatically.

The levers – from left to right as you stand in front of the control console the following functions:

1. **Push:** Drill mast displacement to the front
   **Pull:** Drill mast displacement to the back

2. **Pull:** Swivel head to the left around its axle
   **Push:** Swivel head to the right around its axle

3. **Push:** Swivel head tilting forwards
   **Pull:** Swivel head tilting backwards
Push/Pull: Telescope right track section

Push/Pull: Right rear propping cylinder up/down

Push/Pull: Telescope left track section

Push/Pull: Left front propping cylinder up/down

Push/Pull: Left rear propping cylinder up/down

Push/Pull: Right front propping cylinder up/down
6.8.1 Safety device for drill mast slewing

Cylinder limitation for drill mast slewing

The drill rig KR 702–2 can be fitted with different types of drill masts and drilling equipements. For the following examples of drilling equipements, the two cylinders of the function “drill mast slewing” must be limited.

Examples for different drilling equipement:

Example 1:  
- Telescopic drill mast 164, 2150 long
- Lateral slidable glide slide
- Cat head with rope winch
- Rotary drill head or hydr. drifter

⇒ Cylinder limitation ± 15° (KLEMM part.-no. 0000557217)

Example 2:  
- Drill mast 160, 3950 long (HPI)
- Rotary drill head

⇒ Cylinder limitation ± 3° (KLEMM part.-no. 0000557369)

During drilling operations the two red cylinder limitations (see picture) must be fixed between the hydr. cylinders and the slewing head.

Due to stability reasons it is strictly forbidden to dismount the limitations!
Non compliance of these instructions can lead to accidents and damages on the drill rig!
6.9 Drilling controls

6.9.1 Drilling controls on base drill rig

**ATTENTION!**
After every adjustment of the drill mast, you **must** regulate the pressure maintaining valve! A too low regulation of the pressure maintaining valve can result in damages and danger for persons.

**symbols**

1. Pressure maintaining valve for hold-back device
2. Manually adjustable pressure regulator for drill string rotation
3. Manually adjustable pressure regulator for drifter percussions (only for hydr. drifter)
4. Manually adjustable drifter percussions frequency (only for hydr. drifter)
6.9.2 Drilling controls on slewable control panel

symbols

5 Push/Pull: Drill string rotation

6 Push: Drifter percussion
Pull: Additional rotation

7 Push: Rapid feed downward
Pull: Rapid feed upward

8 Push: Feed downward
Pull: Feed upward
symbols

9
Push: Winch hook down
Pull: Winch hook up

11
Push: Close clamping device
Pull: Open clamping device

10
Manual regulation of feed pressure

12
Push: Side shifting of drill head unit
Pull: Side shifting of drill head unit

CAUTION!
Do not touch the lever for sidewise shifting of the drill head unit while drilling with rotary head!
Slidewise shifting of the drill head unit while drilling operations will damage the drill rig and is danger for person!

Please note!
The sidewise shift of the glide slide is only to be used to open the rope working area of the rope winch in the drilling axis.
Drilling operations and other operations with sidewise shifted drilling unit out of drilling axis are strictly forbidden!

Please note!
By different tight seals in the clamping cylinders, differences in mobility etc., the synchronisation can be affected unfavorably. In order to reach a synchronisation of the clamping cylinders it is advisable to open and close the clamping devices completely occasionally.
6.10 Electric control box

Functions on the electric control box

1 Push button (INCHING / RESET)
2 EMERGENCY-switch off
3 Selector switch (INCHING / PERMANENT)
4 RPM regulation for diesel engine
5 Gear switching for rotary drill head KH 20
   - Switch in left position: slow speed
   - Switch in middle position: medium speed
   - Switch in right position: fast speed
6 Horn
7 Start-button
6.11 Telescopic function of the drill mast

Drill mast type 164 is equipped with a hand operated valve to block telescopic mode (see picture below)

**Open position of the valve**

The open position allows to use the telescopic function of the drill mast. While drilling the telescopic mode will be activated first. Then the displacement of the glide slide on the drill mast is activated.

If the valve block is closed the range of operation is limited to the displacement of the glide slide on the drill mast.
6.12 Drilling operation

1. Use boom control levers to align the drill mast in the required position. Mast has to be pressed against object to drill. Check mast inclination with angle indicator.

2. Adjust the feed pressure setting using the adjustment valve on the control panel.

3. The pressure setting can be monitored with the pressure gauge installed on the power pack.

4. The right feed pressure setting depends on ground conditions, drilling diameter and bore hole length, and is reflected by an optimum penetration rate.

**CAUTION**

System pressures are set at the primary pressure limiting valves. Do not attempt to adjust these pressure settings. This would result in hose – seal – and valve damages. It also reduces the life of this equipment.

5. While tramming the rig, be sure to align the drill mast horizontally, resting on the mast support bracket. The drill head unit must be positioned between mast carrier and mast support bracket.

6. Never attempt to turn the drill rig on the spot in swampy or boggy ground conditions. Try to free the tracks by tramming and turning slowly at the same time in case the machine gets trapped.

7. Working without a rod centralizer is normally not permitted. Take care to ensure that the amount of play between the drill string and rod centralizer does not exceed the amount specified. **Approximate max. clearance with respect to rod centralizer:**

   rod diameter + 4mm

   If this approximate distance is reached, the jaws in the rod centralizer must be replaced with new ones that are compatible with the rod diameter. **Note that the manufacturer can accept no warranty liability whatsoever for loss or damage resulting from a failure to observe these setup guidelines.**

**Equipment of the KR 702–2 with the serial no. M–19133**

Drill head unit consists out of:
Rotary drill head KH 20
Regardless of which system or method you are using make sure that you have also the following tools and equipment on-site:

A) **Coupling Grease** with an applicator brush  
B) A **Wire Brush** to clean casing and threads  
C) **Wrenches** of the proper size for the inner drill string (with a **Safety Rope** on the handle)  
D) 2 No. 36” **Pipe** Wrenches (these are handy on any drill)  
E) A set of **Saw Horses** of sufficient strength to hold your drill rods and casing and to keep them off the ground  
F) A **Shovel** to remove cuttings from the work area  
G) An **In-line Oiler** (If you are using a DHD)  
H) An extra **Water Line** with nozzle, to wash mud and grout from tools and drill rig  
I) A **Grease Gun**  
J) A **Level** or **Angle Indicator** to align the mast on the hole  
K) **Whip Checks** for all hoses

**Drilling method**

The choice for the right drilling method

- single rotary head

as well as the decision which drilling accessories and flushing medium (air and / or water, only water, water and ground support medium like BAROID) is the best one, can only be made after a careful consideration of all site conditions and the main contract specifications.

After having chosen the accessories (of which Klemm offers a wide range off all different kinds) the operator has to determine the right feed pressure and R.P.M. settings, in order to get the best performance.

Park the drill rig on levelled and bearing ground. Use boom and mast control levers to spot the drill mast with the inclination required.

When drilling, mast has to be pressed and fixed to ground or to object to drill !!

Always check the mast inclination during set – up and drilling.
6.13 Safety device for the rotation and feed functions
(Safety system)

The norm "Drill-rig safety" EN 791: 1995 describes in section 5.4.2.2 the requirements of an additional safety device for the functions rotation and feed. Drill rigs with feed mast where there is the danger that persons can be caught and injured by rotating parts must be equipped with an additional safety device. This safety system must be located in the immediate danger area i.e. the area where the rotating drill string which can be reached into by a person.

In an emergency situation the installed additional safety device on the KLEMM Bohrtechnik drill rigs switches off the pilot pressure which activates the drilling functions. The energising signal to the pilot controlled functions (amongst others feed, rotation, percussion) is switched to zero. The relevant hydraulic consumers such as hydraulic cylinders and hydraulic motors are immediately taken out of operation and are stopped.

The additional safety device works as follows: Positioned in the immediate danger area there are one or more contact ropes. These contact ropes are held under tension by spring loaded electrical switches (S10 and S11) with an output signal of 24V. By actuating the contact rope the electrical switch (S10 or S11) is pulled into the switching position and changes the output signal to 0V. Due to the missing electrical signal a 4/2 electro hydraulic valve (Y1.2) is switched into its neutral position. This means that the hydraulic oil of the pilot pressure system is sent back to tank and all the pilot controls are subsequently pressureless. All the main consumers are cut-off from there relevant power lines.

Drilling can only be restarted when the operator actively resets the system.

The additional safety device according to EN 791 has three different operating modes:

1. Continuous operation

- The drill mode.
- The drill mode selection switch (S112) must be set in position "Zero".
- The system must be activated by pressing the "inching/reset" button (S111) by doing so the operator ensures that unintentional movement of machine functions is avoided.
- The contact ropes on the mast are free and hold the electrical switch in the neutral position, (contract rope tension is not to loose and not to tight).
2. Tripping mode

- The operating status after a contact rope has been activated.
- The drill mode selection switch (S112) is still set in "Zero" position.
- All drilling functions (rotation, feed) are switched off, regardless if the contact rope is still switched or if it has return to the neutral position.
- The diesel engine remains switched on.

