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PREVENTIVE MAINTENANCE SCHEDULE**STANDARD CRANES**

LUBRICATION should be carried out as shown on the lubrication sheets for the crane supplied, plus sheet no. 5413 "LUBRICATION OF SLEWING BEARING RINGS", with reference to the approved lubricants list no. 2102. Check for any notes on oil change and flushing after start period. Lubrication periods can also be used for visual checking, especially for pulleys with lubricated bearings.

BOLT TIGHTENING BY TORQUE WRENCH should be to the figures given on sheet no. 2268. Torque's for slewing bearing ring bolts: See sheet 2266. Main structure bolts must always be checked after any shock loading has taken place. The sheet "TEST LOADING" for the resp. crane type should then be consulted.

PREVENTIVE MAINTENANCE should be carried out in relation to the number of **operational hours** with max. period limits. Consideration should be given to weather and location conditions, principally with regard to low temperature, icing, high winds, salt-laden atmosphere, blown sand, etc.

When protective plugs or covers are removed for inspection they must be correctly replaced.

As indicated on sheet no. 2184 "OPERATION & SAFETY RULES", a response check of the controls should be made as each work shift commences.

Any form of fault - noticed, felt or heard - not necessarily interfering with operational safety should be logged and checked for correction immediately or during the next maintenance period.

The crane operator should carry out the daily maintenance of the crane.

Do not alter the setting of the safety devices. Faults in mechanical and electrical systems must be corrected by professional personnel.

In the event of mechanical or electrical faults, the crane must not be operated until the cause has been found and the fault corrected.

It is imperative that the crane be maintained correctly to avoid unnecessary stoppage. The following preventive maintenance routine should be implemented by the crane operator. It is his responsibility to see that the crane is maintained and lubricated as described and that loose bolts are retightened. He should also call for professional assistance if repair work is required.

PREVENTIVE MAINTENANCE SCHEDULE - STANDARD COMBINATION CRANES

(M = mechanical / E = electrical / V = visual /hand-check/inspection/cleaning (electr.) / T = maintenance check with required tools

ITEM NO.	CATA-GORY	LOCATION	ACTUAL OPERAT. TIME IN HRS.					NOTES
			50	100	250	500	1000	
			MAX. PERIOD IN WEEKS					
			1	4	12	26	52	
1	M	Structure bolt connections (mast, slewing, jib(s), undercarriage)		V			T	T after the first 100 hrs. of operation
2	M	Cotter pin bolts (portal, tower, stays)			VT			
3	M	Special bolts or axles (with bolted-on end plates)		V			T	
4	M	Hoist winch bolts (foundation frame, motor, gearbox, flange bearings, drum/flange connect.)		V			T	
5	M	Slewing ring bolts (or roller ass.)	V		T			See service sheet
6	M	Slewing gear bolts		V			T	
7	M	Trolley or luffing winch bolts		V			T	
8	M	Bogie/undercarriage assembly bolts (bogie slip clutch)		V	T			See service sheet
9	M	Lube/hydr. installation leakage		V			T	
10	M	Chain drives to limit switches	V					
11	M	Open gears (slewing - bogie)	V					V also incl. lube
12	M	Pulleys (sealed bearing fitting)				V		
13	M	Drives (misalignment through shaft couplings - V-belt tension - centr. clutch shoes)			V			
14	M	Hoist rope (incl. swivels/drum connect.)		V				Parallel-jib crane types only
15	M	Trolley/hook (bolts, etc.)			V		T	
16	M	Trolley rope (incl. connect. & tensioning)			V			
17	M	Counterweight & ballast blocks					V	
18	E/M	Moment & max. load devices	V				T	See "Test loading"
19	E	Hoist motor (commutator, brushes, air filter, etc.)		V				See service sheet Note: Emergency use of brake instr.
20	E	Hoist brake - air gap - cleaning	V		V			
21	E	Tachogenerator			V			
22	E	Collector ring & brushes (slewing)			V			
23	E	Slip rings (motors)			V			
24	E	Slewing, trolley or luffing, bogie brakes (air gap checks)		V				
25	E	Overspeed controllers (magnet impulse type hoist/slewing) - air gap check		V				
26	E	Electr. panel heaters				V		
27	E	Resistance banks (remove any dirt)					V	
28	E	Motor/control box terminals (nuts or screws)				V	T	
29	E	Sealed switches (trolley/luffing end stops, pos. indicator, moment & max. load devices, height/depth stop, etc.				VT		Incl. light lube & contact inspection
30	E	Feeder cable (rail-mounted cranes) for abrasion damage, etc.				V		
31	E	Main power pick-up shoe (rail level)		V				
32	E	Cleaning of electr. panel cabinets		V				
33	E	DC motors						See special instr.

GENERAL HINTS

Constant readiness for operation and high life requires regular and conscientious lubrication. Prior to crane assembly effect the necessary oil change. We request that the following are complied with in detail:

Danger!

For lubrication and maintenance operation also conform to protective and accident prevention regulations and comply with the valid special regulations at the respective jobsite. Take the crane out of operation. Secure danger areas at, and in the slewing crane (an unintentional taking into operation of the crane mustn't be possible).

Used oil must be disposed of, according to the local regulations.

