Railway Crane
User's Manual
Maintenance (Part-III)

140 TONNE DIESEL HYDRAULIC B.D.CRANE WITH 'A' FRAME

140 T GOTTWALD CRANE 1986 DESIGN
REVISED EDITION- Dec'2002

LOCOMOTIVE WORKS JAMALPUR

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Periodic Maintenance Schedules **1**

Note:- The maintenance overhaul work performed in relation to this manual given in Part-1 is as per RDSO Maintenance Schedule of 140 T crane vide Report No. MP-727/90 and added by Jamalpur on feedback of users & experience gained during SEG Visits.

Any change in the RDSO's Maintenance Schedule Report will be circulated by RDSO. Corresponding correction should be made in this manual also.

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This schedule for examination and maintenance of the various parts of 140 t Diesel Hydraulic Breakdown Crane (GOTTWALD DESIGN) has been evolved taking into account the experience gained by allot tee railways in the field of crane maintenance.

The service periods of cranes specified in this schedule for maintenance attention are the maximum allowable between successive examinations. Variations in operating conditions between successive examinations. Variations in operating conditions may make it necessary to carry out examinations more frequently, or to introduce examination of details not scheduled herein. In such cases the matter should be brought to the notice of the concerned Sr DME / DME/AME who alone is authorised to introduce any change in the standard examination detailed herein. The Sr DME/ DME/ AME must in all cases, bring to the notice of the Motive Power Directorate of RDSO, any modifications to the schedules giving full details.

The intensive utilisation of the crane makes such a scheme necessary in order to reduce the ineffective time. A well-organised inspection is essential to ensure reliability and freedom from failure of various details in service. Whilst carrying out the works of the schedule, all missing nuts, bolts, set screws, cotters, and split pins etc. must be replaced and also the items when found defective must be renewed.

There are certain fundamental requirements that are important to any successful maintenance programme. These are:-

1. Adequate provision of well-trained supervisors and quality workmen.

2. Adequate provision of proper maintenance facilities and tools.

3. Adequate time for scheduled maintenance work to be completed properly before the crane is released for its next assignment.

4. Provision of fuel, lubricating oil and water treatment equal to or better than that required ensuring satisfactory crane performance.

5. A well scheduled maintenance programme including an effective system of maintaining records – for this purpose, various prescribed schedule forms recommended to be filled up during each schedule are given at the end of the report.

6. All measuring devices such as torque wrenches, lubricant dispensers etc., which require calibrating should be checked quarterly for accuracy or sooner, if required.

7. All tools and parts should be accounted for and removed from the crane after any maintenance work has been performed.

8. All work done including methods and tools used must be in accordance with manufactures instructions/ maintenance manual or any technical orders issued.

9. Only genuine spare parts should be used.

10. Use of waste cotton on diesel hydraulic crane is PROHIBITED. Use only lint less rags or wiping towels. The appearance of exterior and interior of the crane must be maintained properly.

11. The crane must be maintained in first class/ tip – top condition, so that, it can be despatched to the site of accident without any delay.

12. The Fire Extinguishers are to be maintained by the appropriate authority up to the requisite standard. Under no circumstance should any diesel hydraulic crane be allowed to leave the shed without Fire Extinguishers.

13. The nature of any ball or roller bearing is such that very little lubrication is required. The grease which may be packed in the bearing is sufficient for many hours of operation, and unless the grease is lost by leaking out through the seals; the amount of grease applied at any one greasing is small. More failure in ball and roller bearings are caused from dirt and over greasing than from lack of lubrication. The manufactures' recommendations for the maintenance and lubrication should, therefore, be rigidly followed.

14. Whenever any schedule examination is carried out, all the items of the lower schedules should also be attended to.

PERIODIC MAINTENANCE SCHEDULES

To ensure reliable operation and for the proper upkeep of140T diesel hydraulic brake down cranes following periodic maintenance schedules have been prescribed:-

1. Daily schedule
2. Schedule at the completion of 100 working hours (monthly)
3. Schedule at the completion of 250 working hours (3 monthly)
4. Scheduler at the completion of 500 working hours (6 monthly)
5. Schedule at the completion of 1000 working hours (yearly)
6. Schedule at the completion of 2000 working hours (2 yearly)
7. Schedule at the completion of 4000 working hours (4 yearly)
8. Schedule at the completion of 8000 working hours (8 yearly) **i.e. POH** – this is to be carried out at Eastern Railway Workshop / Jamalpur.

Details in regards to various checks/ attentions to different components / assemblies during mentioned prescribed time bound maintenance schedule are given in subsequent pages.