3. Inching function

- To change casing and to continue stepwise with the drilling functions. To manoeuvre out of an emergency situation.
- Drill mode selection switch (S112) must be set in position "1".
- The contact rope can be in the neutral or in the tripped state.
- Through a one time pressing of the button "inching/reset" (S111) by the operator the pilot pressure is re-opened for a limited time (max. 600ms), the rotary head can be operated within this time 1/3 of a revolution.
- Greater movement can only be achieved be continuous tipping of the "inching/reset" button.
6.13.1 Start-up and functional test of the safety device for the rotation and feed functions

CAUTION

Check the safety device functions every time prior to setting up and drilling operations. If the safety device is defect, working with the drill rig is strictly forbidden!

Electric control box on slewable control panel

![Diagram]

- Push button inching/reset
- Selector switch inching/permanent
- EMERGENCY-switch off
Power – up Self Testing Method

1. Start the engine. To activate the drilling functions, turn the selector switch INCHING/PERMANENT to the "PERMANENT" setting and press INCHING/RESET key briefly.

2. If the drilling functions are further inactive, the safety rope tension of the safety device is not correct or the rope is torn. The safety rope is to be retightened by using the rope tensioning device. The front edge of the eyebolt of the safety pull-switch must be on the same height with the front edge of the adjusting plate (see picture below).

3. Press INCHING/RESET key to activate the safety device.

Safety pull-switch on drill mast

[Diagram showing the safety pull-switch, safety rope with tension adjuster, adjusting plate, setting line of rope tension, and eyebolt]
Safety device functional test

1. Set rotary head control lever to “Rotation”. Rotation **must** stop immediately, if **one** of the safety wires is touched.

2. Press **INCHING/RESET** to return to the operating mode.

**CAUTION**

DO NOT DISABLE THE ACCIDENT PREVENTION DEVICE UNDER ANY CIRCUMSTANCES. TO COMPLY FAILURES MAY LEAD TO SEVERE OR FATAL INJURIES.

DO NOT OPERATE THE DRILL RIG IF THE SAFETY DEVICE IS FAULTY.

INFORM SITE SUPERVISION IMMEDIATELY AND CONTACT YOUR KLEMM BOHRTECHNIK SERVICE SECTION.

Apart from its safe-guarding function, the safety device is a useful tool when adding or removing drill string sections.

1. Set selector switch **INCHING/PERMANENT** to the "**INCHING**" setting.

2. Set rotating sense of rotary head to the required direction.

3. Every time the yellow **INCHING/RESET** key is pressed, the drill string will turn by approx. 1/4 to 1/2 rotation, depending on rotary head rpm setting.

4. Repeat pressing **INCHING/RESET**, until the tool joint is unscrewed or tightened.

Resetting the safety device to safe-guarding mode:

1. Turn selector switch **INCHING/PERMANENT** to the "**PERMANENT**" setting.

2. Briefly press **INCHING/RESET** key.

3. The safety device is reset to the safe – guarding mode.
6.14 Safety guard as additional safety device mounted on drill mast of the drill rig KR 702-2

The drill rig KR 702-2 is equipped with a safety device for the rotation and feed functions (Safety system, see on page 73), which is prescribed in the norm "Drill-rig safety" EN 791:1995. As additional safety device for vertically drilling operations, the drill mast can be equipped with a safety guard. The safety guard is mounted in the front section of the drill mast and consists basically of a steel frame, two laterally fixed lattice elements and two swing doors with a locking.

**PLEASE NOTE**

The drilling functions “rotation” and “feed” are only released when the safety device for the rotation and feed functions (safety system with contact ropes) is activated and the safety guard is in closed and locked condition!

Drill rig KR 702-2 with mounted safety guard

Locking system of safety guard

**Please note!** To release the drilling functions, the handle of locking system must be in locked position (see picture) and the limit switch must be activated by the contact roll.
6.14.1 Instruction for backfitting a safety guard to the drill mast type 164

The necessary conversion as well as the following mounting of a safety guard to a drill mast type 164 must be carried out as follows:

1. Align drill mast in vertical position and prop it to the ground.
2. Move back the drill head unit backwards to the front end of the drill mast by using the feed function.
3. Demount the safety rope with pull switch of the safety device.
4. Demount the holder of the pull switch.
5. Screw on the holders (pos. 1–4) of the safety guard on the left and right side of the drill mast and align them angular (see picture).

**Holders of safety guard**

- **Pos 1.** Holder (310mm long)  
  part no.: 0000559922

- **Pos 2.** Holder (225mm long)  
  part no.: 0000559921

- **Pos 3.** Holder (280mm long)  
  part no.: 0000559923

- **Pos 4.** Holder (205mm long)  
  part no.: 0000559920
6. Insert the cable to the existing cable into the pull-switch of the safety device on the left side of the drill rig and connect it.

**Pull-switch of safety device**

Before the connection of the limit switch cable

![Before connection](image1)

After the connection of the limit switch cable

![After connection](image2)

7. Mount the safety rope with pull switch to the rear holder pos. 3 (see page 79).

8. Attach the safety guard with the mounted holders to the drill mast.

9. Lay the electrical cable of the limit switch through the interior of the safety guard.

**Laying of the electr. cable from the pull–switch to the locking mechanism**

![Laying cable](image3)
6.14.2 Safety instructions for transport of the drill rig with mounted safety guard

CAUTION

The transport of the drill rig with mounted safety guard is only allowed with mounted transport lock (angle plates)

ATTENTION!
For transport purpose, both transport locks (angle plates) must be bolted to the left and right slewing door!
7 Crawler tracks

The KLEMM drill rig is equipped with two crawler tracks. In order to ensure a perfect function of the tracks, special attention to the correct track chain tension and maintenance of the tramming gear must be paid. Rotating component wear parts such as lower rollers, carrier rollers and Idlers are sealed with lifetime friction seal groups and oil lubricated. Oil changes or refilling are not necessary. All screws have to be fastened after 50–100 hours of operation with the required torque. We recommend to check the torque of screws once a week.

7.1 Adjusting Track Tension

For operation of the drill rig it is important that the chains are correctly tensioned. A chain should be tensioned that it has approx. 2 cm slack span on 1 m. If the distance from the supporting roller to the idler amounts to e.g. 1.5 m, then the chain has to sag approx. 3 cm in the center.

If the sagging of the chain exhibits a higher value than 3 cm, grease has to be filled in the lubrication fitting (2) of the tensioning cylinder (3) by a grease gun (4) until the correct tensioning value is reached. If the track chain tension is to high, the adapter nipple (1) of the tension cylinder (3) is to be loosened and grease must be discharged, until the correct value is reached. Afterwards the adapter nipple is to be tightened again.
If the sag of the crawler chain is not measurable e.g. cause of soiling or strong rigidity, the chain tension must be controlled by checking the hydraulik pressure in the tensioning cylinder. For that purpose a manometer unit (e.g. grease gun with manometer) must be attached to the lubrication connection of the chain tensioning cylinder.

KLEMM Bohrtechnik offers a “track tensioning safety device” under the articles no. 0000563682. This “track tensioning safety device” is equipped with a manometer, which shows the pressure that is in the tensioning cylinder while tension. The maximum permitted pressure in the tensioning cylinder while tension must not exceed 50 bar.

For setting the chain after correct tension of the crawler chain, the drill rig must be moved forwards and back a few meters. Afterwards the chain tension must be checked again.

**CAUTION**

The indicated references for the adjustment of the track chains must absolutely be observed. Non observation of this references leads to substantial damage to the chassis and to expiry of any warranty claims!

**CAUTION**

Stretching of a soiled or rigid crawler chain by using the tensioning device is not permissible! Non observation of this references leads to substantial damage to the chassis and to expiry of any warranty claims!
7.2 Repairs on crawler chains

ATTENTION

The Chains are under tension!
The Chains are tensioned by a high pressure grease cylinder!

ATTENTION

Before removing or repairing crawler chains, the drill rig must be switched off and firmly stabilised.
Chain repairs must only be done only by qualified personnel. Worn bolts must always be renewed.

Do not weld on crawler plates. Broken crawler plates must be replaced by new.
Before repairs and replacement operations are executed, it is absolutely necessary to reduce the chain tension. The tension of the chain is controlled by a special high pressure cylinder filled with grease (see page 82 item no.1).
After repairs are finished, the track must be tensioned as described on page 82.

7.3 Controls on tramming gear box

To check the oil level of the tramming gear box, be sure that the filling plug for the oil filling (1) and the drain plug (2) are positioned as shown below.

