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Fire Protection

(Z 18 094)

Preventative measures against the risk of fire

1 Keep the crane clean, in particular making sure that there is no combustible material around. Following maintenance work on the hydraulic system, engine and fuel system, clean the crane thoroughly.
Remove any residues of oil, fuel or cleaning agents.

2 After cleaning the engine compartment, check all

- Fuel lines
- engine oil lines
- hydraulic oil lines

for leaks, loose connections, shear points and damage. Rectify any determined faults immediately.

3 electric leads, plug connections and connecting clamps for loose fittings and damage. Rectify any determined faults immediately.

4 Check the turbocharger mounting.
Check exhaust and fresh air leads as well as lubricant feed and return lines for leaks. Rectify any determined faults immediately.

5 Portable fire extinguishers must be filled and ready for use.

2 Oils, Lubricants and Capacities

In the following tables you can find the **permitted consumables**. Only consumables corresponding with the columns “Permitted consumables” or “Regulation” may be used.

The consumables must be suitable for the ambient / operating temperature. If there are deviating surrounding temperatures, they must be replaced in accordance with the following tables.

CAUTION!

The consumables may only be replaced if the ambient temperatures are within the specified limits. Otherwise there is a risk of safety−relevant components being either limited in function or becoming damaged.
When replacing consumables from the normal temperature range to, for example, the cold temperature range or vice versa, system components with no flow−through (such as cylinders, for example) must be rinsed.
Mixed operation is not permitted (for example, hydraulic oil for the cold temperature range and the remaining consumables for the normal temperature range). This would mean that the technically possible operating temperature of the crane vehicle would be limited at the top end by the consumable for the cold temperature range and at the bottom end by the consumable for warm temperatures.

The specified capacities are approximate values. For an accurate measurement, maintenance and operating personnel must carry out checks at the designated inspection points such as inspection plugs, dipsticks and inspection windows.
Further specifications on consumables are available on request. If consumables are used which do not correspond with these regulations or if additives have been subsequently added to the consumables, this can result in subsequent damage for which we do not assume any responsibility, even within the warranty period.

If consumables are used which are not listed by name but are included in the regulations, the maintenance intervals could change.

Lubricating points for grease

Filling / lubricating point	Capacities l / *US gal*	Permitted consumables	Regulation	Classification	Lower and upper ambient temperature °C		 *°F*		Lower and upper operating temperature °C		 *°F*		Note
Section 6.1 Roller−bearing slewing ring **Section 7.2** Output shaft, Slewing gear **Section 8.6** Bearing, Hoists, Reeving winches, **Section 9.5** Bearing, luffing gears **Section 11.2, 11.3, 11.5** Main boom, Fly jib, Superlift Mast A−frame Grease nipple Hook block Rope roller bearing	−	Shell Gadus S2 V220	**Grease:** KP2K−20 NLGI class 2 Lithium complex		−15	+45	*+5*	*+113*	−	−	−	−	*3
		Shell Gadus S5 V220	**Grease:** KP2N−40 NLGI Class 2 Lithium complex		−30		*−22*						*3
		Klüber Isoflex Topas L 152	**Grease:** NLGI Class 2 synthetic		−40	+45	*−40*	*+113*	−	−	−	−	*3
		Fuchs Renolit JP 1619	**Grease:** NLGI class 1 Lithium complex			+25		*+77*					
Section 6.2 Slew ring teeth	−	Ceplattyn Eco S	**Special adhesive grease**		−	−	−	−					*3

4.3 Tips on Maintaining the Crane

The purpose of maintaining the crane is to:

- safeguard operational reliability
- maintain efficiency
- prevent downtimes
- maintain the value of the machine
- reduce repair costs

4.4 Measures for Maintaining the Crane

4.4.1 Inspections of the condition

Inspections of the condition are visual inspections undertaken by the crane operator at **regular** intervals in accordance with the **lubrication and maintenance schedule**.

For example:

- Checking oil levels and oil quality
- Checking displays and monitoring equipment
- Checking the tank and filter systems for clogging and to ensure they are functioning properly
- Checking the hoses and lines for leaks and damage
- Checking bearings for adequate lubrication and abnormal bearing clearance
- Checking the drive mountings (transmission, motors, valves)
- Checking the ropes for lubrication, contamination and wear

As a result of these **regular** visual inspections, damage can often be recognised and eliminated **in good time**. This means that **downtimes** are **avoided** during operation of the crane.

Sect.	Work to be carried out	Interval (operating hours)																
		1*	2*	3*	4*	50	100	150	200	250	500	1000	1500	2000	3000	5*	6*	
19	**Crawler Chassis**																	
19.1	Drive gearbox																	
19.1.1	Transmission − Checking the Oil Level					x												
19.1.2	Drive − Checking the Oil Level					x												
19.1.3	Motor Flange − Checking the Oil Level					x												
19.1.4	Transmission − Changing Oil										1x		x			x		
19.1.5	Drive − Changing Oil										1x		x			x		
19.1.6	Motor Flange − Changing the Oil										1x		x			x		
19.1.7	Cleaning the Bleeder Valves / Filters				x												x	
19.1.8	Cleaning the Drive Gearbox				x												x	
19.2	Lubricating idlers, track and support rollers	Lubrication by central lubricating system																
19.3	Lubricate the connecting pins																x	
19.4	Servicing the Hydraulic Cylinders on the Chassis					x											x	
19.5	Tensioning the Track Group			x													x	
19.6	Lubricate link pins on the running gear of the crawler−mounted crane and check the tension of the tracks if there are noises when travelling			x														
19.8	Checking the Screw Connections of the Drive Gearbox			x						x								
19.8	Central lubricating system	Service, fill, set and troubleshoot as required																