Lubrication points and lubrication periods:

Under particularly heavy loading, severe dusty or very wet conditions, it may be necessary to maintain the crane more frequently than stated in the lubrication instructions. The enclosed lubrication instructions provide an overview of all lubrication points, filling quantities and the associated lubricants and lubrication periods. The following is of interest for the lubrication points.

Roller bearings:

All roller bearings except for the bearings in the gearboxes are provided with grease filling at the factory. Under normal operation, it is sufficient to check the bearings every six months. The roller bearings of rope pulleys and rollers without possibility of lubrication have permanent life lubrication for maintenance-free operation.

Attention!

The lubrication of the ball bearings requires special care. Here we urgently request that the lubrication and maintenance instructions for the ball bearing are complied with. Separate lubrication and maintenance instructions are also binding for the electric motors.

Gears:

Most gears are filled with oil at the factory. The oil should be changed according to the maintenance schedule. Use only the prescribed quality oils. Oils with different basic oils mustn't be mixed with one another (e.g. mineral oil with synthetic oil). If large grain abrasion (more than 25 µm) or flashes of material of the gear flanks are ascertained, the gear must be generally checked by visual inspection. The gear must be generally overhauled in the case of features such as scores, seizing, formation of pits, flaking, cracks and plastic deformations of gear wheels.

Ropes:

Regular maintenance and good lubrication increase life. At least as soon as bare places show, lubricate with oils specified for this, the total length of the ropes. The lubrication instructions of the rope manufacturer must be complied with for the ropes.

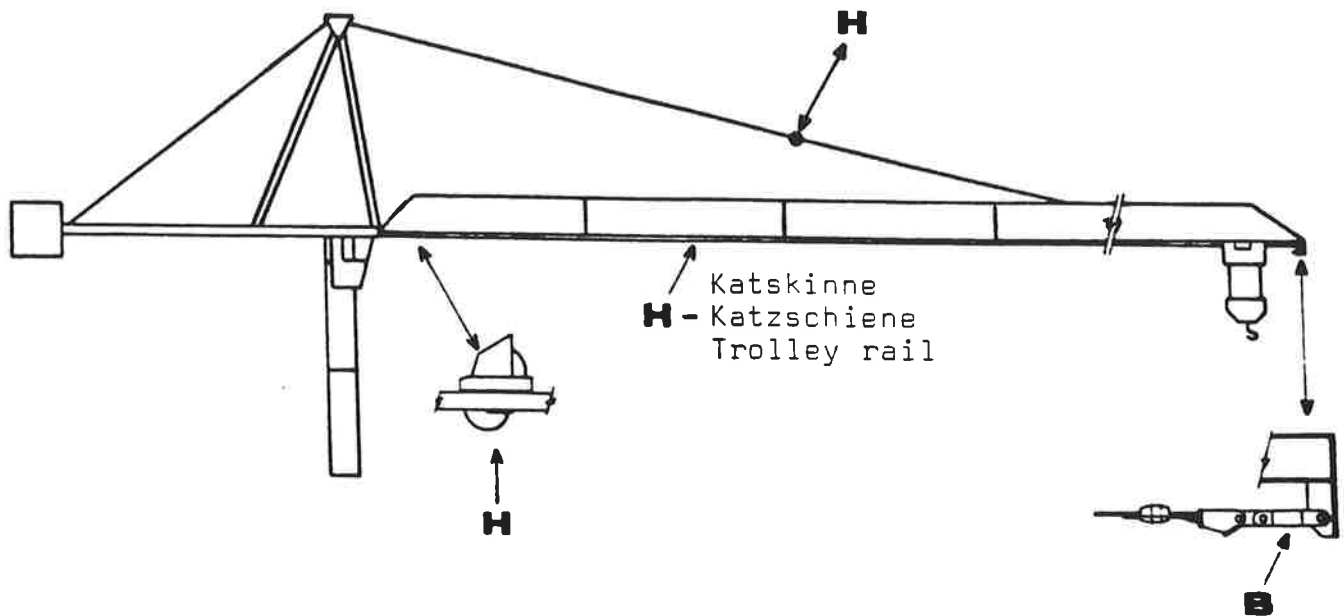
For all other lubrication points we request you to comply with the lubrication and maintenance instructions.

Danger!

Only take a ready for service crane into operation (covers and protection devices must be installed).

SMØRING/SCHMIERUNG/LUBRICATION

DIV. UDRUSTNING
DIV. AUSRÜSTUNG K-154/K-2000/K-250D
MISC. EQUIPMENT



OBS: - Kat- og lastwirer må IKKE smøres.

NB: - Katzfahr- und Hubseile dürfen NICHT geschmiert werden.

NOTE: - Trolley and hoist ropes must NOT be greased.