To check the oil level, the filling plug (1) must be unscrewed. The oil level must reach up to the edge of the filling hole. If necessary oil must be refilled (total amount of filling of approx. 1.2 litres).
Before screwing in the filling plug, the sealing must be controlled and replaced if necessary.

Important controls at the tramming gear box

- Check leak tightness: daily
- Check oil level: all 200 – 250 operating hours
- Change oil: first change after approx.. 200 operating hours. Each further oil change all 2000–4000 operation hours, at latest however after 12 months.
8  Care and maintenance of the KLEMM crawler drill rig type KR 702–2

The use of machine and automatic drill rigs is very important in the modern day building trade because it saves a considerable amount of labour and rationalizes the drilling and blasting work.

The efficiency of the machine application must be as high as possible and particular attention must be paid to a high availability of the machines.

Please bear in mind that machine failures on the building site can cause high consequential costs and delays.

The availability of the machines and the avoidance of unforeseeable failures assume a well organized maintenance system which ranges from the manufacturer to the utilising company and building site operation.

The aim of scheduled care, maintenance and service is to achieve optimum availability of the implemented drill equipment and accessories.

A.  Basic principles

Maintenance measures are:

- **Maintenance**
  
  Measures for maintaining the nominal condition, e.g. cleaning, lubricating, oil change, simple adjustments.

- **Inspection**
  
  Measures for defining and evaluating the actual condition.

- **Preventive maintenance**
  
  Replacement of still operable parts or modules with the aim of preventingly eliminating signs of wear before damage occurs.

- **Repair**
  
  Measures for reinstating the nominal condition.
B. Safety regulations

Care, maintenance and servicing of building machines considerably influences the operating safety. It should be pointed out that every fifth industrial accident happens in connection with maintenance. The two main causes of accident are:

a) Improper maintenance
b) Deficient operating safety due to absence of or insufficient maintenance

The official safety rules consisting of the rules for the prevention of accidents, regulations and safety rules must always be observed.

Individual regulations require inspection, in particular:

- as required or
- at fixed intervals

by:

- a specialist or
- expert

Specialists are persons who due to their professional training and experience have sufficient knowledge in the field of the technical equipment to be tested and are able to assess the safe condition of the technical equipment.

Experts are persons who due to their professional training and experience have special knowledge in the field of the technical equipment to be tested. They should be able to test and provide an expertise of the technical equipment.

For the purpose of these care and maintenance instructions this means that:

Care, maintenance and service work can be performed by trained, specialist personnel of the owner.

PLEASE NOTE

Structural changes, additions, mountings, adjustment of pressure limiting valves and safety valves etc., which modify the equipment's behaviour (e.g. Stability), are to be effected only after consultation and with the written permission of KLEMM Bohrtechnik and under the supervision of a KLEMM Bohrtechnik Specialist Expert. Changes without consultation of the manufacturer result in a total loss of warranty.
8.1 Maintenance intervals

Proper maintenance prevents premature wear and preserves the functionality of the device.

Any damages can be detected at an early stage and save the owner expensive repairs.

The maintenance intervals are specified as follows:

- Every 10 operating hours or daily
- Every 50 operating hours or weekly
- Every 500 operating hours or every three months
- Every 1000 operating hours or once a year

For normal operation the intervals are accumulative, i.e. when work for the 100 hour maintenance is due, the work for the 10, 50 and 500 hour maintenance is also due.

For assignments with a strong development of dust and extreme wet it may be necessary to perform the lubrication and maintenance work at shorter intervals than those specified.

PLEASE NOTE

The maintenance work must be recorded and countersigned in the service log by the machine operator responsible upon completion. The Klemm Bohrtechnik company will be allowed access to this log in the event of claims under the warranty.

DISPOSAL

Old oil, filter elements, hydr. hoses, fuels, lubricants, cleaning agents, batteries, emptied or partially emptied vessels of above mentioned materials and cleaning cloths etc. are special waste and must be disposed of as such!!
8.2 **Recommended Oil- and grease-types for drill rig KR 702-2 with Power Pack PP-95–DS**

<table>
<thead>
<tr>
<th>Fields of use</th>
<th>Oil- and grease-type</th>
<th>Quantity (liters)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diesel engine</strong>&lt;br&gt;TCD 2012 L04 2V</td>
<td>SAE 10 W–40 / SAE 10 W–30&lt;br&gt;Specification:&lt;br&gt;-ACEA E3, E5, B3, B4, A3&lt;br&gt;-API CH–4, SJ</td>
<td>approx. 15*</td>
</tr>
<tr>
<td><strong>Hydr. circuit</strong>&lt;br&gt;Mineral hydraulic oil:</td>
<td>Specification: Requirements of hydraulic oils&lt;br&gt;HLP (DIN 51524–2) must be fulfilled.&lt;br&gt;VG 32: for winter conditions in Central Europe&lt;br&gt;(–20°C bis +20°C)&lt;br&gt;VG 46: for summer conditions in Central Europe or Indoors&lt;br&gt;(–5°C bis +30°C)&lt;br&gt;VG 68: for tropical conditions or in warm rooms&lt;br&gt;(+5°C bis +40°C)</td>
<td>400</td>
</tr>
<tr>
<td><strong>Bio hydraulic oil:</strong>&lt;br&gt;Specification: VDMA 24’568 HEES (water–insoluble, synthetic esters), ISO 15380&lt;br&gt;VG 46: field of use for outer temperatures from −15°C up to +40°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Original Klemm oil filling:</strong>&lt;br&gt;Hydr. oil HLP 68 (mineral oil)&lt;br&gt;(VG 68)&lt;br&gt;(VG = viscosity class)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tramming gear</strong>&lt;br&gt;BP ENERGOL GR–XP 150&lt;br&gt;Specification: The oil must correspond to the requirements &quot;lubricating oils CPL&quot; according to DIN 51’517 part of 3.</td>
<td>1,2</td>
<td></td>
</tr>
<tr>
<td><strong>Grease for general greasing</strong>&lt;br&gt;Lagermeister TS KP2N–30&lt;br&gt;Specification: DIN 51502, KP2N–30</td>
<td>Grease cartridge&lt;br&gt;0,4 kg&lt;br&gt;(part-no. 0000692007)</td>
<td></td>
</tr>
</tbody>
</table>

* These values are the approx. capacities for the crankcase oil sump which not include the standard installed oil filters. Engines with auxiliary oil filters will require additional oil. See also operation manual of diesel engine.
8.2.1 Characteristics of different hydraulic oils for Klemm drill rigs

The selection of the right hydraulic-oil and the ambient-outside-temperature-ranges have important influence on hydraulic functions and speeds of the drill rig.

The max. permissible viscosity-range for the hydraulic components is 1600 mm²/s only for engine start-up (cold start). For short running times (warm-up phase of diesel engine) the permissible viscosity-range is 1000 mm²/s.

The permitted operating-viscosity-range for the hydraulic components should be between 10 mm²/s und 380 mm²/s.

The optimum operating-viscosity-range for the hydraulic components should be between 16 mm²/s und 36 mm²/s. Please refer to the following "Viscosity–Temperature"-diagrams for mineral hydraulic oils and the bio hydraulic oil Panolin HLP Synth 46.

**Viscosity–temperature–diagram for mineral hydr. oils**

![Viscosity-temperature-diagram](image-url)
**Viscosity-temperature-diagram for bio hydr. oil**
Panolin HLP Synth 46 and mineral hydr. oil HVLP 46 + HVLP 68

**Caution!**
When hydr. oils of different manufacturers respectively different types of oil from the same manufacturer are mixed, it can lead to silting and sedimentations. These facts can create malfunctions and damages of the hydraulic system.

**Caution!**
Mineral oils and synthetic oils can **not** be mixed. Therefore please refer always to page 88 (original Klemm oil fill).
8.3 Filters and filter inserts for KR 702–2 and PP–95–DS
8.3.1 Filter and filter inserts for KR 702–2

(only with mounted hydr. drifter)

**Drifter pre line filter cpl.** ................................ Part no. 0000532504  
**Filter insert for drifter pre line 3μm (1 pc.)** ........ Part no. 0000388887  
**Filter contamination indicator for drifter filter** ...... Part no. 0000388903

**First** change of the filter insert must be done after 100 working hours, all further 500 working hours, or sooner in case the dirt indicator needle moves up. After the filter change the dirt indicator moves back into neutral position.
8.3.2 Filter and filter inserts for Power Pack PP–95–DS

CAUTION

Always stop the diesel engine of the drill rig before maintenance or repair work is being done !!