1* − daily before commencing work 2* − weekly 3* − monthly 4* − quarterly 5* − at least once per year
6* − when necessary, − on main and fly jib components and SL mast parts before each lift

5.5 Pump Distributor Gear − Checking the External Screw Connections

(Z 72 745)

Check the external screws on the gear housing and on the frame mount. Tighten any loose screws; remove broken off or defective screws and, if required, replace them with new ones with Loctite.

Screws for the pump and gear housing mount:

Item	Quan-tity	Size	Quality	Tightening torque Ma		with Loctite 222
				(Nm)	(lbf−ft)	
1	4	M 18 x 1.5 x 45	8.8	360	265.52	x
2	8	M 14 x 1,5 x 40	10.9	187	137.92	x
3	12	M 20 x 55	10.9	510	376.16	−
4	8	M 16 x 40	10.9	265	195.45	−

6.4 Checking the Lip Seals on the Slewing Ring

(Z 72 747)

A visual inspection of the lip seals (1) on the slewing ring must be carried out at least once per week. There must be no visible cracks or damage.

7.3 Slew Gearbox − Cleaning the Housing

Do not use a high−pressure cleaner for cleaning.
Water can get into the slew gearbox and damage the seals on the machine. Never spray seals and sealing gaps directly.

Clean the gearbox case when required or when an oil change is due.

– Clean contaminated gear components and mounting surfaces with a metal cleaner, for example Hakupur 50−373−7.

– Remove oil, grease and heavy dirt using a metal cleaner, for example Hakutex 27 EL.

7.4 Slew Gearbox − Checking the Oil Level

(Z 73 015)

If a consistent oil loss is determined during the oil check, operation must be stopped and the device must be dismantled in order to find the cause of the leak.

The oil level must always be checked when the slew gearbox is at a standstill and the oil has cooled down.

Check the oil level at the slew gears using a dipstick.

1. Unscrew the oil filler plug (1) and pull out the dipstick (2).
2. Clean the dipstick (2) with a cloth.
3. Screw the dipstick (2) back in place.
4. Unscrew the oil filler plug (1) and pull out the dipstick (2).
5. Read the oil level off the dipstick.
   ✓ The oil level is correct when it is between the “min.” and “max.” markings.

If the oil level is below the “min.” marking, top up oil until the “max.” marking is reached on the dipstick (2). See section 7.5 for the procedure.

See section 2 “Oils, Lubricants and Capacities” for the correct oil types and oil quantities.

Inspection of the drained oil

Systematic oil inspections at regular intervals are a measure for “preventative maintenance”. They make it possible to diagnose reliable trends with regard to wear development and beginning damage.

If damage is diagnosed early enough it means lower repair and downtime costs and can spare large partial or complete dismantling procedures.

A reliable diagnosis can only be made by a competent lab.

8.9 Hoists and Reeving Winch − Checking the Brakes

To ensure faultless braking performance, the disc brakes in the hoists (B, Z 72 105) and in the reeving winch (B, Z 73 006) must be checked at regular intervals to make sure they are functioning perfectly.

Defective or oiled−up discs in the case of brakes which have run dry force a reduction in the holding load.

The defective parts must always be replaced and the brake cleaned before taking up work again.

This work may only be undertaken by a trained specialist!

If all traces of oil cannot be completely removed from the disc linings, these linings must be replaced.

In the case of work with insufficient braking effect,

R I S K O F A C C I D E N T S!

Releasing the disc brake without the tension arrangement can lead to serious injury.

For safety reasons, at least three full turns of rope must remain on the rope drum when unreeling the hoist ropes.

9.3 Luffing Gear 2 − Checking the Oil Level, Topping up Oil

(Z 72 102)

If a continuous loss of oil is determined during the regular oil level checks, operation must be stopped and dismantling must take place.

☞ *The oil level must always be checked when the transmission is at a standstill and the oil has cooled down.*

Transport position “T”

☞ *The oil level must be checked with the oil dipstick (7) completely screwed in.*

Check the oil level of luffing gear 2 (W2) using the oil dipstick (7) in the oil level pipe (8) **with the Superlift mast set down “horizontally”** at **0**°.

1. Unscrew the oil filler plug (3) from the top end of the oil level pipe (8) and pull out the oil dipstick (7).
2. If the oil level is below the “min.” marking, top up oil using a funnel or a hose until the “max.” marking is reached on the oil dipstick (7).

☞ *See chapter 2 “Oils Lubricants and Capacities” for the correct oil types and oil quantities.*

3. Screw the oil filler plug (3) back on.

Working position “A”

The oil level of luffing gear 2 (W2) is measured electronically using the filling level sensor (6) at a **Superlift mast angle of 125**° (Superlift mast radius: 19.5 m / 63.97 ft).

The oil level is correct when it is between the “min.” (4) and “max.” (5) markings. A fault message is sent if the oil level does not reach the “min.” (4) marking. The oil level can be checked at a Superlift mast angle of 125° on the screen of the service display.