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Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
1	**DAILY**	
1.1.	**BEFORE STARTING THE ENGINE**	
1.1.1	**MAIN ENGINE**	**2.4**
1	Check engine oil level and top up if necessary (recommended oil castrol Deusol Super 20 m W - 40; SAE –40 or equivalent). Must be maintained at 'H' mark.	
2	Checks for evidence of fuel, oil, water and exhaust leaks.	
3	Fill / top-up radiator with clean/chromate treated water which should be free from any suspended impurities such as clay, sand, etc. Radiator cap should be fitted back after necessary fill up since this will cause aeration and over heating of the water/coolant.	
4	Battery acid level to be checked up and to be topped up if necessary with distilled water. The terminal should be adequately coated with petroleum jelly.	
5	Clean dust pan and pre –cleaner on dry type Air Cleaners.	
6	Clean crank case breather.	
7	Check belt tension and condition of belts for cuts, fretting, cracking, etc.	
8	Fuel tank to be filled up with clean diesel oil to "FULL" capacity (Capacity 1000 litres)	
9	Check for loose foundation bolts. Tighten then if required.	**2.5**
1.1.2	**AUXILIARY ENGINE**	
1	Check for engine sump oil level. Top up, if necessary.	
2	Fuel tank to be filled up with clean diesel oil to "FULL" capacity (capacity 11 litres).	**2.2**
1.1.3	**SUPERSTRUCTURE**	
1	Check for the oil level in pump distribution box (P.T.O.Unit). Top up, if necessary (oil: HP –90).	
2	Check hydraulic oil level. Top up, if necessary (oil: HLP –68). For this check, rising of gallows may be necessary.	

Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
3	Check if all the stop valves of the hydraulic tank are open; if not, open them fully.	
4	Top up air oilier supply, if necessary (Oil: HP –90).	
5	Observe for any leakage or damages of hoses and pipes. Rectify if necessary.	
6	Check the cablings connecting the various parts of the PAT/electrical system for physical damages.	
7	Drain condensate from both air reservoirs.	
8	Check fire- extinguishers and first Aid Box in position and keep them in working order.	
	NOTE: Even minor leakage of oil must be noted and eliminated.	
1.1.4	**UNDERCARRIAGE**	**2.3**
1	Check for axle mounted air compressor system for damages and deficiencies; make good if any.	
2	Checks, spring suspension for any breakage or deficiency.	
3	Check for damage and deficiency in the brake system including pipes and hoses.	
4	Floor plate to be cleaned. Ensure it is free from oil and greasy substances.	
5	Drain out condensate from all the six air reservoirs (3 small size ones of capacity 14 litres each and 3 large size ones of capacity 50 litres each).	
6	Check leakages and functioning of parking brake.	
	NOTE: Even minor leakage of oil must be noted and eliminated.	
1.1.5	**MATCH TRUCK**	**2.6**
1	Check for breakage of deficiency in spring suspension system.	
2	Check for damage and deficiency in the brake system including pipes and hoses.	
3	Check leakages and functioning of parking brake.	

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Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
1.2	**AFTER STARTING THE ENGINE**	
1.2.1	**MAIN ENGINE**	**2.4**
1	Check leakages of oil, water, and air supply and rectify wherever required.	
2	Check for any loose nut, bolt, or fastener. Tighten them, if required	
3	Check gauges and indicators for engine speed, ammeter, lube oil temperature, lube oil pressure, water temperature indicator and fuel indicator in driver's cab. (For details refer engine maintenance manual.)	
4	Check lube oil pressure at both idling and maximum speed (Operating Pressure 8 PSI and 40/70 PSI respectively).	
5	Clean the engine.	
1.2.2	**AUXILIARY ENGINE**	**2.5**
1	Check for any leakage of oil. Rectify wherever required.	
2	Check for loose foundation bolts. Tighten them, if required.	
3	Clean the engine.	
1.2.3	**SUPERSTRUCTURE**	**2.2, 2.3,2,7 & 6.5**
1	Check air pressure (operating pressure to be 6.5 bar to 7.5 bar); rectify faults, if any.	
2	Check pollution indicator of hydraulic oil filter. Replace the filter if the indicator is at the red mark or above 3 bar.	
3	Check hydraulic oil pressure of slewing circuit (200 bar), power circuits I and II (280 bar) and pilot circuit (30 bar).	
4	Check functioning of fans, lights, screen wipers, and horns in cab.	
5	Checks for leakages of oil water and air; rectify wherever required.	
6	Ensure that all limit switches are in working order.	
7	Check that solenoid valves are not bridged (manually).	
1.2.4	**UNDERCARRIAGE**	**2.3**
1	Check for leakages; rectify, wherever required.	
2	Check functioning of brake rigging arrangement.	