**Hydr. filter and filter insert**

Return line filter cpl. ........................................ Part no. 0000532422
Filter insert for return line filter 10µm (1 pc.) .... Part no. 0000532418
Filter contamitation indicator for return line filter . Part no. 0000279542

Open the maintenance flap on top of the power pack. The return-line filter is mounted on the hydr. oil tank of the power pack. Remove cover plate of filter housing, change insert and close housing.

**Filter changes** : The first filter change has to be done after 100 operating hours. Later changes all 500 hours

![Diagram of filter system](image)
Diesel engine filter for Deutz TCD 2012 L04 2V

All filters of the diesel engine are located at the left side of the engine compartment.

**Engine oil filter (Deutz)**

**Part no. oil filter (1 piece) ................. 0000388866**

The engine oil filter (see photo) must be changed every 500 hours or once a year.

**Fuel filter (Deutz)**

**Part no. fuel filter (2 pieces) ................. 0000532371**

The fuel filter is mounted on the right – back side of the engine. The fuel – filter must be changed every 500 hours.
Fuel prefilter with water separator

The insert of the diesel prefilter and the seal kit must be changed at least all 1000 hours (see also in the operation manual of the diesel engine). The diesel prefilter must be controlled of water mass once a day.

Please note!
Inadequate maintenance of the fuel prefilter results heavy damages of the engine fuel injection system!! In particular this valids for countries which use low quality fuels.

Fuel prefilter

Part no. filter insert (1 piece) ............... 0000532382

1. Fuel supply to pump
2. Fuel return from control block FCU (Fuel Control Unit)
3. Fuel hand pump with bayonet plug for locking and unlocking
4. Thermostat valve with shut down lever
5. Filter cartridge
6. Connection facility for electrical water level sensor
7. Drain cock
8. Water collection vessel (bowl)
9. Fuel inlet from fuel tank
10. Fuel return to fuel tank
A. Connection for electr. warning / horn
Fuel pre–filter, changing / bleeding filter insert

Filter change:

- Close fuel stopcock (for high tanks)
- Position fuel collecting vessel beneath fuel pre–filter.
- Loosen drain cock (7) and drain water + fuel completely.
- Unscrew filter cartridge (5) together with water collecting vessel (8) in anti–clockwise direction and remove.
- Loosen water collecting vessel (8) from old filter cartridge (5) in anti–clockwise direction and remove.
- Empty remaining fuel into the fuel collecting vessel and clean water collecting vessel (8).
- Screw water collecting vessel (8) onto the new filter cartridge (5) in clockwise direction.
- Clean any dirt from the sealing surface of the new filter cartridge (5) and the reverse side of the filter head
- Wet the sealing surfaces of the filter cartridge (5) slightly with fuel and screw back onto the filter head in clockwise direction (17–18 Nm).
- Open the fuel stopcock and bleed the system (see "Bleeding fuel system").
- Dispose of collected fuel and old filter cartridge (5) properly.

Bleeding fuel system:

- Unlock the bayonet plug of the fuel hand pump (3) by pressing and turning anti–clockwise at the same time. The pump plunger is now pushed out through the spring.
  
  **Turn the shutdown lever of the thermostat valve (4) by approx. 45° in clockwise direction until it is felt to engage.**
- Pump until a very strong resistance is felt and pumping becomes very slow.
- Now carry on pumping a few more times (the return pipe must be filled).
- Start the engine and run for about 5 minutes in idle or low load.
  Check the pre–filter for leaks.
- Perform some more pumping movements. (The return line must be filled).
- Turn the shutdown lever of the thermostat valve (4) by approx. 45° in anti–clockwise direction until it is felt to engage.
- Lock the bayonet plug of the fuel hand pump (3) by pressing and turning clockwise at the same time.
Air filter

The air filter is mounted in the engine compartment and can be reached by the swiveling door at the left side of the sound-proof cover (see picture). In the filter housing, a main filter element and a safety filter element are installed. Both filter elements must be changed all 500 operating hours. For changing the filter elements the housing cover must be dismantled.

ATTENTION:

Never run the diesel engine without properly mounted air filter because the motor will be damaged by abrasive airborne particles.

Part no. air filter cpl. (1 piece) ........................... 0000532456
Part no. main element for air filter (1 piece) ............. 0000368655
Part no. safety element for air filter (1 piece) ............. 0000368657
### 8.4 Scope of the 100 hour inspection

<table>
<thead>
<tr>
<th>100 hour inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>The first inspection must be made after 100 operating hours. The following points must be dealt with:</td>
</tr>
<tr>
<td>- Change engine oil and filter</td>
</tr>
<tr>
<td>- Change hydraulic filter</td>
</tr>
<tr>
<td>- Check gear oil levels</td>
</tr>
<tr>
<td>- Check screw connections for tight fit, tighten if necessary</td>
</tr>
<tr>
<td>- Checking welded structures</td>
</tr>
<tr>
<td>- Checking system pressures</td>
</tr>
<tr>
<td>- Eliminating possible leakages</td>
</tr>
<tr>
<td>- as well as performing all the work that is listed in the 10 hour table (see lubrication, maintenance and inspection schedule).</td>
</tr>
</tbody>
</table>

The 100 hour inspection must be made by KLEMM Bohrtechnik Customer Service or an authorised dealer. The maintenance work must be recorded and countersigned in the service log by the machine operator responsible upon completion. The KLEMM Bohrtechnik company will be allowed access to this log in the event of claims under the warranty. Failure to do this work will lead to voiding of the warranty.
## 8.5 Lubrication Chart Maintenance and Service Intervals

<table>
<thead>
<tr>
<th>Maintenance and service works after each 10, 50, 500, 1000 operating hours</th>
<th>10</th>
<th>50</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
</table>

### 1. Diesel Engine TCD 2012 L04 2V
- Check oil level in engine
- Change engine oil (by authorized technical personnel)
- Clean cooling fins
- Check level of coolant
- Exchange engine oil filter cartridges
- Exchange fuel filter cartridges
- Check air filter contamination and clean if necessary
- Check V-belt tension

For maintenance detailed data of the engine manufacturer must be absolutely observed (see engine manual)!
All 500 operation hours an engine inspection is to be accomplished by authorized technical personnel.

### 2. Hydraulic system
- Check oil level
- Check for leaks
- Check oil temperature - see also Instructions
- Take oil sample of the hydraulic oil and renew the oil if necessary
- Change filters
- Check fittings for tightness
- Check hydraulic hoses on damages and renew them if necessary
- Clean cooler block and air intake fans
- Check for leaks and noise characteristics
- Check hydr. cylinders for leak tightness

### 3. Electrical installation
- Check acid and charge level
- Emergency stop
- Safety device
- Horn
- Illuminating (option)
<table>
<thead>
<tr>
<th>Maintenance and service works after each 10, 50, 500, 1000 operating hours</th>
<th>10</th>
<th>50</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4. Crawler tracks / Crawler undercarriage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check track chain tension</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check track chain links on damages</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check oil level of trammimg gear box (also see chapter 7.3)</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change gear oil</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check steel structure for breaks</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>5. Drill mast</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check steel structure for breaks</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grease feed system (chain and chain wheels)</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed gear – check oil level</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed gear – change oil</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Bearings and Bushings</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check feed chain on damages and wear</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check clamping chucks on wear</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean piston rods of the clamping- / breacking cylinders and check the cylinders for leak tightness</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check wear of rod centralizer (approximate max. clearance with respect to rod centralizer: rod diameter + 4mm)</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check hose guide chain (option) for damages</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>6. Glide slide</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check steel structure for breaks</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check deflectors on wear and renew them if necessary</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check wear of guiding strips (max. lateral clearance = 5mm, max. clearance in reference to the drilling center height = 10mm)*</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Wear limits of the guiding strips mounted on glide slides
<table>
<thead>
<tr>
<th>Maintenance and service works after each</th>
<th>10</th>
<th>50</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>10, 50, 500, 1000 operating hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Drill head unit (KH / KD)
- Drill heads (rotary drill heads / hydr. drifters)
- Please refer to the technical manual of the corresponding rotary drill head or hydr. drifter
- Check wear parts of the drilling accessories (e.g. bushings, sealings) and renew them if necessary

8. Kinematics
- Check steel structure for breaks
- Gearse all lubrication points
- Check guide rails on wear and grease them
- Check bearings on wear

9. Flushing device
- Check armatures for function and tightness

8.5.1 Maintenance of piston rods of hydraulic cylinders

![Diagram of hydraulic cylinder]

It is recommended to lubricate piston rods that are not retracted in resting position, regularly once or twice a week with hydraulic oil (or something similar). Please conserve the piston rods with acid-free fat, if longer downtimes are expected.

Please note:
Cleaning of chromed piston rods with a high pressure cleaner or alkaline cleaning agents damages the chromium layer and destroys the corrosion protection!
8.5.2 References for the maintenance of the telescopic drill mast type 164 with attached clamping-/breaking device

In the front range of the telescopic drill mast 164, several larger cutouts (drillings) are located at the right and left side. This cutouts ensure the entrance to the interior for the drill mast. The entrance is used to clean the front deflector roll and to grease the bearings of the deflector slide.