☞ *If the ”min.” marking is not reached, oil must be topped up. It is only possible to top up oil in the transport position “T”.*

Checking the luffing gear brakes W1 or W2 when erecting the crane with the maximum possible equipment:
(Z 72 105)

☞ *The luffing gear brakes W1 and W2 must be checked during every erecting procedure with maximum equipment.*

1. Undertake the erection procedure as described in the assembly instructions (Part 3).
2. Lift the last equipment part to remain on the ground during the erection procedure to just above the ground.
3. Interrupt the erection procedure.
   - superstructure engine running, no movement triggered.
   - All control levers in the crane operator's cab are in the middle position.
4. Attach marking:
   - for **W1**, on the rope drum W1 and on the main boom foot section
   - for **W2**, on the rope drum W2 and on the Superlift mast foot section
5. Leave the crane in this position for approximately 2 minutes.
6. Check the marking on the rope drum W1 and on the main boom foot section or on the rope drum W2 and on the Superlift mast foot section:
   - no change in marking = brake is functioning properly
   - Marking has changed (winch creeping) = brake is not functioning properly; repair the brake.

Checking the luffing gear brake W1 or W2 when raising maximum loads with other equipment variants:
(Z 72 105)

1. Lift the load to just above the ground using the hoist (approx. 10 cm / 3.9 inch).
2. Interrupt the lifting of the load.
   - superstructure engine running, no movement triggered.
   - All control levers in the crane operator's cab are in the middle position.
3. Change the radius slightly using W1.
4. Leave the crane in this position to check the brake.

For the further procedure, follow the steps in the previous segment "Checks when erecting the crane with maximum possible equipment" from point 4.

10.2 Derricking Gear − Changing the Oil

(Z 73 008)

Risk of burns and scalding!
Both the surface of the transmission and the oil that is being drained off can be very hot.
Avoid any contact and wear protective clothing.

Use the oil quality listed in chapter 2 “Oils, Lubricants and Capacities” or indicated on the serial plate.

Mixing mineral and synthetic oils is not permitted.

Normally, the oil change in the derricking gear must be performed when the main boom is set down horizontally or is removed.

When changing the oil, it must be drained off while still warm, i.e. after a longer period of operation. Proceed as follows to do so:

1. Remove the oil filler plug (1) from the top end of the inspection glass.

Keep a suitable collecting container ready.

2. Remove the oil drain plug (2) from the bottom end of inspection glass.

Dispose of used oil in an environmentally friendly manner. To do so, also observe the individual national regulations.

If the surrounding temperature is low, rinsing must be done with a heated partial amount of new oil do that any grit or contamination can be drained off.

3. Screw the oil drain plug (2) back on.
4. Fill new oil using a funnel or hose until the “max.” marking is reached on the oil dipstick (3).
5. Screw the oil filler plug (1) back on.

During operation, a considerable amount of oil is distributed in the interior of the transmission housing. We recommend therefore that the oil level be checked and, if required, any oil be added immediately after commissioning the system and with the transmission at a standstill.

10.4 Derricking Gear − Checking the Bolted Connections

(Z 73 011)

Do not use roller bearing grease KP2K!

As all the fixing bolts on the derricking gear have been fitted using Loctite, retightening is generally not required. A visual inspection is adequate.

Loose, broken off or defective bolts must be removed and replaced with new ones including Loctite if necessary.

Tightening torques

Item	Qty.	Size	Quality	Tightening torque Ma	
				(Nm)	(lbf−ft)
1	32	M 20 x 55	10.9	560	413
2	31	M 24 x 55	10.9	970	715.4
3	4	M 20 x 55	10.9	560	413

Lubricate all the grease nipples on the hook blocks (Z 81 716):

- “D” − Hook block “type 125 t (275.6 kip)”, 3 sheaves
- “E” − Hook block “type 54 t (119 kip)”, 1 sheave
- “F” − Hook suspension gear 18 t (39.7 kip)

The cable must, however, under no circumstances be pulled sideways from the bundle or reel, as with this method a torsion is created in each turn of the rope as it is unwound. Every rope torsion alters the length of lay of the strands and cable and thereby the ratios of the rope element lengths and ultimately the load distribution in the cable.

Cutting into sections

Often cables have to be cut into sections or shortened by the user. The cables can be cut in various ways. Up to a diameter of 8 mm (0.315 inch), cable cutters can be used. Mechanical or hydraulic cutters are also available for larger cable diameters. If, however, a power source is available, it is recommended that a pneumatic or electric right−angle grinder be used.

In any case, the cables must be carefully bound at the point of separation to prevent fraying of the rope ends or changes in the cable and strand laying lengths. This especially applies when sectioning off non−rotating or non−twisting cables, the strands of which are often purposefully left unformed by the cable manufacturer.

The rope ends must be bound using iron wire; insulating tape cannot prevent structural changes in the cables occurring.

(Z 29 093)
First the separating point is marked using chalk or insulating tape. One end of the seizing wire, approx. four times the cable diameter in length, is then placed along the length of the cable and then the wire and the cable are bound together starting at the separating point (a).
The cable is now bound tightly along a length of approx. three times the rope diameter (b).
The length of wire which has been bound is then pulled tight using pincers and is twisted together with the second wire end (c).