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After 100 Working Hours (Monthly) 1.3

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Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
2	**AFTER 100 WORKING HOURS (MONTHLY)**	
2.1	**MAIN ENGINE**	**2.4**
1	Clean the air intake filter.	
2	Make sure that the vent hole in the fuel tank cap is clear.	**2.1.6**
2.2	**SUPERSTRUCTURE**	
1	Check that display of radius on the PAT console of the crane agrees with the actual radius.	
2	Check that all working parameters of load charts are in relation to PAT cut off.	
2.3	**UNDERCARRIAGE**	**2.2 & 2.3**
1	Check for travel brake equipment, linkages, linings, etc. and pneumatic systems.	
2	Check functioning of out- riggers and hydraulic cylinders.	
3	Lubricate travel gears with grease.	
4	Lubricate brake linkage with oil.	
5	Lubricate out rigger pins with oil.	
6	Lubricate side bearer with grease.	
7	Check lubricating oil level and top up if necessary (Recommended oil-Castrol Densol Super 20 W 40), SAE –40 equivalent) **REF:** RDSO's SL/CR/140t/BG/JMP dt. 8.5.1992	
8	Lubricate bogie pivot with grease.	**2.6**
2.4	**MATCH TRUCK**	
1	Lubricate trestle pad and trestle pivot with grease.	
2	Lubricate side bearer with grease.	
3	Lubricate brake linkage pins with oil.	
2.5	**JIB**	**2.14**
1	Lubricate main and auxiliary snatch block swivel and sheave bearings.	
2	Lubricate derrick pulley blocks and sheaves bearings.	
3	Lubricate ropes with grease.	

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After 250 Working Hours (3-Monthly) 1.4

Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
3	**AFTER 250 WORKING HOURS (3-MONTHLY)**	
3.1	**MAIN ENGINE**	**2.4**
1	Change/ replace engine oil. **NOTE**: When lube oil is examined through lube oil analysis in a laboratory, oil change period may be extended, if oil condition satisfactory.	
2	Fit new lube oil full flow, filter element, and gasket.	
3	Remove, clean and inspect dry type air cleaner for holes and tears. Check gaskets/ 'O' rings for damage. Paper type elements should be cleaned by compressed air, in the direction opposite to the flow of air. Discard element even if a pinhole exists.	
4	Change lubricating oil bypass filter element and gasket.	
5	Change water filter element.	
6	Change fuel filter element and gasket.	
7	Check all air – cleaner connections for cracks, chafing, etc. Tighten all air in –take connections.	
8	Drain water and sediments from fuel tank.	
9	Clean crankcase breathers.	
3.2	**UNDERCARRIAGE**	**2.3 & 2.13.7**
1	Checks wear on brake lining.	
3.3	**MATCH TRUCK**	**2.6**
1	Checks wear on brake lining.	
3.4	**JIB**	**2.14**
1	Lubricate rope, drum, sheaves, and jib stopper pad with grease.	
2	All structural components are to be visually examined for defects/ cracks	

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Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
4	**AT THE COMPLETION OF 500 HRS (6 MONTHLY)**	
4.1	**AUXILIARY ENGINE**	**2.5**
1	Knock out soot from the exhaust silencer.	
2	Clean the cooling air duct and space between cooling fins on cylinders.	
4.2	**SUPERSTRUCTURE**	**2.2**
1	Checks drive assemblies.	
2	Check oil level and top up, if necessary (Oil: HP –90) : - Pump distribution gear box - Main hoist reduction unit - Auxiliary hoist reduction unit - Derrick reduction unit - Recovery winch reduction unit - Slewing gear reduction unit - Traction gearbox.	
3	Clean and re-grease boom foot sliding surface (fork and pin).	
4	Lubricate: - Counter weight gallows with grease, - Rope drum bearings with grease, - Foot pedal in cab with oil.	
5	Check ropes for damages/ breakages.	
6	Collect sample of hydraulic oil. Get it tested and replace if required.	
4.3	**UNDERCARRIAGE**	**2.3 & 2.13.7**
1	Clean and lubricate with grease : - Sliding surfaces - Slewing gear teeth - Traction gear reduction unit - Splined shaft - Screw coupling and buffers.	
2	Lubricate with grease (Servo Coat - 140) slewing ring bearing through grease nipples.	
3	Lubricate bogie bolster pins with grease.	

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After 500 Working Hours (6-Monthly) **1.5**

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Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
4.4	**MATCH TRUCK**	**2.6 & 2.13.7**
1	Clean and lubricate screw coupling and buffers with grease.	
2	Lubricate bogie pivots with grease.	
3	Lubricate bogies bolster pins with grease.	