**Bearing lubrication of the deflector slide**

1. Erect drill mast into vertical position.
2. Set the lever of the sequence control into “activated” position (see picture 1).
3. Slide back the drill head unit until the telescopic mast is driven out approx. 350 mm. The lubrication points of the deflector slide are at the same height as the drill mast cutouts (see picture 2).
4. Lubricate the bearings of the deflection unit.
Cleaning the front deflector roll

1. Erect drill mast into vertical position.
2. Set the lever of the sequence control into “activated” position (see picture 1).
3. Slide back the drill head unit until the telescopic mast is driven out approx. 350 mm.
4. Set the lever of the sequence control into “inactivated” position (see picture 3).
5. Slide forward the drill head unit, so that the deflector unit slides backwards out of the range of the drill mast cutouts (see picture 4).
6. Clean the front deflector roll of the drill mast.
8.5.3 Changing clamping chucks on the clamping devices

The toothed clamping chucks used in the clamping and breaking device are to hold the drill rods tight when changing the rods. The teeth exposed to great force during the breaking process are therefore subject to heavy wear.

These clamping chucks should be changed as follows:

1. . . Move the clamping device about half way closed.
2. . . Lever the clamping chucks out of the chuck holder with a screwdriver.
3. . . Do not grease the new clamping chucks in the area of the O-ring.
   The clamping chucks and the borehole of the chuck holder must be absolutely free of grease.
4. . . Insert new clamping chucks in the chuck holder.
8.6 Special instructions for Deutz Diesel engine
TCD 2012 L04 2V

8.6.1 Permitted fuels for DEUTZ diesel engine

For Deutz diesel engines which are used for our drill rigs, the in technical circular "TR 0199–3005" listed fuel types are permitted. The use of low quality fuel (inclusion of dirt, high water content) **shall be avoided in any case!**

The consumption of such fuels can lead to severe damages of the injection system and to engine breakdowns.

The requirements nowadays in view of environmental laws assume high quality injectors with narrow manufacturing tolerances, which don’t allow low quality fuels. Injector damages occurred by low quality fuels, which don’t correspond with above mentioned technical memo, do not fall under our warranty policy.

8.6.2 Dark coloration of diesel fuel due to oil ingress

Pay absolutely attention that the dark coloration of diesel fuel does not exceed the permissible limit value by oil ingress. This limit value is to be taken from the technical circular TR 0199–99–1133 of the company Deutz. In order to keep the dark coloration of the diesel fuel small, the diesel tank must be driven as empty as possible before refilling.
8.6.3 Cooling liquid

To ensure long life running conditions and to avoid damage of the Deutz Diesel engine, the instructions of the manufacturer for the cooling liquid must be strictly observed.

The instructions for the right maintenance of the cooling system protective liquid are indicated in the manual of the manufacture (Chapter 4.3 – 4.3.3).

The following concentrations of the cooling liquid may not fall below / may not exceed the following limits!!

<table>
<thead>
<tr>
<th>Cooling system protective liquid:</th>
<th>percentage of water:</th>
</tr>
</thead>
<tbody>
<tr>
<td>max: 45 Vol %</td>
<td>55%</td>
</tr>
<tr>
<td>min: 35 Vol %</td>
<td>65%</td>
</tr>
</tbody>
</table>

The tank volume of the protective cooling system of the Deutz engine TCD 2012 L04 2V is approx. 5,6 liters (only engine volume without extern cooling system)

When it is necessary to fill up the cooling fluid because of exaporation, leakages or repairs (e.g. hose exchange) it is mandatory to have the right mixture of water and cooling fluid.

This cooling fluid protects important inner of the motor against corrosion and further destruction.

CAUTION !
The cooling fluid, which is filled in in the Klemm factory, has a concentration of 40% protective liquid. That concentration will give protection against frost to a temperature of −25°C (−13°F).

CAUTION – Important !

1.) Check the cooling fluid level every 40 operating hours (once a week). The engine is shut down automatically when the level of the cooling fluid falls below the minimum and can not be restarted again.

2.) Do never fill up with pure water alone! Only use mixtures of water and cooling fluid!

3.) If these instructions for the filling up with the cooling fluid are not observed, no warranty claims will be accepted!

Deutz Order – No. for cooling fluid: 01011490
8.6.4 First filling and refilling of cooling liquid on Deutz diesel engine type TCD 2012 L04 2V

6. Remove cap from coolant filling entry pipe of compensation tank.

7. Fill coolant by filling entry pipe. The compensation tank must be filled up completely to the upper surface of filling entry pipe.

8. Install cap on filling entry pipe and close system.

9. Start diesel engine and keep running about 5 minutes.

10. Control coolant level by removing cap.

Attention: if coolant level should be too low, additional coolant fluid must be filled in the system by repeating the operation step 1–3.

Pic. 1: coolant diagram

1 Coolant outlet at the cooler  9 Heating
2 Thermostat  10 Coolant to thermostat
3 Coolant feed line to pump  11 Heating connection
4 Coolant pump  12 Compensation line
5 Lube oil cooler  13 Ventilation line to compensation tank
6 Cylinder cooling  14 Coolant outlet to cooler
7 Cylinder head cooling  15 Compensation tank
8 Coolant inlet to heating  16 Compensation line to heat exchanger
The following points must be observed and respected

1. Control of coolant level: the level must be checked by removing the filling cap; level must reach upper position of filling entry pipe!

2. After first filling and refilling processes the level of coolant must be checked the next day **before** starting the diesel engine.

3. If coolant system has a leakage and about 1.0 liter fluid is missing, the automatic level switch of the diesel engine sends a signal to the engine control system. The power of the diesel engine will be reduced by 50% and the error is shown on the display of the engine monitoring box (see pic. 2). The leakage volume of coolant must be refilled immediately up to the upper level on filling entry pipe to guarantee good operation conditions of drill rig.

4. If diesel engine is overheating in the range of 125°Celsius = equivalent 285°Fahrenheit the power of the diesel engine will be reduced by 50% and the error is shown on the display of the engine monitoring box (see pic. 3). To avoid this error, the engine should run for about 5 minutes without any operations of the drill rig before switching off.

**CAUTION:**

The cooling fluid is very hot and dangerous! Never remove filling cap from hot engine coolant system, because hot steam will burn head, eyes, hands etc.!

pic 2: Indication coolant level too low

pic 3: Indication coolant overheated
8.7 Hydraulics

8.7.1 Hydraulic oil

Optimum transmission can be only assured, if operating temperature, viscosity and quality are right. For details see "Recommended Oils and Lubricants" – page 88. Old oil, or oils having been subjected to temperatures in excess of 70°C lose important operating characteristics and reduce the service life of seals, hoses, pumps and cylinders.

8.7.2 Filtration

Check the filter contamination indicator daily, as soon as the fluid has reached a temperature of approx. 20°C – 30°C.

Observe the visual indicator:
- Pressure gauge (red–greenfield) on return line filter
- Red button on supply line filter for hydraulic drifter.
  If the red button of the contamination indicator jumps out during cold starts (below 27°C operating temperature), the indicator is faulty and must be replaced.
  If the button jumps out after normal operating temperature is reached (approx. 50°C), the filter element is contaminated and must be replaced.

Filter Cartridges
Be sure to use only tested and approved cartridges.
  a) HP–Filter – 3 μm in the percussion mechanism supply line
  b) LP–Filter – 10 μm for the return line
8.7.3 Oil Changes

Drain oil only at operating temperature. Be sure to clean fittings before opening draining plugs.
If the waste oil contains metal abrasion, drain pumps separately and check for attrition. Oil motors should also be inspected.
Metal abrasion is due to increased attrition, causing reduction in performance, irreversible damage and subsequent total loss of the component.

Urgent replacement of the damaged pump or motor is required.

Condensation
High humidity and extreme fluctuation in oil temperature cause condensation.
Water stimulates saponification of the oil, causing frothing, and therewith increases the possibility of cavitation and damage to the pumps.
The formation of foam can be checked through the inspection glass.

PLEASE NOTE!
Park the drill rig on even ground and let the fluid settle and cool down.
Drain the oil/water mixture and dispose it in accordance with anti-pollution stipulations.
Afterwards fill in hydraulic fluid. Do only use the hydr. fluid according to original Klemm hydr. oil filling!

Cleaning the Oil Tank
◆ Be sure to clean the oil tank during every oil change
◆ Use only non-fibrous cleaning rags.
◆ Thoroughly inspect the tank for utmost cleanliness

Fill the hydr. tank
For filling new hydraulic oil, the connection of the return line filter **must** be used.
The filter at the filling connection has to be a filter with max. mesh size 10µm.