SMØRESKEMA:
SCHMIERTABELLE: INFO No. 2300
LUBRICATION CHART:

SMØREMIDLER:
SCHMIERMITTEL: INFO No. 2102
LUBRICANTS:

KRØLL GIANT CRANES

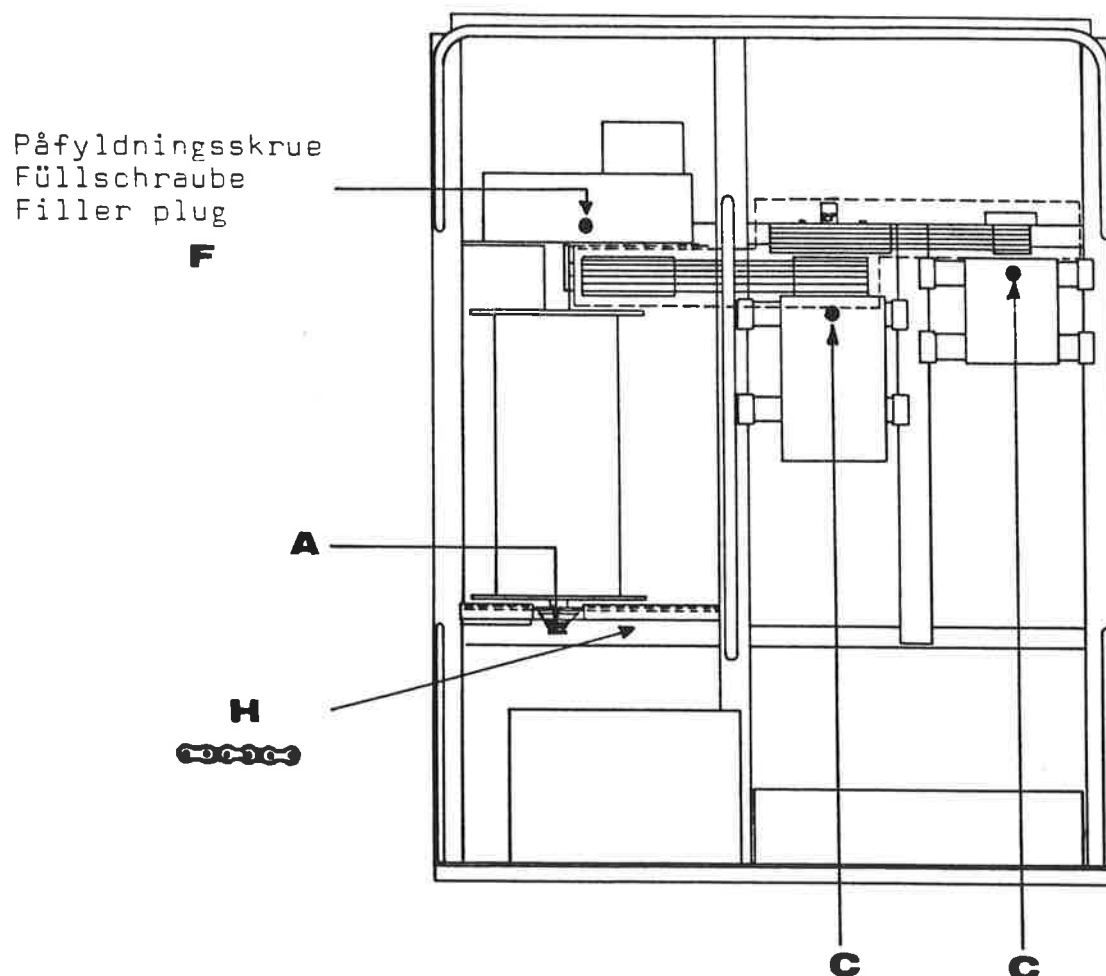
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2310-00

SMØRING/SCHMIERUNG/LUBRICATION

- 75 HK LASTSPIL m/VEKSELSTRØMMOTOR
- 75 PS HUBWERK - DREHSTROMANTRIEB
- 75 HP HOIST WINCH - A.C. OPERATION

Fedtmængde i gear:
Fettmenge im Getriebe:
Grease quantity in gearbox:

ca./ungefähr/approx. 15 kg



SMØRESKEMA:
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KRØLL GIANT CRANES

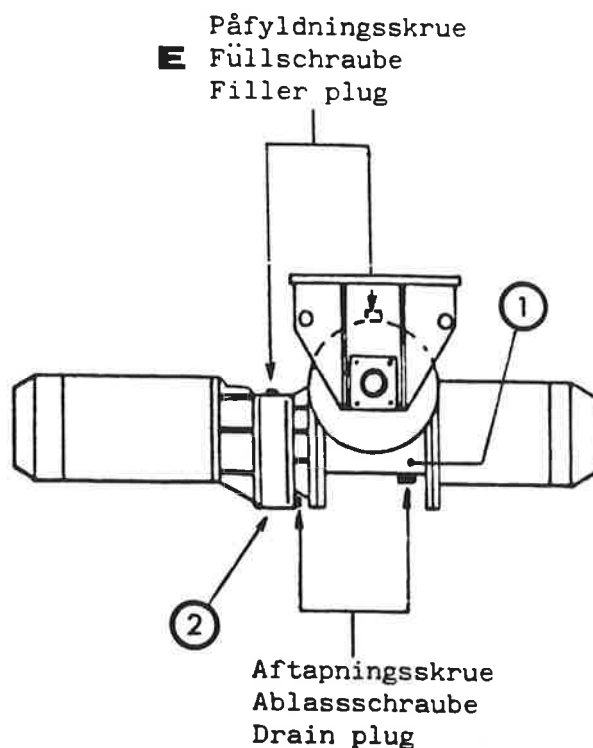
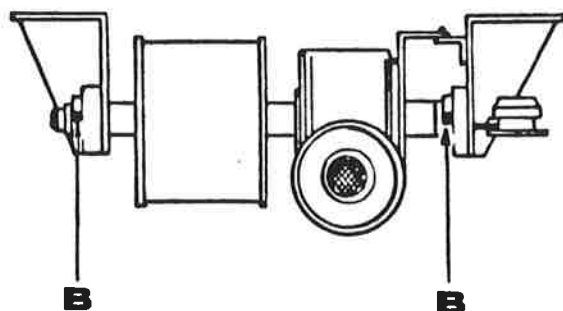
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2302-01