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Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
5	**AT THE COMPLETION OF 1000 HOURS (YEARLY)**	
5.1	**MAIN ENGINE**	**2.4**
1	Check for turbocharger oil leaks.	
2	Tighten turbocharger mounting nuts.	
3	Check engine blow –by.	
4	Clean radiator.	
5	Adjust injector and valves.	
6	Check wobble and eccentricity/ alignment marks on rubber type. Discard damper if misalignment is more than 1/16”.	
7	Check belt tension and adjust as required.	
8	Remove and clean air compressor breather element.	
5.2	**AUXILIARY ENGINE**	**2.5**
1	Drain sumps. Flush out with approved brand of flushing oil and refill with new oil.	
2	Clean the oil tank and ceramic filter thoroughly.	
3	Clean fuel filter bowl.	
4	Change paper element of the fuel filter.	
5	Change the lub oil filter.	
5.3	**SUPERSTRUCTURE**	**2.2**
1	Drain sediment from hydraulic oil tank.	
2	Check oil, water and air hoses. Change them, if necessary.	
3	Check for corrosion. Repair, if required and paint.	
4	Clean water and air cooler fans with water jet.	

After 1000 Working Hours (Yearly) 1.6

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Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
5	Inspect drive assembly.	
6	Carry out fuel oil tank flushing.	
7	Change gearbox oil.	
8	Check setting of limit switches.	
9	Check windows and doors for corrosion, proper fitting and locks.	
5.4	**UNDERCARRIAGE**	**2.6**
1	Check oil level of the travel gear box.	
5.5	**MATCH TRUCK**	**2.6**
1	Check oil level in compensator tanks of hydraulic brake control.	

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After 2000 Working Hours (2-Yearly) 1.7

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Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
6	**AT THE COMPLETION OF 2000 HOURS (2 YEARLY)**	
6.1	**AUXILIARY ENGINE**	**2.5**
1	Change the paper element of air cleaner.	
6.2	**SUPERSTRUCTURE**	**2.8.3 & 2.6**
1	Re- tightens all the bolts of the slewing ring with a tightening force of 783.7 KN + 6.6 KN. If one or more bolts are found to be slack while tightening with torque wrench, then loose bolts should be replaced. Simultaneously two adjacent bolts of the slack bolt/ bolts also should be replaced. If 12 or more bolts are slack, all bolts should be replaced.	
2	Check brake equipment for functioning.	
6.3	**UNDERCARRIAGE**	**2.8.3 & 2.6**
1	Re-tighten all the bolts of the slewing ring with a tightening force of 783. 7 KN +_ 6 KN. If one or more bolts are found to be slack while tightening with torque wrench, then loose bolts would be replaced. Simultaneously two adjacent bolts of the slack bolt/ bolts also should be replaced. If 12 or more bolts are slack, all bolts should be replaced.	
2	Check brake equipment for functioning.	
6.4	**MATCH TRUCK**	**2.6**
1	Check brake equipment for functioning.	

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After 4000 Working Hours (4-Yearly) 1.8

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Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
7	**AT THE COMPLETION OF 4000 HOURS (4 YEARLY)**	
7.1	**MAIN ENGINE**	**2.4**
1	Check turbocharger end clearance.	
2	Check accessory drive end clearance.	
3	Check crank shaft end clearance.	
4	Clean injector inlet screens.	
5	Clean and calibrate all injectors.	
6	Check fuel pump calibrations.	
7	Replace fuel pump filter screen and magnet.	
8	Check fan hub and drive.	
9	Clean and tighten all electrical connections. **NOTE**: Arrange for authorised dealer for engine manufacturer's mechanic to check your engine completely – refer engine maintenance manual for details.	
7.2	**AUXILIARY ENGINE** **NOTE:** Arrange for authorised dealer for engine manufacturer's mechanic to check your engine completely – refer engine maintenance manual for details.	**2.5**
7.3	**SUPERSTRUCTURE:**	**2.1.5**
1	Carry out visual inspection of wire ropes by disassembling.	
7.4	**UNDERCARRIAGE**	**2.3**
1	Check wheel wear.	
2	Inspect axle box roller bearings and refill with grease (LITHON –3 HPC).	
7.5	**MATCH TRUCK**	**2.6**
1	Check wheel wear.	
2	Inspect axle box roller bearing and refill with grease (LTTHON –3HPC)	

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After 8000 Working Hours (8-Yearly) 1.9

Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
8	**POH AT THE COMPLETION OF 8000 HOURS (8YEARLY) (TO BE CARRIED OUT AT E.RLY. WORKSHOP, JAMALPUR)**	
8.1	Run the main power pack	2.4
1	Check all motions.	
2	Check all safety devices.	
3	Check all load chart parameters in regard to PAT and Limit Switch cut off.	
8.2	Run the auxiliary power pack and check all motions of auxiliary Circuit	2.5
8.3	Jointly check with crane Incharge for all damages / deficiencies/ working problems/ anything abnormal. Verify jointly with crane Incharge consignee reports, while crane received for POH>	2.2
8.4	Crane with match truck to be placed in POH bay having E.O.T facility.	2.13.4 & 2.15
8.5	Remove all lifting tackles, lifting beams and counter weights from match truck. Send lifting tackles and beams to chain house along with original certificates for examination and testing.	2.15
8.6	Open hoist –I wire rope, hoist –II wire rope, derrick wire ropes and winch rope. Send them Chain House along with original certificate for examination and testing.	2.15
8.7	Open gantry rope, load cell, equaliser, sensor cable, and stopper.	2.14
8.8	Remove bridle, stopper, and boom (Check bridle pulleys, structural damage and nylon items.	2.14
8.9	Open ‘A’ frame (front leg, upper leg). Check pulleys, structural damage, and nylon items.	2.14
8.10	Open gallows. Check structural damage and nylon items.	
8.11	Remove match truck for POH.	2.5
8.12	Start auxiliary power pack and slew the crane for take out main power pack under propped condition.	2.4
8.13	Disconnect all sensing devices of main power pack (electrical)	

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After 8000 Working Hours (8-Yearly) **1.9**

Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
8.14	Open main power pack and lower for POH (Before opening, close all stop cocks except auxiliary pumps Q8 and Q9). Send the main power pack to authorised dealer / manufacturer for POH and load testing.	2.4
8.15	Start auxiliary power pack, slew back the crane and release the props.	2.5
8.16	Open auxiliary power pack and lower for POH (Before opening, close stop cock). Send the auxiliary power pack to authorised dealer / manufacture for POH and load testing.	2.5
8.17	Disconnect all hoses and pipes of under carriage and rotor (check, replace if required)	2.2
8.18	Open the pivot nut; lift the crane; run out bogie; keep on trestle.	2.6.4
8.19	Release wheels and send to wheel shops for inspection of bearings and regressing and necessary repairs. Check wear of brake disc, brake shoe and working of the parking brakes. Re –adjust / replace, if required.	2.6.5
8.20	Open the pivot nut of match truck; lift the match truck; run out bogie; keep on trestle.	2.6.4
8.21	Release wheels and send to wheel shop for necessary inspection and repair. Check wear of brake disc, brake shoe and working of the parking brakes. Re – adjust / replace, if required.	2.6.4,2.6.5 & 2.6.9
8.22	Check travelling gear box, pneumatic cylinders and valves. Replace as required.	2.6.1
8.23	Check structural damage of bogie (crane and match truck) and repair as required.	2.13.7
8.24	Disconnect all hoses and pipes of superstructure and rotor.	
8.25	Drain out entire hydraulic oil (HLP –68) and store in drum. Flush the tank before refilling with fresh hydraulic oil.	2.2.3
8.26	Drain out entire diesel oil and store in drum. Flush the tank before refilling with fresh diesel oil.	2.4.3

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After 8000 Working Hours (8-Yearly) 1.9

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Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
8.27	Dismantled all motion's machineries i.e.:	2.9.2,2.10.2, 2.11.2 & 2.12.2
1	Main hoist drum assembly,	
2	Auxiliary hoist drum assembly,	
3	Derrick drum assembly,	
4	Recovery winch drum assembly. Inspect these assemblies and replace as required.	
8.28	Fitment of slewing ring:	2.8
1	Levelling of slewing ring to be ensured	
2	Systematically replace all bolts and nuts of slewing ring of super structure and under carriage	
3	Grease the slewing ring.	
4	Tighten the bolts with a tightening force of 783.7 KN + 6.6 KN. Follow the sequence strictly as recommended by manufacture.	
8.29	Lift super structure and keep on trestle.	
8.30	Check all gear boxes (replace if required) :	24.2,2.8 2.9.1,2.10.1, 2.11.1 & 2.12.1
1	Hoist –I (Main)	
2	Hoist –II (Auxiliary)	
3	Derrick	
4	Slewing gear box	
5	Recovery winch. Replace the oil (Oil: HP –90).	
8.31	Check all cylinders, valves of super structure and under carriage (Replace if required).	2.2

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After 8000 Working Hours (8-Yearly) 1.9

Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
8.32	Check structural damage of super structure and under carriage. Repair as required.	2.13
8.33	Lift super structure and keep on under carriage on slewing ring. Follow manufacturer's instructions while assembly.	2.13
8.34	Keep all motion's machinery in position systematically	2.9.2,2.10.2, 2.11.2 & 2.12.2
1	Main hoist drum assembly	
2	Auxiliary hoist drum assembly	
3	Derrick drum assembly	
4	Slewing gear box	
5	Recovery winch drum assembly.	
8.35	Keep auxiliary power pack in position and connect the hoses.	
8.36	Connect the hoses and pipes of rotor with super structure.	2.5
8.37	Connect all hoses and pipes of all drum assembly of super structure.	2.2
8.38	Fill up hydraulic oil (HLP –68) into the tank (Capacity 1400 litre).	2.9.2,2.10.2, 2.11.2&2.12.2
8.39	Assemble the bogies (after receiving wheel sets from wheel shop) of:	2.2.3
1	Crane	2.13.7
2	Match Truck.	
8.40	Push the bogies inside the crane/match truck.	2.13.7
8.41	Lift the crane, remove trestle and lower on bogies (Tighten the pivot nut).	
8.42	Lift the match truck; remove trestle and lower on bogies (Tighten the pivot nut).	
8.43	Connect all hoses and pipes with under carriage and rotor.	
8.44	Connect all hoses and pipes of match truck.	2.2 &24.3
		2.2 & 2.3

After 8000 Working Hours (8-Yearly) 1.9

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Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90	Ref. No. of Maintenance Manual
8.44	Attach match truck with crane.	
8.45	Assemble main power pack in position; connect all pipes (after slewing the crane and propping by auxiliary power pack.).	2.4
8.46	Assemble gallows in position and fit cylinders.	2.2.11
8.47	Assemble 'A' frame (lower leg, upper leg and front leg) in position.	2.14
8.48	Assemble boom in position.	2.14
8.49	Assemble stopper in position.	2.14
8.50	Assemble bridle block in position.	2.14
8.51	Assemble gantry/ tension wire rope with equaliser, load cell and bridle block.	2.15
8.52	Start main / auxiliary power pack.	2.4 &2.5
8.53	Reeve on derrick wire ropes.	2.11.2
8.54	Reeve on main hoist wire rope.	2.9.2
8.55	Reeve on auxiliary hoist wire rope.	2.10.2
8.56	Reeve on recovery winch rope.	2.12.2
8.57	Check all electrical items and connect.	2.1
8.58	Check all load chart parameters in reference to PAT and set all limit switches.	2.1.6
8.59	Test and trial at 25% over load.	
8.60	Spray paint.	

Sl. No.	Schedule Item as per RDSO Maintenance Schedule Vide Report No. MP- 727/90
9	**GENERAL WORKING INSTRUCTIONS:**
1	Periodic maintenance of the crane should be done after it is placed on level track and parking brakes of crane and match truck applied.
2	After completion of schedule maintenance work check and ensure that no tools or replaced parts lie over the crane.
3	The staff while working under the crane or while standing over footboards/ super structure must not smoke or strike up fire nearby.
4	In case any structural part is damaged and it is to be rectified, ensure:
4.1	Direct flame does not damage cables, hoses, pipes; must take all fire prevention measures for hoses, cables etc. from direct heat by shielding the flame.
4.2	For any structural repair, ensure proper preheating, use of recommended electrodes and argoshield welding.
	FURTHER READING;
1	Gottwald's manual.
2	Engine manufacturer's manual.

Railway Crane
Maintenance Manual

Electrical System 2.1

Railway Crane
Maintenance Manual

Description

The superstructure switch cabinets serve to house the essential electrical and electric components, which are required to control, monitor and supply the crane with power. They are located in the machinery house, side panel **(See Figure 'A').**

SAFETY INSTRUCTIONS
Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.

In addition, a "Maintenance Work" warning sign must be visibly posted both in and out side the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.

The crane must not be in the way of other vehicles.

Ensure that no one is near hot and moving parts—Danger of getting burnt, crushed and drawn into the equipment!

Maintenance Instructions:

Check the switch cabinets for any external damage.

In particular, check the doors as to whether they close properly.

Any faulty seals must be replaced immediately.

* Check cabin connections for firm seating and damage.

Clean the switch cabinet's interior with a suitable cleaning aid.

Remove any water, which has penetrated into the cabinet.
Establish the cause and eliminate.

Clean the hinges and locks on the switch cabinet door and grease slightly

Railway Crane
Maintenance Manual

Figure 'A'

Railway Crane
Maintenance Manual

Description
The cableways and junction boxes serve to protect, distribute and fan in the cable looms. To provide a better overview and to protect the individual cables, the cables are concentrated in cableways.