PLEASE NOTE

New oil is always contaminated by filling devices, drums and other containers.

ATTENTION:
Damages due to filling of contaminated oil which has not been filled through the connection of the **return line filter** (see picture on page 92) are not warrentable!
8.7.4 Repairs and maintenance of the hydraulic system

8.7.4.1 Trouble shooting

a) No oil supply and unusual noise characteristics from pump

<table>
<thead>
<tr>
<th>Cause</th>
<th>Reason</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cavitation in pump</td>
<td>Local restriction in suction line, e.g. partially closed ball-valve</td>
<td>Open ball-valve fully</td>
</tr>
<tr>
<td></td>
<td>Fluid too cold</td>
<td>Heat fluid to recommended temperature</td>
</tr>
<tr>
<td></td>
<td>Damaged tube, or defective hose</td>
<td>Repair or replace tubes or hoses</td>
</tr>
<tr>
<td>Fluid freezing</td>
<td>Fluid level in tank too low</td>
<td>Replenish to right level</td>
</tr>
<tr>
<td></td>
<td>Wrong hydraulic fluid</td>
<td>Replace with correct fluid</td>
</tr>
<tr>
<td></td>
<td>Fittings in suction line take air in</td>
<td>Tighten or replace fittings</td>
</tr>
<tr>
<td></td>
<td>Porous suction line</td>
<td>Replace hose or tube</td>
</tr>
<tr>
<td>Mechanical Vibrations</td>
<td>Wrongly aligned or loose connection</td>
<td>Realign or tighten screws</td>
</tr>
<tr>
<td></td>
<td>Vibrations of tubes</td>
<td>Re-tighten connections</td>
</tr>
<tr>
<td>Pump</td>
<td>Worn or damaged</td>
<td>Repair or replace</td>
</tr>
<tr>
<td>Engine / Motor</td>
<td>Worn or damaged</td>
<td>Repair or replace</td>
</tr>
<tr>
<td>Pump rotating in wrong direction</td>
<td>Suction and P-Port of pump wrongly connected</td>
<td>Change connections</td>
</tr>
</tbody>
</table>
### b) No Pressure build – up

<table>
<thead>
<tr>
<th>Cause</th>
<th>Reason</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump not working correctly</td>
<td>Air intake on suction line</td>
<td>Tighten and seal connections</td>
</tr>
<tr>
<td></td>
<td>Pump running hot</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pump RPM too low or insufficient engine capacity</td>
<td>Repair or replace</td>
</tr>
<tr>
<td></td>
<td>Leakage from pressure port to return line</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wrong pressure settings</td>
<td>Adjust pressure setting</td>
</tr>
<tr>
<td></td>
<td>Safety valve does not close. Dirt or wear / particles in line</td>
<td>Clean, assess damage, repair or replace</td>
</tr>
<tr>
<td></td>
<td>Shuttle valve or other valve open. Dirt or abrasion particles in line, or electrical fault</td>
<td>Find faulty component, adjust, clean, repair or replace</td>
</tr>
<tr>
<td></td>
<td>Cylinder bore, piston or piston seals damaged</td>
<td>Repair or replace damaged components</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
c) Pressure or flow fluctuations

| Cause                                           | Reason                     | Remedy                                                                 |
|                                                |                           |                                                                       |
| Knocking of pressure limiting or safety valves | Valve seat damaged        | Repair or replace                                                      |
| Valves sticking                                | Fluid contaminated         | Drain fluid. Clean tank and system. Refill with new fluid.           |
| Air pockets in the system, causing irregular or jerky movements | System not properly ventilated | Bleed system. See also Start-up instructions |

d) Temperature of fluid too high

| Cause                                           | Reason                                           | Remedy                                                                 |
|                                                |                                                  |                                                                       |
| Hydraulic fluid is pumped under pressure through pressure limiting or safety valve to the tank | System malfunction due to contamination or damaged components | Clean, repair and replace as required |
|                                                | Safety valve setting too low                     | Adjust setting                                                         |
| Inadequate Cooling                             | Cooler motor faulty                             | Repair or replace                                                      |
|                                                | Cooler fins closed (dirt)                        | Clean                                                                  |
| Fluid circulation too fast                     | Tank filling level too low                       | Replenish to required level                                            |
e) Control valve not working correctly

<table>
<thead>
<tr>
<th>Cause</th>
<th>Reason</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spool jamming</td>
<td>Contamination</td>
<td>Dismantle spool, clean valve</td>
</tr>
<tr>
<td></td>
<td>Fluid too hot</td>
<td>Cool fluid to approx. 50°C (122°F)</td>
</tr>
<tr>
<td></td>
<td>Magnet burned out</td>
<td>Replace magnet</td>
</tr>
<tr>
<td></td>
<td>No pilot voltage</td>
<td>Check pilot voltage</td>
</tr>
<tr>
<td></td>
<td>No pilot pressure,</td>
<td>Check pilot pressure</td>
</tr>
<tr>
<td></td>
<td>with pilot operated</td>
<td></td>
</tr>
<tr>
<td></td>
<td>shuttle valves too low</td>
<td></td>
</tr>
</tbody>
</table>

8.7.5 Reference to repairs at the hydraulic system

**CAUTION**

Be sure to close ball-valves on pump suction lines before replacing pumps. Before restarting operation, open the shut-off flaps in suction line! Otherwise the pumps will be destroyed!

Disconnect pump bearing flush line and secure immediately using a blind plug. Contamination entering this line will damage pump bearings. This bearing-flush is used on capacity controlled pumps, and for (some) HD-controlled, constant-flow pumps. This line must **never** be disconnected.

**Before disassembling cylinders and motors, lower and support boom.**

**Set all operating levers to "O".**

**Check system pressure (gauges) and relieve pressure if necessary to prevent accumulator effect.**

8.7.5.1 Special guarantee remarks

This drill rig is covered under manufactures warranty for a period of 6 months or 1000 hours, whichever is sooner. Repairs must be carried out by our authorised distributors.

Wear and tear items, oils and coolants used for daily refilling, damages, consequential damages and transportation for repair are not claimable under our terms of Warranty.

Full details of the manufactures warranty are available on request.

The system pressure of the drill rig is fix adjusted by valve blocks, which are secured against inexpert regulation.

An adjustment of the system pressure during the guarantee is only allowed with explicit permission of the **KLEMM Bohrtechnik**.

Non-compliance leads to immediate loss of all warranty entitlements!
8.8 Special Remarks (Welding Instructions)

Main components of boom, mast support and kinematic joints are recently made from high quality cast steel like GG 60, GG 50, GG 40.3.

Those cast steel constructions do not accept weldings, because the metallurgical structure of steel will be disturbed, prudurcing stress areas with possible failure. Please contact KLEMM Bohrtechnik Technical Services, if you should repair or fix items on cast steel components!

<table>
<thead>
<tr>
<th>ATTENTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding operations at the drill rig are forbidden!</td>
</tr>
<tr>
<td>Necessary welding operations may only be done by specially trained personnel of Klemm Bohrtechnik!!</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ATTENTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>The battery disconnecting switch must be turned to the left side (anticlockwise) to interrupt the electric circuit before you start with service or repair works or in case of danger.</td>
</tr>
<tr>
<td>At the end of operation, the disconnecting switch must be turned to the right side (clockwise). The electric circuit is closed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ATTENTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>In order to prevent damage when carrying out ELECTRIC welding of the installation, the plug connection of the (EMR) shall first be pulled out! It is located at the rear side of the Power Pack inside the sound proof cover.</td>
</tr>
</tbody>
</table>
8.9  Maintenance of the starter battery

The battery’s operational readiness is subject to constant recharge from the dynamo.

The installed batteries are of the maintenance-free type.

8.9.1  Cold start

PLEASE NOTE

Store the battery at room temperature during the winter months

The capacity of the battery will be greatly reduced at low ambient temperatures.

Should the charge level be too low to start your engine, warming-up indoors or in a water filled container, to approx. 20°C, may be helpful.

If the charge level is insufficient:

a) Use second unit and jump leads
b) Check battery and recharge

8.9.2  Installing the battery

ATTENTION: Please note the risk of short circuit!

A) Switch off all consumers.
B) Check polarity +/- of pole shoes.
C) Pole shoes / pole ends must be metal bright. Non-compliance causes resistance and drop in performance.
D) Tighten pole shoes securely.
E) Do not rest tools on the battery.

CAUTION

Danger of short circuiting

F) Protect poles and shoes with battery grease to prevent corrosion and reduce current creepage.
8.10 Accumulators

Hydraulik-accumulators are mounted on our drill rigs:

- at impact mechanism of hydraulic drifters
- at the hydraulic damping device of hydraulic drifters
- as pilot oil control unit

**CAUTION**

The pilot control accumulator has no approval obligation.