Superstructure roller set

(Z 80 909)

☞ *The rope sheave bearings are lubricated ex−works with a low−temperature grease (KE2K−50).*
At locations where temperatures below −25 degree Celsius (−13 degree F) are not to be expected, the sheaves can be lubricated with high pressure grease KP2K.

Check the roller bearing for secure seating, bearing play, running noises or similar signs of wear.

Regrease the roller set via the grease nipple every 1200 operating hours or not less than once a year.

12.6 Replacing the Hydraulic Oil

(Z 80 910, Z 80 911)

Different types of hydraulic oils may not be mixed. For this reason, if hydraulic oil is being topped up, the same oil must be used which is already in the hydraulic oil reservoir.

See section 2 “Oils, Lubricants and Capacities” for the correct oil types and oil quantities.

To change the oil, the crane must be in a horizontal position with the oil at operating temperature.

Keep a suitable collecting container ready.

1. Connect the hose to the quick−release coupling (1) on the hydraulic oil reservoir (3) and drain off the hydraulic oil.

Dispose of the hydraulic oil in an environmentally safe manner. To do so, also observe the individual national regulations.

2. Release hose from the quick−release coupling (1) and pour in fresh hydraulic oil via the return line filter (5).
3. Screw the dust cap of the quick−release coupling (1) back on.

Fill the hydraulic oil reservoir up to the top marking on the inspection glass (10 = rated capacity, see arrow Z 80 910). This marker is valid at room temperature (approx. +20 °C I +68 °F) and when all cylinders are retracted.

The filling level must at least reach the lower marking on the inspection glass (11 = minimum filling level, see arrow Z 80 910), even when all cylinders are extended, as otherwise the hydraulic pumps could be damaged.

4. Check to make sure that all tank shutoff points (4) are opened. All tank shut−off points (4) must be open.

12.13 Lower Luffing Mast Support Cylinders

12.13.1 Lower Luffing Mast Support Cylinders − Checking the Oil Level

(Z 80 923, Z 63 362)

The oil level must be checked before erecting the boom system. It is advantageous to do this during the luffing mast assembly procedure.

☞ *The oil level of the support cylinders is best checked before the luffing masts are fitted on the fly jib. They are more accessible at this point and there is no need to work at height.*

1. Pin the support cylinder to the lower luffing mast using the top, tank−side locating hole. The piston rod must be retracted completely and the transport safety lock (chains or cable) must be fitted.
2. Use the auxiliary crane to move the support cylinder into horizontal position.
3. Unscrew the oil inspection plug (K).
4. Check oil level. The oil level must be 2−3 cm (0.79 − 1.18 inch) below the upper edge of the cylinder pipe when the cylinder is in horizontal position and the piston rod is completely retracted.
   Top up oil as required. See section 2, “Oils, Lubricants and Capacities”, for the type of oil.

Lubricate the support cylinder pins before each erection procedure.

Continued: Checking the gas pressure

3. Insert the spindle of the gas filling and inspection device into the hexagon socket SW 6.
4. Screw on the union nut M28x1.5 and tighten manually.
5. Close the stop valve of the gas filling and inspection device.
6. Unscrew the spindle slowly and read the gas pressure on the pressure gauge. Compare the read value with the value in the “Table for pressure test”, column “Gas pressure p1 for temperature T” (see page 39).
7. Screw in the spindle again and tighten manually.
8. Briefly open the stop valve of the gas filling and inspection device in order to release pressure.
9. Unscrew union nut M28x1.5.
10. Tighten the cylinder screw (10) again (Ma = 25 Nm / 18.4 lbf−ft).
11. Check the seals of the gas filling connection “N” using seal spray or soapy water.
12. Screw on the screw cap (36) again.

12.14.4 Correcting the Oil and/or Gas Pressure and Filling the Support Cylinder

(Z 80 912)

Before any corrective measures are undertaken with relation to the oil or gas pressure

– the support cylinder must be fully extended (L = 1010 mm / 39.76 inches).
– the oil side must be depressurised.

Depressurising the oil side

Risk of injury!
Due to oil gushing out under high pressure.

Depressurise the oil compartment by screwing a hose with a miniature test port onto the vent connection “E” and draining the leaking oil into a container.

13.1.5 Replace Fuel Filter

(Z 72 741)

Before the filter element (20) can be replaced, the stop valve (17) below the fuel tank must be closed.

1. Clamp off the fuel hose between the tank and the fuel filter.
2. Release the two hose clips on the fuel filter (20).

Clamp off the hoses before removing them from the fuel filter so that no fuel can spill out of the lines.

3. Remove the hoses from the fuel filter.
4. Fit a new filter.

The stop valve (17) must be opened again after the filter element (20) has been replaced.

13.2.4 Air Conditioning − Having the Collector Dryer Replaced

Every 2 years or whenever there has been an interference with the refrigerant circuit, the collector dryer must be replaced by a specialist garage.

13.2.5 Air Conditioning − Error Diagnosis of the Condenser

Result	Cause	Measure
Insufficient air flow at the liquefier	Contamination of the cooling fins (fins) of the liquefier	Clean the cooling fins with a water jet. Note: Do not use a high−pressure cleaner.
	Pump inlet is contaminated	Clean pump inlet
	Collector dryer clogged or saturated.	Replace collector dryer. A clogged dryer can be checked during operation by measuring the refrigerant temperature at the dryer inlet and the dryer outlet. A temperature difference of 2−3°C (3.6−5.4°F) indicates a clogged collector dryer.
Refrigerant loss	Interference of the refrigerant lead	Check all leads for beaks due to external circumstances or to chafing.
	Leak in the system	Empty, fill up, check for leaks and repair.