SAFETY INSTRUCTIONS
Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and outside the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The cane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!

Maintenance Instructions
Check the junction boxes for external damage. Ensure, in particular, that the cover is sealed properly and tightly. If a cover is not seal properly, electrical equipment can be severely damaged through water and dirt penetrating.

Check the cables for external damage, bends, or sheering points and check whether the cables are firmly seated in the cable looms.

Clean the junction box interior with a suitable aid (e.g. vacuum cleaner). Eliminate any water, which may have penetrated into the boxes. Establish the cause and eliminate.

Railway Crane
Maintenance Manual

Description

The batteries are fed by the 3 – phase generator of the diesel engine system. The batteries supply the electrical system of the crane with power. The batteries for the diesel engine are located on a stand in machinery house**. (See Figure 'A')**

SAFETY INSTRUCTION

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and outside the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!
Never place objects or tools on the batteries. Keep the batteries clean and dry – Danger of short – circuiting!
Use caution when handling battery acid. Observe the respective safety regulations. Avoid contact with skin and do not drink - ***Danger of causticisation!***
Do not drink the purified water – ***Danger of poisoning!***
No smoking, no naked flame or light, sparks or glowing ashes near the batteries – ***Danger of explosion and fire!***
Caution near the overhead lines! Do not climb up on to crane superstructure!
Mortal danger!

Maintenance Instructions

Check the batteries and the cable-connecting terminal for external damage.

Check whether the batteries are firmly seated on the battery carrier: if required, tighten the mounting bolts on the retainer bar.

Screw out the filler plugs and check the electrolyte level; if required, top up the distilled water to the marking.

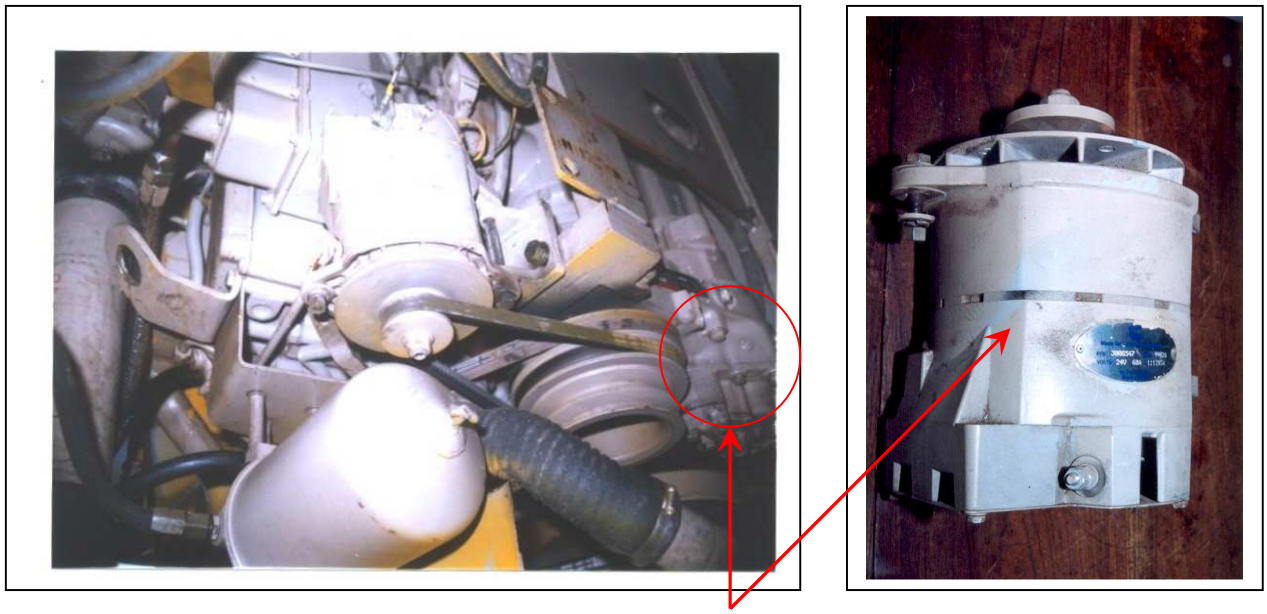
Clean battery covers with a suitable aid according to regulations and then dry to avoid leakage current. If moisture has penetrated in to the batteries, find the cause and eliminate it.

Clean the cable connecting terminals, grease with pole grease and check for firm seating. Then close the battery drawer.

Railway Crane
Maintenance Manual

Figure 'A'

Railway Crane
Maintenance Manual



3-phase generator

Description

The generator converts the mechanical power into electric power.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling. In addition, a "Maintenance Work" warning sign must be visibly posted both in and outside the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one in near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!