The Nitrogen pre-tension pressure is $p = 15$ bar.

In case of malfunction the accumulater may be changed without special approval.

8.10.1 Introduction and precaution instructions

Klemm accumulators are in accordance the european regulation 97/23/EG (Pressure Equipment Directive), article 3, chapter 3.

If an accumulater will be detached and repaired the accumulator has to be checked by an **authorised person**, according to the operational dependability regulations §10 before it's sent back to site.

**Caution:**

Nitrogen pre-tension has to be released before air-freighted. This is valid for separate spare part or monted accumulators!

Any works on hydraulic systems or repair works shall be realized in suitable workshops (warehouses) or under clean environmental conditions!
8.10.2 Works at accumulators

- Use only original Klemm parts! If not, you'll lose warranty claim!
- For ordering spare parts there are adequate part-numbers available in our part lists. This is also valid for repair works!
- Watch the indicated torques for tensioning the screws!
- During disassemble – assemble of units, unit parts, seals, watch the installation direction and location!
- Do not weld at accumulators for repair purposes!
- Part – assembly drawing shall be used for repairs!
- During works at open systems (drifter, rotary head) works like oxygen cutting, grinding, welding etc. shall be avoided!
- Any mechanical damages, welding, pretensioning etc. are not allowed!
- The mounting of precision parts has to be executed carefully, light moving, without jamming and uncontrolled forces!
- Before disassembling the accumulator the nitrogen has to be released:
  - take off the cap plug.
  - unscrew inlet screw carefully for approx. 1 - 1.5 revolutions, until nitrogen escapes (hiss effect). Don’t take off the inlet screw completely, until the pressure has been released completely.
- Disassemble the accumulator and clean all parts carefully.
- Check the parts on damages and change them, eventually the whole accumulator.
- After each disassembly of an accumulator a new diaphragm, new screws and seals shall be installed!
- Before assembling the accumulator each part has to be cleaned with non explosive and non aggressive cleaner and pressurized air (don’t use water, it leads to corrosion!)
- Fit diaphragm and seals according to the drawing. Oil the seal edges and watch the assembling position!
- Assemble the accumulator according to the drawings.
- Fill the accumulator with nitrogen (N₂) only!
- Use therefore only the original Klemm accumulator filling device (P/N: 0000678027)!
- Watch the specified filling pressure of the accumulator!
- Don’t inhale nitrogen (N₂)! Work only in safe environment!
8.10.3 Assembly of cpl. Accumulator

- Watch specified screw torques!
- All threads at the accumulator have to be free of dust and grease!
- Accumulators with support threads have to be glued in with high tensile glue liquid!
- Works have to be executed in clean environmental areas!
- Hydraulic fittings and hoses have to be tighten properly!
- Check the specified filling pressure of the accumulator!
- Seals and screws have only be used in accordance to the Klemm parts lists and shall be bought from Klemm only!

8.10.4 Putting into operation

- All persons who doing repair- or maintenance works at the accumulator shall have read the operations manual and shall have well understood the instructions.
  Not authorized or not special instructed persons are not allowed to do repair- or maintenance works at accumulators!
- Watch the safety instructions according to any countries law!

8.10.5 Using of accumulators

- Use accumulators only in oil temperature range -10°C to + 80°C!
- Accumulators have to be secured versus external forced ruptures!
8.11 Conservation of hydraulic piston rods and machine components

External conservation procedure

**Important:**

Before parts are mounted and used which were treated with external conservation additives on metal surfaces, these corrosion inhibitors must be removed with special solvents, fuel, petroleum or wax-containing solvents.

Gear Parts, spline shafts and driving shafts which were preserved with corrosion inhibitors must be washed/treated with the same solvents/chemicals mentioned above.

**CAUTION**

1. Make sure that shaft seals never get into contact with aggressive solvent chemicals!
2. Make sure when removing corrosion inhibitors with solvents to use eye protection and gloves
3. Make sure to work in good ventilated areas because solvents may be toxic.
4. Be sure to avoid open fire and smoking because emanations of solvents are inflammable.

Valvoline 150 is especially recommended to preserve shaft seals because this product does not interfere with the seals material.

**PLEASE NOTE**

Please, do not pressure wash the new drill rig within the first two weeks.
Do not use cleaning agents with solvent or degreasing substances.
Do not use aggressive chemical cleaning agents, e.g. concrete remover.
This can spoil the paint work and chromed parts.
Do not direct the pressure washer onto electric components and seals.
9 Stability of the drill rig KR 702–2

General informations

Stability means the safety against fall over of the drill rig about it’s own tipping edges. Tipping edges are the connection lines between the track chain guide rollers and the sprocket wheel in tramping direction. At right angle (90°) to the tramping direction the connection lines between the front bases and the rear bases are further tipping edges. As a result of the above explained undercarriage with parallel tracks it creates a rectangular tipping edge range.

The safeties of stability are described and results by the stability safety angles, which are the max. allowed terrain inclinations in tramping direction and cross to the tramping direction.

The minimum permitted stability safety angles according to DIN EN 791 are 10° for tramping the drill rig and 5° for operations under all other circumstances including the influence of wind– and operation forces.

Safety instructions for stability of drill rig

The KR 702–2 drill rig has been designed and tested in accordance with DIN EN 791 in reference to stability. Pay attention that the kinematic possible slewing ranges are restricted by the drill rigs attached equipment and the drill mast set-up in various drilling position as well as the restrictions resulting of the minimum stability safety angles according to DIN EN 791.

These restrictions are valid for the following important instructions for safe operation of the drill rig on typical sloped work surfaces when drilling and tracking.

The information applies for the following conditions:

All indicated max. permitted ground inclinations are valid for the rig with or without attached Power Pack PP–95–DS with tracks (not with crawler undercarriage).

- weight of drill mast cpl.: 1300 kg
- glide slide with drill unit slided in highest position of the telesk. drill mast
- max. weight of mounted drill rods 150kg.
- Wind force at wind speed v = 20m/s.

| Operation with drill mast positioned vertically for vertical drilling operations |
|---|---|
| **Restrictions:** | |
| Drill mast inclination max. 2,5° forwards out of vertical position. | |
| Drill mast inclination max. 5° sidewise out of vertical position. | |
| Maximum permissible terrain incline machine tracks direction | 10° |
| Maximum permissible terrain incline transverse direction | 5° |
| Ground pressure averaged | 82 kN/m² |
Transport position with drill mast
align horizontally, resting on the mast support bracket.
Glide slide with drill head unit positioned above the drill mast carrier

### Restrictions:
Glide slide with drill head unit must be positioned above the drill mast carrier and the cylinder guidance of the displacement cylinder of the complete telescopic drill mast must be put down on the mast support.

<table>
<thead>
<tr>
<th>Maximum permissible terrain incline machine tracks direction</th>
<th>20°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum permissible terrain incline transverse direction</td>
<td>10°</td>
</tr>
</tbody>
</table>

Ground pressure averaged 77 kN/m²

### Important general safety instructions:
- Total weight of drill string max. 150 kg or 60 kg/m.
- Total length of drill string not longer than max. feed length.
- Extension of the feed length by using the drill mast displacement cylinder is inadmissible.
- When drilling or pulling the drill string, the drill mast must be propped at the drilling point.
- When drilling the drill rig must be additional propped to the soil by the rear propping cylinders and by the optionally mounted front propping cylinders.
  It is to be guaranteed by the building contractor that the underground exhibits a sufficient load-carrying capacity.
- When propping the drill rig, the ground contact of the tracks must alway be ensured.
- Attaching or removing of additional equipment at the drill mast and to other parts of the drill rig, which affect stability, is only allowed after consultation of KLEMM Bohrtechnik.
- While drilling and transportation of the drill rig, the telescopic tracks must be spreaded to max. width of 1250mm.
- The tracks may be retracted briefly to a width of 750 mm for door passages only. For this purpose, the drill mast must be placed in transport position.
9.1 Safety recommendations for tramming operations of drill rig

Tramming or any activation of the crawler tracks of KR 702–2 drill rig inside buildings or at the job site are only permitted with fully spreaded (telescoped) crawler chassis to 1250 mm width.

Non-respect of these recommendations may be the reason for heavy accidents due to reduced stability when tramming with retracted crawler chassis !!

The retracted mode for tramming is only permitted during passage of doors and small entries.

ATTENTION:
Tram with fully telescoped crawler chassis (1250mm) just before you pass doors/entries; then retract during passage manoevres and spread to full width immediately after te passage.

Tramming operations of the KR 702–2 rig are only permitted with drill mast in transport position and laying on the special support frame. The rotary head must be positioned in the middle of the drill mast.

ATTENTION:
Prior to tramming on the job site prepare the ground and remove obstacles and undulations like deep holes and small walls.