SMØRING/SCHMIERUNG/LUBRICATION

• KATSPIL MED TROMLE
KATZFAHRWERK MIT TROMMEL K-250D/K-400D
TROLLEY WINCH - DRUM TYPE

Oliemængde i gear:
Ölmenge im Getriebe:
Oil quantity in gearbox:

ca./ungefähr/approx. 4,5 l (Pos. 1), 0,6 l (Pos. 2)



SMØRESKEMA:
SCHMIERTABELLE: INFO No. 2300
LUBRICATION CHART:

SMØREMIDLER:
SCHMIERMITTEL: INFO No. 2102
LUBRICANTS:

KRØLL GIANT CRANES

INF. REF.
2396-00

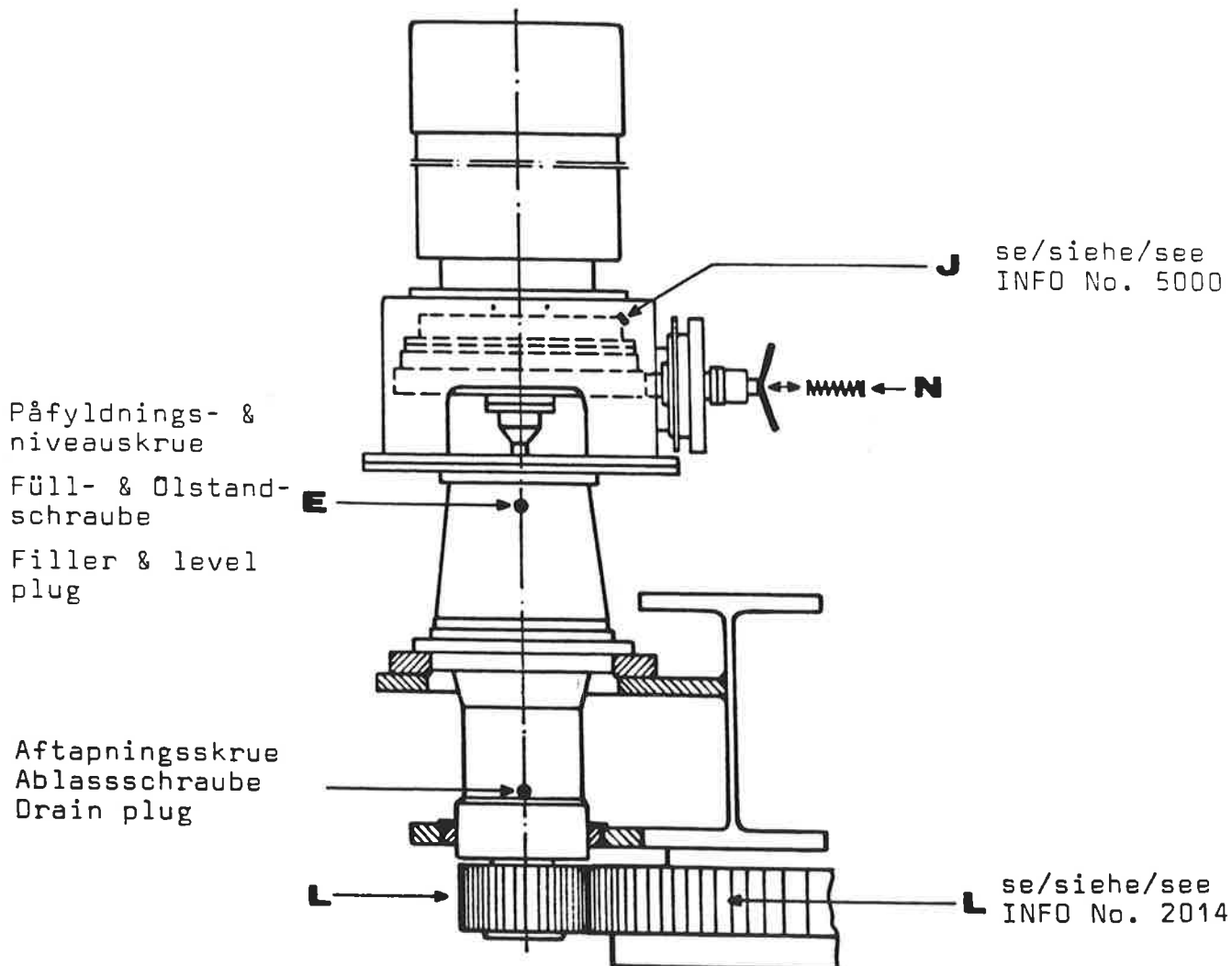
SMØRING/SCHMIERUNG/LUBRICATION

KRØJEMASKINERI
DREHWERK
SLEWING MACHINERY

K-154/K-2000/K-175/K-400D

Oliemængde i gear:
Olmenge im Getriebe:
Oil quantity in gearbox:

ca./ungefähr/approx. 11 l



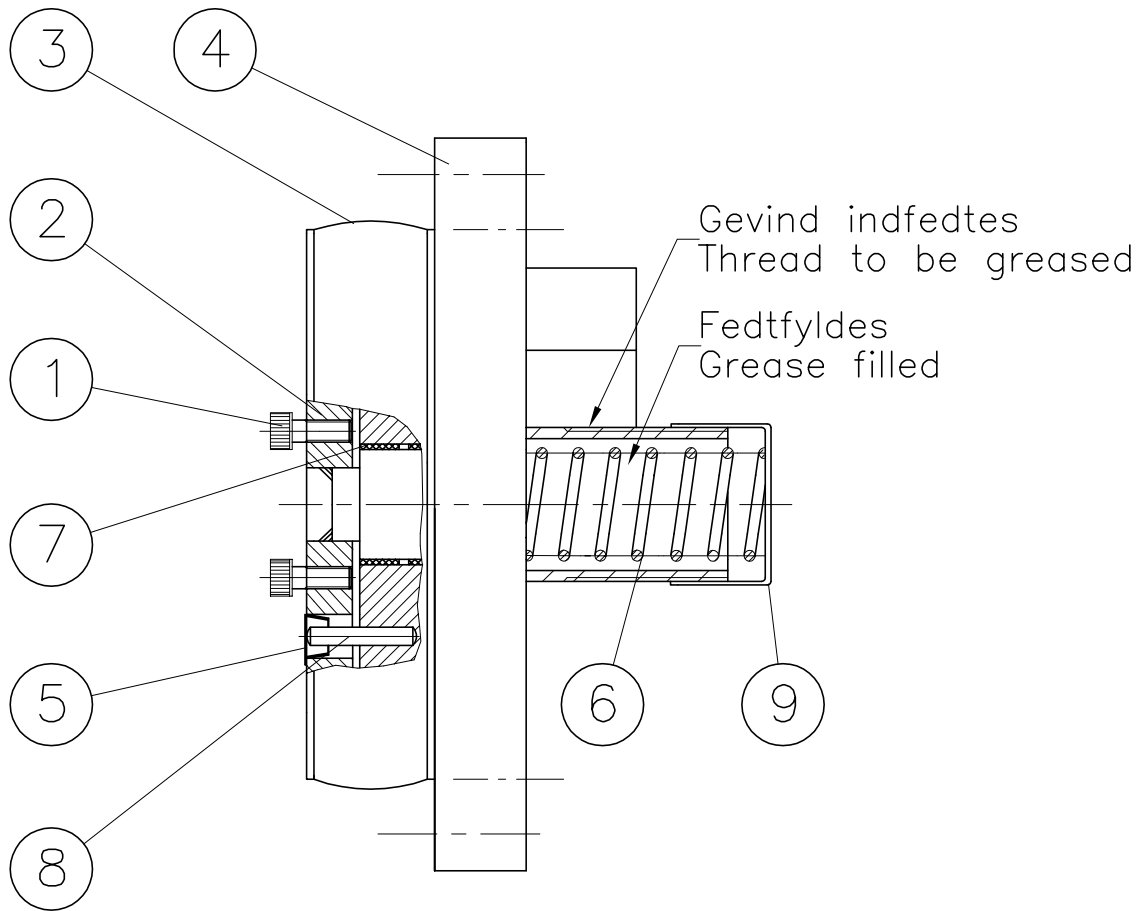
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SCHMIERTABELLE: INFO No. 2300
LUBRICATION CHART:

SMØREMIDLER:
SCHMIERMITTEL: INFO No. 2102
LUBRICANTS:

KRØLL GIANT CRANES

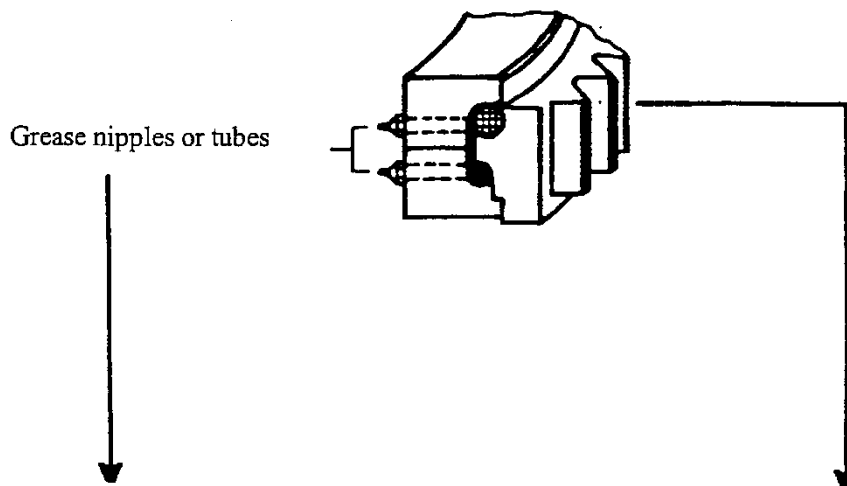
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2309-00