13.3 Liquid Petrol Gas Heating “Trumatic E2400”

(Z 53 505, Z 63 244)

- **Do not fail to comply to the manufacturer’s instructions for use contained in Part 4 of this documentation.**
- **Repairs must only be carried out by qualified personnel in a suitable specialist workshop.**
- **The power supply must be disconnected when carrying out repair work on the heating as well as when there is electronic welding work on the crane chassis or on the superstructure. To accomplish this, undo the fuse “F1” in the safety socket (Z 53 505) under the crane operator’s cab. It is not sufficient to switch the heating off at operating panel (Z 63 244).**
- **The plugs in the electronic control unit must only be removed or plugged in if the power supply has first been disconnected by removing the fuse “F1”.**

14.5 Fuse Overview

(Circuit diagram see appendix)

BMK	value/A	Location	Page path	Description
F0301	50	Battery		Main fuse: basis electric
F0302	50	Battery		Main fuse: Control
F0311	10	Cab	19.3	Power supply 12 VDC
F0312	10	Cab	19.4	Power supply 24 V DC central, sockets super-structure
F0313	10	Cab	19.10	ADM3−FR battery
F0314	25	Cab	19.12	MR2B / SCR battery
F0315	5	Cab	20.11	Diagnosis J1949, IFM control
F0316	10	Cab	23.3	Horn (acoustic warning equipment)
F0317	5	Cab	23.5	Warning lighting
F0318	10	Cab	23.6	Hazard light
F0319	7,5	Cab	25.3	Front windows wipe/wash system
F0320	7,5	Cab	27.3	Heater timer
F0321	20	Cab	27.5	Heating system fan
F0322	10	Cab	27.6	Air conditioning: Fan, battery
F0323	10	Cab	27.9	Air conditioning: Compressor
F0324	10	Cab	28.8	Monitor D_LOG battery
F0325	10	Cab		***free***
F0326	7,5	Cab	30.3	Central control system 1.1
F0327	10	Cab	32.3	***free***
F0328	10	Cab	32.13	***free***
F0329	7,5	Cab	33.3	Emergency control system 1.1
F0330	10	Cab	25.8	***free***
F0331	10	Cab	27.14	***free***
F0332	7,5	Cab	20.3	Monitoring diesel engine / hydraulics
F0333	7,5	Cab	20.5	Diesel engine start / stop; adjustment; generator
F0334	10	Cab	20.8	Diesel engine preheating (optional)
F0335	7,5	Cab	20.9	Diagnosis diesel engine, ignition
F0336	7,5	Cab	24.3	Cab exterior lighting
F0337	7,5	Cab	24.5	Superstructure exterior lighting
F0338	7,5	Cab	24.6	Exterior lighting of winches
F0339	7,5	Cab	24.8	Ascension lighting

15.1 Fuel Filter

Risk of fire!

When handling fuels there is a risk of fire as they are easily flammable.

Avoid fire, naked flame, smoking and spark formation when handling fuels.

☞ *Dispose of used filter elements, seals and fuel remnants in accordance with the regulations valid at the location of operation.*

15.1.1 Fuel Separator (Preliminary Filter)

15.1.1.1 Fuel Separator − Emptying the Inspection Glass

(Z 72 738)

Water is heavier than diesel fuel, it collects as a differently coloured fluid at the bottom of the inspection glass (7). The inspection glass (7) must be emptied before clogging reaches the bottom of the filter element (5). Drain off the water that has collected in the inspection opening (7) daily.

1. Open drain valve (8) and vent screw (2).
2. Collect the water / fuel mixture from the filter element into a container.
3. Close drain valve (8) again.
4. Fill the preliminary filter using feed pump (3).
5. Close vent screw (2).

15.2 Fuel Tank − Draining Water and Deposits

(Z 72 742)

The fuel tank is in the superstructure.

☞ *This should only be done when the fuel tank is almost empty.*

☞ *Keep a suitable collecting container ready.*

1. Close the shut−off valve (16).
2. Disconnect the fuel line on the shut−off valve (16).
3. Open the shut−off valve (16).
4. Drain the water as well as any residue and the remaining fuel.

☞ *The tank is not fully drained.*

5. Clean the seal and refit the fuel line.
6. Fill up (see section 15.4).

⚠ **Do not start the engine with an empty fuel tank.**

15.3 Fuel System − Checking the Lines

In addition to the visual inspections (e.g. checking the oil level), the fuel system in the engine compartment should be inspected once a year. The following points must then be checked:

– All system fittings must be free of leaks and sufficiently tightened.
– With reusable fittings, the hose on the connection to the hose nipple must be fitted firmly. If in doubt, secure the hose additionally with a hose clip or replace the hose completely.

⚠ **If pipes and hoses are damaged due to mechanical, thermal or other influences, they must be replaced.**
Ensure that all leads and hoses have sufficient distance to hot engine parts (for example, turbocharger) and do not chafe.