<table>
<thead>
<tr>
<th></th>
<th>Permitted slope</th>
<th>Permitted side inclination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tramming and working condition</td>
<td>10°</td>
<td>5°</td>
</tr>
<tr>
<td>Transport conditions (mast down)</td>
<td>20°</td>
<td>10°</td>
</tr>
</tbody>
</table>
Tramming and working condition

10°

sketch of permitted slope

5°

sketch of permitted side inclination

Transport conditions

20°

sketch of permitted slope

10°

sketch of permitted side inclination
10 Attachment points for truck transport

10.1 Attachment points for drill rig KR 702–2

1–4 : Attachment points to fasten the drill rig for truck transport
5 : Fix the slewable control panel with the locking bolt in transport position parallel to the tracks
6 : **Do not** use the trailer coupling as an attachment point to fasten the drill rig for truck transport

The attachment points are indicated as shown:

![Diagram showing attachment points]

(r.h. side + l.h. side of the drill rig) (r.h. side + l.h. side of the drill rig)

**CAUTION**

Truck transport and loading the drill rig with a crane is only allowed after the gauge of the telescopic tracks is shifted to maximum width!
10.2 Attachment points for Power Pack PP–95–DS

Power Pack PP–95–DS with carrier

7–10 : Attachment points to fasten the power pack for truck transport

The attachment points are indicated as shown:

lashing point
**Power Pack PP–95–DS with crawler undercarriage**

11–14 : Attachment points to fasten the power pack for truck transport

The attachment points are indicated as shown:

[Diagram showing attachment points 11, 12, 13, 14 and a lashing point]
11 Lifting the drill rig KR 702–2 and the Power Pack

11.1 Lifting points for drill rig KR 702–2

Klemm Bohrtechnik recommends the use of the crane cross bar. To reach the indicated overall center of gravity the drill rig must be brought into the shown loading position before lifting.

**ATTENTION:** Before lifting the drill rig, the gauge of the telescopic tracks must be shifted to maximum width!

The lifting points for complete device are indicated as shown:

![Diagram](attachment:image.png)

1 + 2 (r.h. side + l.h. side of the drill rig)  3 + 4 (r.h. side + l.h. side of the drill rig)

**ATTENTION:** Attach the ropes in such a way, that they cannot get in contact with machine parts (e.g. hose guide chain) when lifting the drill rig. When lifting the drill rig, the rig must take off and remain in horizontal position.
11.2 Lifting points for Power Pack PP–95–DS

Klemm Bohrtechnik recommends the use of the crane cross bar. To reach the indicated overall center of gravity the power pack must be brought into the shown loading position before lifting.

**Power Pack PP–95–DS with carrier**

7–10 : Lifting points for the power pack

ATTENTION: Attach the ropes in such a way, that they cannot get in contact with machine parts when lifting the power pack. When lifting the power pack, the machine must take off and remain in horizontal position.
Power Pack PP–95–DS with crawler undercarriage

Klemm Bohrtechnik recommends the use of the crane cross bar. To reach the indicated overall center of gravity the power pack must be brought into the shown loading position before lifting.

11–14 : Lifting points for the power pack

ATTENTION: Attach the ropes in such a way, that they cannot get in contact with machine parts when lifting the power pack. When lifting the power pack, the machine must take off and remain in horizontal position.
Cross bar with hoisting ropes for crane loading of the drill rig KR 702-2 or Power Pack PP-95-DS

For loading KLEMM drill rigs with drill mast in transport position by using a crane, you have to use a cross bar with hoisting ropes (see sketch).

Cross bar (max. 20t)  
(Part No. 0000594516)

Hoisting ropes  
Load capacity of each rope min. 2,5 tons
## Technical data

### Tramming motors
- Traction: approx. 20KN
- Tramming speed: maximum 1.8km/h

### Undercarriage
- Specific ground pressure: 8.3N/cm²
- Total width: 750mm (spreadable to 1250mm)
- Length (axle to axle): 1385mm
- Length of tracks: 1935mm
- Width of grousers: 200mm
- Ground clearance: 210mm

### Drill mast
1. **type 164 / 2150 lg.**
   - Length O/A: 2150mm–3150mm
   - Feed length: 1200mm–2200mm

2. **type 164 / 2450 lg.**
   - Length O/A: 2450mm–3450mm
   - Feed length: 1500mm–2500mm

- Feed force (250 bar / 3626 psi): max. 38kN
- Retraction force (250 bar / 3626 psi): max. 60kN
- Feed speed: 12.0m/min
- Rapid feed speed: 48.0m/min
- Retraction speed: 7.2m/min
- Rapid retraction speed: 28.8m/min

### Transport dimensions (without safety guard)
- Length: 3000mm
- Width (tracks shifted to max. gauge): 1250mm
- Height: 2040mm

### Transport dimensions (with safety guard)
- Length: 3000mm
- Width (tracks shifted to max. gauge): 1500mm
- Height: 2500mm

### Weight
- Weight total with drill head unit (without drill rods): approx. 4.6to
- Single weight of safety guard: approx. 0.165to
## Technical data Power Pack PP-95-DS

### Power source:
- DEUTZ diesel engine **TCD 2012 L04 2V**
- **95 kW / 2300 min⁻¹**
- certified by **COM 3/ EPA 2**
- Serial number diesel engine **10932414**

### Diesel tank capacity
- **approx. 150 liters**

### Hydraulic system:
- **1 x 115 l/min. constant**
- **1 x 92 l/min. constant**
- **1 x 20 l/min. constant**
- **1 x 15 l/min. constant**
- System pressure **max. 250 bar / 3626 psi**
- Hydr. tank capacity **approx. 400 l**

### Electrics
- **24V / 100Ah**

### Transport dimensions
1. **Power Pack with carrier**
   - Length **4200 mm**
   - Width **1640 mm**
   - Height **2388 mm**
2. **Power Pack with crawler undercarriage**
   - Length **3540 mm**
   - Width **1050 mm**
   - Height **2453 mm**

### Weight
- **(with carrier)** **approx. 2,6 t**
- **(with crawler undercarriage)** **approx. 3,0 t**

### Caution!
The standard–ambient temperature range of **–20°C (−4°F) up to +40°C (+104°F) shall not be exceeded. Otherwise we cannot guarantee a trouble–free operation!**
13.3  Emission values of diesel engine

The indicated emission values concern the operation of the diesel engine without soot particle filter system.

<table>
<thead>
<tr>
<th>Emission values diesel engine DEUTZ TCD 2012 L04 2V</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO .................................................. 0,565 g/KWh</td>
</tr>
<tr>
<td>NMHC + NOx .......................................... 3,712 g/KWh</td>
</tr>
<tr>
<td>Particulates ......................................... 0,097 g/KWh</td>
</tr>
</tbody>
</table>

13.4  Technical data of sound level measurement

acc. to DIN EN 791 and 2000/14/EC (Outdoor-Noise-Directive)

<table>
<thead>
<tr>
<th>A–registered sound power level (LWA) in different operating modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured sound power level LWA:</td>
</tr>
<tr>
<td>without loading (idle running of engine) ............... 89 dB</td>
</tr>
<tr>
<td>with loading (full throttle of engine) .................. 100 dB</td>
</tr>
<tr>
<td>with running drill head unit (rotating) .................. 103 dB</td>
</tr>
<tr>
<td>with running drill head unit (rotating/percussion) ...... --- dB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Declared sound power level LWA(declared):</th>
</tr>
</thead>
<tbody>
<tr>
<td>without loading (idle running of engine) 91 dB</td>
</tr>
<tr>
<td>with loading (full throttle of engine) 103 dB</td>
</tr>
<tr>
<td>with running drill head unit (rotating) 106 dB</td>
</tr>
<tr>
<td>with running drill head unit (rotating/percussion) --- dB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A–registered sound pressure level (LPA) in different operating modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound pressure level at the control panel of the machine LPA:</td>
</tr>
<tr>
<td>without loading (idle running of engine) 66 dB</td>
</tr>
<tr>
<td>with loading (full throttle of engine) 73 dB</td>
</tr>
<tr>
<td>with running drill head unit (rotating) 85 dB</td>
</tr>
<tr>
<td>with running drill head unit (rotating/percussion) -- dB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sound pressure level in distance of 16m from the machine LPA16:</th>
</tr>
</thead>
<tbody>
<tr>
<td>without loading (idle running of engine) 53 dB</td>
</tr>
<tr>
<td>with loading (full throttle of engine) 64 dB</td>
</tr>
<tr>
<td>with running drill head unit (rotating) 67 dB</td>
</tr>
<tr>
<td>with running drill head unit (rotating/percussion) -- dB</td>
</tr>
</tbody>
</table>
14 Kinematic possible mast movements
KR 702–2 basic version