THIS DRAWING IS THE PROPERTY OF
KRØLL GIANT CRANES A/S AND MAY
NOT BE REPRODUCED IN WHOLE OR
PART WITHOUT PERMISSION



9		D.B.I. Dut		No. 42.4				Type M 50421
8	42.89505030	Ascending pipe $\varnothing 5 \times 30$			1		0.1	
7	43.00099634	Bushing	20	MB 3020 DU	2			
6	4-06.20018406	Spring			1		0.1	
5		D.B.I. Dut		No. 15 S	2			
4	C2-34.00045719	Magnet		180 Volt DC	1		8	
3	4-34.00015347	Rubber muff			1		0.1	
2	3-34.00015320	Armature			1		2	
1	42.10006014	Insex M6 x 14		10.9	4			
Pos Nr.	Tegning Nr.	Titel	Længde	Type-Kvalitet	Stk	Vægt stk	Vægt total	Bemærkninger

KONST.: 071129 JL	PROJ.	KRANTYPE	STK.	SAML. TEGN.			
TEGN.: 071129 JL		K100L					
GODK.: 071129 JL		KH100L					
ERSTATTER:	SKALA:	OVERF. AREAL:	OVERFLADE-BEHANDLING:	MATR.:			
	1:2	m^2		DIM.:			
ERSTATTET AF:	TOTALVÆGT:	ANT. TEGNING.:	TITEL	ANT. STYKL.:			
	10,5 kg		K-brake 180 V				
OPRINDELSE:	TRANSPORTMÅL:						
	m^3						
		KRØLL CRANES A/S		TEGN. NR.			
NORDKRANVEJ 2		DK-3540 LYNGE		C4-16.00045720-00			
PHONE: +45 48 18 74 00		FAX: +45 48 18 88 07					



THE BEARING is to be greased with Shell Alvinia EP2 or similar.

THE TEETH should normally be greased with ELKALUB GL 10/N or similar every 10 hours' operation or, alternatively, a minimum of twice of week.

Under no circumstances may molybdenum disulphide lubricants be used for the bearing.

Pressed-out grease should be removed in order that ladders and platforms do not become slippery.

NOTES TO LUBRICATION OF SLEW. BEARING RING:

The grease packing will reduce friction, seal and protect against corrosion. Therefore it is recommended to grease until a collar of grease appears all around the circumference of the bearing openings. The collar of grease prevents water, dirt and grease of the external tothing penetrating into the bearing race.

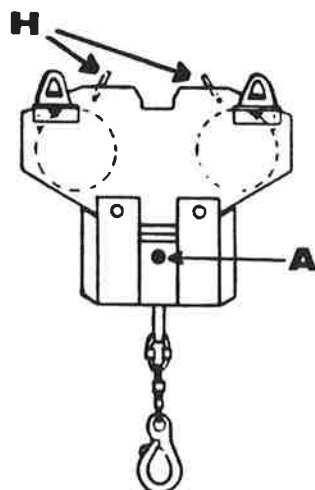
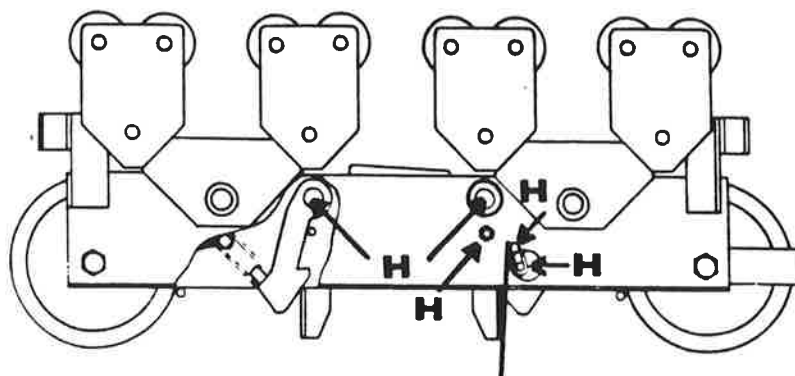
Grease the tothing after working or on weekends, as the grease, especially in form of sprays, need 12 hours to dry. The stipulated time for drying has to be kept. (Consult the recommendation of the manufacturer).

Shorter greasing intervals: In tropical areas, cases of high humidity, wide temperature range.

SMØRING/SCHMIERUNG/LUBRICATION

- OMKOBLINGSSYSTEM FOR LASTWIRESKÆRING 2/4 - 2/4/6
HUBSEIL-UMSCHERUNGSSYSTEM el./oder/or
LINE PART REEVE CHANGE-OVER SYSTEM 4/2 - 6/4/2

Eksempel
Beispiel
Example



SMØRESKEMA:
SCHMIERTABELLE: INFO No. 2300
LUBRICATION CHART:

SMØREMIDLER:
SCHMIERMITTEL: INFO No. 2102
LUBRICANTS:

KRØLL GIANT CRANES

INF. REF.
2304-00

CRANE ROPES

MAINTENANCE INSTRUCTIONS

(DIN 15020)

MAINTENANCE INSTRUCTIONS FOR CRANE ROPES

1. STORAGE

Wire ropes must not have suffered corrosion, rusting, damage or severe contamination with dirt when they are installed. Ropes must therefore be stored in a dry place and moisture condensate prevented from forming on non-galvanized ropes.