16.1.4 Changing the Coolant

The coolant must be mixed with an anti−corrosion antifreeze throughout the year (see operating instructions of the engine). The antifreeze does not have any negative effect on the refined coolant.

The coolant must be changed as soon as required, for example, in case of repairs; see operating instructions of the engine manufacturer.

1. Switch off the engine.

Risk of accidents!

Only open the cover of the engine cooling system when it has cooled down. Otherwise the system is under pressure. Wear suitable protective gloves, clothing and goggles when handling coolant.

2. Slowly turn the cover on the expansion tank (1, Z 72 732) up to the first stop so that any excess pressure can be released. Only then continue to turn the cap to the 2nd stop and remove.

Cover leads, etc. before draining the coolant.

3. Drain the engine and cooler.

Collect the coolant in a suitable container.

3.1 In order to drain the engine, the drain plug on the crankcase (Z 39 452) must be opened.

3.2 In order to drain the cooler, the drain plug on the cooler (1, Z 66 791) must be opened.

✓ The coolant comes out of the drain hole (2, Z 66 791) under the cooler.

Dispose of used cooling fluid in an environmentally friendly manner in accordance with the regulations valid at the location of operation.

4. When the cooling system has been drained, all drain plugs must be screwed back in again.

16.3.1 Carrying out Visual Inspections of the SCR System

Check the following components to make sure they are fitted properly, and check for damage and leaks:

- All components:
  - SCR catalytic converter
  - Pump module
  - Tank of AdBlue® / DEF
  - Dosage apparatus
  - Injection nozzle of AdBlue® / DEF
  - Solenoid valve tank preheater SCR
- Hoses
- Retaining clips
- Plugs
- Sensors and cables

16.3.4.1 Pump Module − Filling the Compressed Air Reservoir (Z 70 054)

The pump module is fitted in the superstructure (1, Z 72 733).

☞ *In addition to the descriptions listed here, please read the instructions and notes on filling the accumulator in the operating instructions of the engine manufacturer.*
The operating instructions for the engine and a maintenance booklet have been appended to part 4 of these operating instructions.

⚠ **The accumulator housing cover (13, Z 70 056, page 24) must not be unscrewed and removed when the accumulator is filled and the system is under pressure.**

Fill up AdBlue® accumulator once a year. When refilling, accumulator (1), which is filled with nitrogen (N_2) ex works, can be filled with oil−free air which is free from grease.

1. Unscrew the dust cap from accumulator filling valve (2) of accumulator (1).
2. Drain accumulator (1) completely by activating the accumulator filling valve (2).
3. Fit adapter lead (3) and accumulator filling valve (2) of accumulator (1).
4. Fill adapter lead (3) to accumulator (1).
5. Set the pressure reducer to 3.7 bar (53.6 psi) and connect tyre filling device (4) to this pressure reducer.

⚠ **The pressure of 3.7 bar (53.6 psi) in adapter lead (3) and in accumulator (1) must not be exceeded to prevent the system from malfunctioning.**

6. Fill up accumulator (1) with tyre filling device (4).
7. Remove tyre filling device (4) and adapter lead (3).
8. Screw the dust cap back onto accumulator filling valve (2) of accumulator (1).

17 Piston Rods

17.1 Exposed Chrome Surfaces − Applying Protective Grease

Despite being of the highest quality, surfaces may be susceptible to corrosion in an aggressive environment. If the device is out of operation for more than one day, exposed surfaces must be protected against corrosion by applying acid−free protective grease.

☞ *See chapter 2 “Oils, Lubricants and Capacities” for the correct protective grase.*

19 Crawler Chassis

Danger due to the crawler and slewing of the superstructure.
Particular care is required in this area when carrying out maintenance, inspection and assembly work.

Work on the chassis may only be carried out with the drive motor switched off.

19.1 Drive Gearbox

(Z 71 148)

The drive gearbox consists of the transmission (A) and the drive (B) to which the motor flange (C) is fitted.

Duo travel gear and Quadro travel gear are identical with respect to checking oil levels and topping up oil. In contrast to the Duo travel gear, however, there are 4 final drives with the Quadro travel gear. This means that both the amount of work and also the oil quantities are doubled.

19.1.1 Transmission − Checking the Oil Level

(Z 71 149)

The crawler chassis must be positioned on a horizontal surface for the oil level check.

1. The oil fill plug (2) and the oil drain plug (3) must be positioned one on top of the other, vertical to the ground.
2. Remove the screw plug (1).
   ✓ The oil must be filled up to the bottom edge of the hole.

To top up the oil, refer to section 19.1.4, “Changing oil”.

If a continual loss of oil is determined during routine checks of the oil level, operation must be suspended and dismantling performed.

19.1.7 Cleaning the Bleeder Valves / Filters

(Z 71 706)

Foreign matter can accidentally get into the drive gearbox interior during cleaning. For the reason, close the bleeder hole when cleaning the valve.

If covered in a layer of dust, the bleeder valves and filters must be cleaned even before the minimum time period of 3 months has passed.

1. Unscrew and remove the bleeder valve / filter.
2. Rinse out the bleeder valve / filter with a suitable cleaning agent.
3. Dry the bleeder valve / filter or blow the bleeder valve / filter dry with compressed air.

Sealing rings must be checked and replaced if required.

19.1.8 Cleaning the Drive Gearbox

(Z 71 706)

The seals can become damaged if the machine is cleaned with a high−pressure cleaner.

– Never spray seals and sealing gaps directly.
– Only use suitable metal cleaners for cleaning, for example, Hakupur 50−373−7 or Hakutex 27 EL.

19.8 Central Lubricating System

19.8.1 Component Parts

(Z 71 709)

The components for the central lubrication system are listed below.

1 Container
2 Pump element
3 Safety valve
4 Filling nipple
5 Connection plug
6 Return connector
7 Lube distributor
8 Drain plug

19.8.2 Function

The central lubricating system automatically supplies grease to all connected lubricating points using the lubricant distributor.

It is active when the crane is driven.

20.4.4 Slew Gear Mechanism − Checking the Bolted Connections

(Z 55 982)

The preliminary tension of the screws (34 and 35) must be ensured by regularly retightening to the prescribed torque.

☞ *Lubricate the heads and threads of all screws (1) with roller bearing grease "KP2K" before screwing them in.*

Tightening torques of the fastening screws for the hydraulic motor and transmission mounting:

Item	Qty.	Size	Quality	Torque Ma	
				(Nm)	(lbf−ft)
34	72	M 16 x 60	8.8	265	195.46
35	24	M 12 x 35	10.9	108	79.66

20.4.5 Slew Gear Mechanism − Visual Inspection

(Z 55 982)

Check the gearbox case, lines and neck bearings for leaks.

20.8 Tyres − Checking the Wheel Nuts, Tightening if Required

(Z 55 987)

– Check all wheel nuts (3) and retighten them with a torque wrench.
  The tightening torque is 360 Nm (265.52 lbf−ft).

After a tyre change, the wheel nuts must be retightened after 10 hours of operation and after 20 hours of operation.

14.5. Electric equipment

Components:	Check for:
Alternators, motor, resistors, brake vents, lighting equipment, heating, leads, collector, switches, protectors, fuses, batteries, lines warning devices	Attachment, condition, function, insulation, guard against direct contact with active components, guard against indirect contact installation

14.6. Control equipment final drive

Components:	Check for:
Shift mechanism, engine control, brakes	Condition, function, shutdown, smooth running, lost motion of linkage and cords (end play), display of control functions, lamps and signals, designation, brake tests

14.7. Controls for the crane drive

Components:	Check for:
Hoists, luffing gears, derricking gear, slewing gear, brakes	condition, function, switching off, free movement, play of linkage and movements (dead gear), display of the monitors, lamps and signals, markings, brake checks with load (test load in the range of the lifting capacity).

14.8. Other control equipment

Components:	Check for:
Outriggers, additional equipment	State, function

Chassis − track carriers (Duo)
(Z 56 827)

Frame superstructure 2
(Z 56 814)

Fly jib (foot section)
(Z 56 815)

Legend:
A = top piece
B = foot section

Runner
(Z 56 820)

22.1.3.1 Theoretical Service Life

The design engineer has assumed certain operating conditions in calculating and dimensioning the winches on your crane.
The winches of your crane are graded as follows (ISO 4301/1, FEM 1.001, DIN calculation parameters for drives):

Power unit group:	M.....
Load collective:	Q..... (L.....)
Load spectrum factor:	Km = ...

This results in a **theoretical service life D**.

☞ *The respective valid values can be taken from the table "Monitoring the winches" in the crane log book.*

⚠ **The theoretical period of use may not be equated with the real (actual) period of use of a winch.**
The real period of use of a winch is additionally influenced by many external conditions, for example:

- **Overloading due to not using the crane as intended.**
- **Insufficient maintenance: the oil is not changed in good time.**
- **Maloperation such as extreme acceleration or deceleration of the load or the load falling into the ropes.**
- **Maintenance errors such as using the wrong oil, incorrect oil filling quantity or contamination when changing the oil.**
- **Assembly errors when undertaking repairs or maintenance.**
- **Leaks not taken into consideration.**
- **Incorrectly set safety equipment.**
- **Concealed damage caused by accidents.**
- **Extreme ambient conditions such as low or high temperatures, aggressive atmosphere, dust and dirt.**

(Z 60 292)

Inspection no. 2 (year 2)

The crane has been used for unloading operations at the harbour:
Load collective **L 3**, i.e. $\mathbf{Km_2 = 0.5}$.

2000 h are recorded on the superstructure hour meter, i.e. during this period: 2000 h − 800 h (used in first year of operation) = **1200 h**.
The winch has been in operation for approx. 40 % of this time, i.e. $\mathbf{T_2 = 480\ h}$.

The spent share $\mathbf{S_2}$ of the theoretical service life in the 2nd inspection interval therefore equals:

$$\mathbf{S_2 = \frac{Km_2}{Km} \times T_2 = \frac{0.5}{0.125} \times 480\ h = 1920\ h}$$

Remaining theoretical service life after the second year:

$\mathbf{D_2} = D_1 - S_2 = 3040\ h - 1920\ h =$ **1120 h**

Inspection no. 3 (year 3)

The crane has been used for assembly work and occasionally for unloading work in the harbour:
Load collective **L 2**, i.e. $\mathbf{Km_3 = 0.25}$.

The superstructure operating hour counter reads **3000 h**, i.e. during this period: 3000 h − 2000 h (used in the first two operating years) = **1000 h**.
The winch has been in operation for approx. 30 % of this time, i.e. $\mathbf{T_3 = 300\ h}$.