2. INSTALLING

When the wire rope is pulled off a reel or uncoiled from a ring, it must neither be twisted more tightly nor untwisted, or else the structure of the rope will be damaged and kinks or loops will form.

We recommend setting up reels on a shaft suspended between trestles, and leading the rope as directly as possible from the reel to the winch drum on the crane. One man should remain by the reel to brake it so that the rope is always slightly taut. Ropes supplied on rings must be uncoiled on the ground.

Before installing a wire rope, make sure that it fits the grooves on the drum and that the diameter is correct for the pulley grooves.

Prevent the rope from dragging across the ground before it is installed, or else the impregnation will pick up dust and dirt. This will damage the rope and cause premature wear. If there is any risk of the rope being dragged across sharp-edged items of the metal structure during installation, cover or pack the danger areas thoroughly with wood.

When replacing a rope, ensure that the new rope is of the same pattern and strength rating as the previous rope when it was new. The end fastenings of the new rope must also be identical with the old ones.

Before running the winch after renewing a rope check that the rope has been wound on correctly and is lying securely in the drum and pulley grooves. Make the first few trial movements at light load only.

If the rope is wound in several layers on to the drum, the layers underneath must be adequately preloaded with at least 1% of the rope's breaking strain or, for heavy duties, 10% of the ropes pull for the anticipated load. This will provide a firm base for the upper rope layers during operation, so that they do not cut into the lower layers or damage them.

If several hoisting ropes are used in pairs, the left-wound ropes must be on the drum with the grooving cut in the right-hand pattern, and vice versa.

3. MAINTENANCE

Wire ropes need regular maintenance, with particular care devoted to rope drives subject to severe loads.

Ropes must lubricate at regular intervals, in particular where they pass round pulleys and drums. The actual intervals will depend on local operating conditions, but subsequent lubrication is normally recommended at least every 200 hours of operation. In special circumstances –extreme weather, sea air etc. – it may be necessary to reduce the intervals between lubrication routines.

The lubricants must be compatible with those already on the ropes. Oils are normally superior to grease because they can penetrate the interior of the rope, but some greases contain additives to aid penetration. Please refer to the Table of Lubricants for details of the greases and oils we recommend.

Ropes which move in operation should be cleaned at intervals, since the mixture of dust and residual lubricant which otherwise forms can prevent fresh lubricant from penetrating the rope.

Lubrication is also important as a means of preventing corrosion. Fixed ropes should be greased or painted to protect them against corrosion or rusting.

If operating circumstances make it impossible to lubricate a rope once it has been installed, its working life will be reduced and it should therefore be inspected at more frequent intervals.

4. ROPE INSPECTION

At regular intervals, wire ropes should be inspected by trained and skilled personnel to ensure that they are still serviceable. Inspect at more frequent intervals in the first few weeks after installing a new rope, and also when the first broken strands are detected or if the rope was subjected to unusually high loads.

When starting up again after a lengthy shutdown period, and after any damage has occurred which could possibly have been associated with the rope, carry out an additional inspection.

Examine sections of rope which pass over pulleys and the end fastenings of the ropes with particular care.

Replace damaged wire ropes in good time. The number of broken strands permitted is governed by local or national regulations. Remember that some time will normally elapse before the first broken strands occur, but that their number will then increase rapidly.

Wire ropes must also be replaced if:

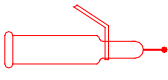




- structural changes have occurred so that the rope diameter is 15% or more below its original nominal diameter over a fairly long distance.
- corrosion or rusting has caused the rope diameter to be 10% or more below the nominal diameter.
- the rope diameter is 10% or more below the nominal diameter on account of wear.
- severe deformation of the rope structure is visible, such as expanded "baskets", severe corkscrew deformation, severe wire strand loops, loose strands on account of corrosion or wear, loops and twists, mechanical damage, severe kinks or necking.

Cast-in or potted rope ends must be checked regularly for strand breakage and corrosion where the rope emerges from the cast metal.

Rope end fastenings using press-fit sleeves must be checked for strand breakages adjacent to the sleeve, cracks in the sleeve material and slippage of the wire rope through the sleeve.

For further inspection requirement, refer to German Industrial Standard DIN 15 020 Part 2.

NOTE: We cannot guarantee faultless operation of the crane if ropes are used other than those specified by us.

SMØREMIDDEL LUBRICANT	+ 40--- ÷ 30° C	4				2	12	7/9		5	7/9	3			4
	+ 45 --- ÷ 20° C	3				1									3
POSITION		A	B	C	D	E	F	G	H	J	K	L	M	N	O
METODE METHOD															
MAX. PERIODE I UGER	KONTROL CHECK					1	4	1	4	1			12	52	4
	SMØREINTERVAL LUBE INTERVAL	4	12	25	1						12				*
MAX. PERIOD IN WEEKS	SKIFT CHANGE					52				52					
MAX. ANTAL DRIFTSTIMER	KONTROL CHECK					100	100	50	100	20		8	250	250 0	100
MAX. NUMBER OF OPERATION HOURS	SMØREINTERVAL LUBE INTERVAL	100	250	125 0	20						250				*
	SKIFT CHANGE					1000				250 0					
	EVT. SMØRING LUBE IF REQUIRED							•	•			•	•	•	
<p>* EFTERFYLDES, NÅR FYLDMÆNGDEN ER NEDE PÅ CA. 1/9 AF MAXIMUM.</p> <p>REFILL WHEN APPROX. 1/5 OF THE MAX. FILLING IS LEFT IN THE TANK.</p>															

DANSK - BEMÆRKNINGER

De fleste rulningslejer er livstidssmurte og kræver ingen smøring.