The spent share $\mathbf{S_2}$ of the theoretical service life in the 3rd inspection interval therefore equals:

$$\mathbf{S_3 = \frac{Km_3}{Km} \times T_3 = \frac{0.25}{0.125} \times 300\ h = 600\ h}$$

Remaining theoretical service life after the third year:

$\mathbf{D_3} = D_2 - S_3 = 1120\ h - 600\ h =$ **520 h**

Calculations must now be carried out to determine whether the remaining theoretical service life is sufficient for the next operating period. If this is not the case, a general overhaul must be carried out (see section 22.1.3.5).

Criteria for removal

A rope must be removed when one or several of the following points are fulfilled. See also the relevant DIN standards.

a) Wire breakage

A cable must be removed when the permitted wire breakage number is in accordance with DIN 15 020 or exceeds it.

The cable must be removed if there are wire breakage clusters or if a cord breaks.

b) Rope wear

If the rope diameter in cables is decreased by 15 % or more during longer journeys compared to the nominal value, the cable must be removed.

c) Corrosion

You can determine corrosion of the outer rope wires with a visual inspection. However, it is difficult to determine corrosion on wires that cannot be seen externally.

Corrosion can lead to a reduction of the static breaking strength of the cable, as the metal rope cross−section is reduced, and can lead to a reduction in operational stability due to corrosion pits.

d) Abrasion

Abrasion of the rope wires can be “interior abrasion” which is caused by movements of the cords and wire against each other when bending the cable up and down or “external abrasion” which is caused by movements between the cable and the sheave or by dragging the cable on the ground or over the material to be conveyed.

Abrasion is encouraged if lubrication is insufficient or lacking or by the effect of dust. If the rope diameter is decreased by 10 % or more compared to the nominal value, the cable must be removed even if no wire breakage was discovered.

22.1.7 Documentation

Instructions for repeated inspections on crawler−mounted and mobile cranes in accordance with § 26 sections 1 and 2 of the accident prevention regulations “Cranes” (BVG D6)

Company:	Inspector:	Date:
Crane manufacturer: TEREX	Crane type:	Construction number:
Construction year:	Inventory no.:	Signature

1st inspection group: Crane document						
Test component	A	B	C	D	E	Remarks
Inspection log book for the crane						
Operation / assembly instructions						
Load tables						
2nd inspection group: Notes / markings						
Test component	A	B	C	D	E	Remarks
Factory sign						
Load / stress details						
Notice of operating regulations						
Prohibition and regulation notices						
Other safety markings						
3rd inspection group: Travel gear 1)						
Test component:	A	B	C	D	E	Remarks
Axles						
Wheels						
Tyres						
Bearing						
Distributor gear						
Cardan shaft						
Leaf springs / springs						
Shock dampers						
Brakes						

A: existing / complete	B : state / servicing	C: Function
D: repair / replacement	E: subsequent inspection required	
fulfilled = x	not fulfilled = −	not required = 0

Company:	Inspector:	Date:
Crane manufacturer: TEREX	Crane type:	Construction number:
Construction year:	Inventory no.:	Signature

12th inspection group: Superstructure / cab						
Test component	A	B	C	D	E	Remarks
Doors						
Windows / glass						
Wipers						
Mirrors						
Seat						
Heating / air conditioning equipment						
Ventilation						
Mufflers						
Control lever for operating functions						
Gear shifting						
Safety device: points of crushing / shearing						
13th inspection group: Superstructure / retaining devices and safety guards						
Test component	A	B	C	D	E	Remarks
Handles and ladders						
Coverings						
Covers						
Flaps						
14th inspection group: Superstructure / drive						
Test component	A	B	C	D	E	Remarks
Combustion engine						
Exhaust system / combustion protection						
Fuel tank						
Filter						
Engine suspension						
Noise absorption						
Oil / coolant levels						

A: existing / complete	B : state / servicing	C: Function
D: repair / replacement	E: subsequent inspection required	
fulfilled = x	not fulfilled = −	not required = 0

Remarks

1) It is considered that an inspection of the traffic safety status of the mobile crane has been carried out if there is a fault−free result of expert inspection in accordance with the road traffic licensing regulations. The expert must carry out an inspection of the traffic safety status on mobile cranes which are not authorised for travel on public roads (see also accident prevention regulations “Vehicles” BGV D29).

2) The expert must still carry out these inspections even if there is a fault−free result from an expert inspection in accordance with the road traffic licensing regulations.

3) Inspection of the winches with regard to the used portion of the theoretical period of use

23.1.1.2 Jumper Setting

The jumper setting is set ex works for
pause time = 1 − 1 h
operating time = 7 − 56 s.

23.1.1.3 Setting the Pause Time

(Z 80 939)

The interval time can be set to 15 levels using the blue rotary switch (10).

Switch position	1	2	3	4	5	6	7	8	9
Hours	1	2	3	4	5	6	7	8	8
Switch position	A	B	C	D	E	F			
Hours	10	11	12	13	14	15			

23.1.1.4 Setting the Operating Time

(Z 80 939)

Switch position	1	2	3	4	5	6	7	8	9
Seconds	8	16	24	32	40	48	56	64	72
Switch position	A	B	C	D	E	F			
Seconds	80	88	96	104	112	120			