Pos. E: Første skift af olie i gearkasser foretages efter 12 uger eller 250 driftstimer.
Gearkasser skal udskylles med skylleolie, før ny olie påfyldes.

ENGLISH - NOTES:

Most ball/roller bearings are lifetime sealed and require no greasing.

Pos. E: First change of oil in gearboxes after 12 weeks or 250 operating hours.
Clean out the gearboxes with flushing oil before filling in new oil.

SMØREMIDLER :
LUBRICANTS : INFO NO.: 2102

REF.	SHELL	GULF	ESSO	MOBIL	TEXACO	CASTROL	MOLUB-ALLOY	SPECIAL	
1	Omala 150 Multigrade 85W/140	EP Lube S 88 MP GO 90	Spartan EP 150 GO GX 80 / 90	Mobilgear 630 Mobilub HD 90	Multigear Lube EP 80W/140	Alpha SP 220 Hopoy LS 90	Gear Oil 90		
2	Omala HD 150 Multigrade 80W/90	Mechanism LP55 Harmony AW 54	Spartan synthetic EP220	Mobilgear SHC 629 Mobilub HD 80	Multigear Lube LP 80W/90	Hopoy Light 80 Hopoy C 80W/90	Gear Oil 80		ONLY
3	Alvania EP 2 Retinax A	Gulfcrown Grease No. 2	Beacon EP 2 MP Grease	Mobilplex 48 Mobilgrease 77	Multifak EP 2	APS 2 Grease LM Grease	BRB 572	Lubral MP 2	
4	Aero Shell Grease 14		Beacon EP 2 MP Grease	Mobilplex 48	Regal AFB 2 Multifak EP 2	APS 2 Grease LM Grease	BRB 572-1		Slewing Ring & King Pin assemb.
5	Tellus T37	Mechanism LP 47 Harmony AW 48	Nuto HP 32	Mobilfluid 125	Rando Oil HDAZ-32	Hyspin AWS/AWH 32			
6	Tellus R5					Hyspin VG 5			
7	Kuggspray Kugggrease	Lubcote Spec.	Surret Fl. 30	Mobiltac 81	Texclad Spray	Grippa 60S Grippa 33S	OG Grease 882 EP Medium	Molykote W Ferro Gard Sp. Medium 12%	Winter
8	Tonna T68	Gulfway	Millcot K 55	Vectra No. 2	Way Lube 68	Magna BD 68 Non Creep 26	MWO-30		
9	HD Grease 221	Gulflex Moly			Molytex EP 2	MS 3 Grease Impervia MO	OG Grease 882 EP Heavy	Molykote X Molypan K	Summer
10								Ferro Gard Molymax	
11	Spirax HO Multigrade 85W/140				Multigear Lube EP 80W/140	Hypoy C 85W/140 Hypoy C 80W/140	Gear Oil 140		
12	Grease S 3655	Gear Grease 0 *)	Fibrax 370 *)	Mobilplex 44 *)	Marfak 00 *)	DK Grease *) Alpha Gel	Grease 0 *)		
13	HD Grease 221				Molytex EP 2	MS 3 Grease Impervia MO			
14								Silicon Grease	

On delivery the cranes are lubricated with SHELL.

*) Must not be mixed with SHELL GREASE S 3655

REF.	SHELL Before 820101	CHEVRON	BP	ELF					
1	Spirax HD 90	Universal Gear lube 85W/140	Hypogear 85W/140EP	Tranself B 85W/140					
2	Spirax HD 80	Universal Gear lube 80W	Hypogear 80W/90EP	Tranself B 80W/90					
3		Polyurea EP Grease 2	Energrease LS-EP 2	Epexa 2					
4		Polyurea EP Grease 1	Energrease LS-EP 1						
5	Tellus T27	EP Hydraulic Oil 32 HV	Energol SHF 32	Hydrelf 32					
6	Tellus C5		Energol HP 5						
7			Energrease OG						
8		Way Oil 68	Maccurat 68	Resto 68					
9		Pinion Grease MS	Energrease L 21 M						
10									
11	Spirax HD 140	Universal Gear lube 85W/140	Hypogear 85W/140EP	Tranself B 85W/140					
12		GP Grease 0)	Energrease FG 00-EP						
13			Energrease L 21 M						
14									

On delivery the cranes are lubricated with SHELL.

*) Must not be mixed with SHELL GREASE S 3655

LUBRICATION

APPROXIMATE QUANTITY OF OIL LIST

Location	Approx. Quantity (litres)	Number of units	Note
Hoist winch gear Bearing			
Luffing winch gear Bearing			
Fly winch gear Bearing			
Tugger winch gear Bearing			
Luff thruster brake SB8.1 Hoist thruster brake SB8.2 Aux thruster brake SB8.1			