Maintenance Instruction

Check the generator and its connections for firm seating and external damage.

The fan belt and its tensioning are dealt with in the section on maintenance work for the diesel engine.

Note: When the engine is running:

- do not switch off the battery main switch.
- do not release battery terminals, pole terminals or lines in the mains
- do not allow the generator to run without being connected to the battery.
  - It is not permissible to short – circuit (or tap) the connections on the generator and the controller among one other or by earthing.

Hoist and Lowering Limit Switches 2.1.5

Description

The crane has limit switches for the main and auxiliary hoists as well as for the derricking gear. **(See Figure 'A')**

Derricking gear:

The limit switches for the derricking gear are mounted directly on the rope drum. In working range, the limit switches switch off in the steepest or lowest boom working positions. In addition, when the bridging switch activated, the derricking motion is switched off in the lowest boom position for transport purposes or in the steepest position for raising/lowering the counterweight.

Main and Auxiliary hoists:

Both hoists are fitted with a hoist and lowering limit switch, which are located on their respective hoist drums. The hoist limit switches switch off the hook in the highest hook position and thus prevent the hook gear from being pulled into the boom head. The lowering limit switches switch off the hoist in the lowest hook position and thus prevent the rope from uncoiling beyond the required remaining safety windings.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane can not be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and outside the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Caution near the overhead lines! Do not climb up onto the crane superstructure! Mortal danger!
Ensure that no one in near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!

Maintenance Instructions

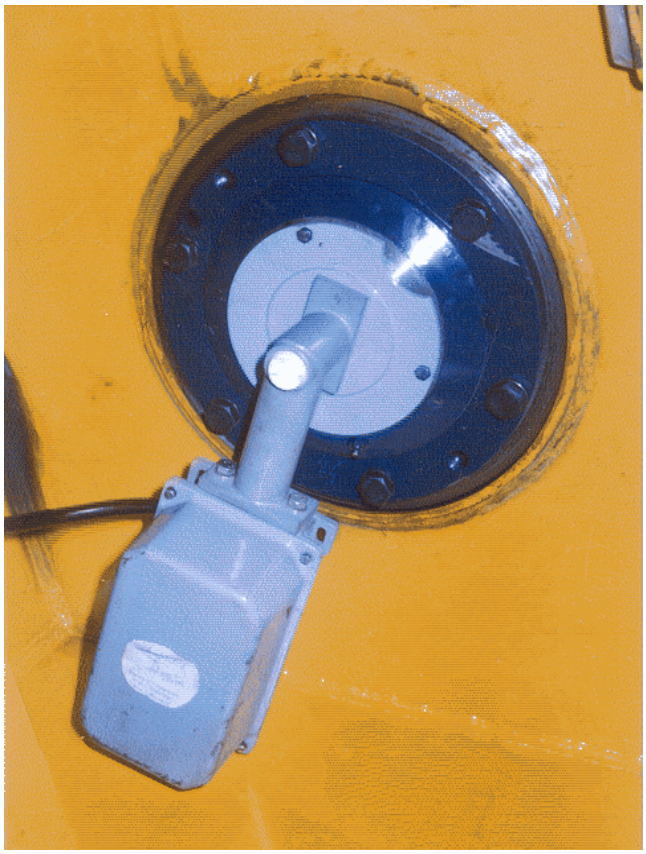
Check the limit switches and their mountings and connections for external damage and firm seating.

Open the limit switches and their mountings and connections for external damage and firm seating.

The functional test must be carried out without load. Approach all the switching points slowly.

Railway Crane
Maintenance Manual

Figure 'A'



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Maintenance Manual

PAT System **2.1.6**

P-1/1

Figure 'A'

Figure 'B'

Description

The PAT System **(Figure 'A')** ensures that crane elements are not subject to overload in all working positions and to ensure that the crane does not tip over because the load lifted exceeds the lifting capacity in the particular configuration.
The PAT system functions based on:

- The selected outrigger base
- The load cells on the load sensor located with gantry wire rope, left side.
- The angle sensor on the boom and slewing sensor

The respective data is shown on the control and display panel in the cab **(Figure 'A').**

In Crane No. 143001 to 143004 SLI of Amrita Lakshmi Electronics (**Figure 'A')** and in Crane No. 143005 to 143010 SLI of Mechanica Systems Pvt Ltd. Pune, has been fitted (**Figure 'B').** For this refer to the manual of these suppliers.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling. In addition, a "Maintenance Work" warning sign must be visibly posted both in and outside the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one in near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!

Maintenance Instructions:
Check the limit switches, the load cells, and the angle sensor for damage and firm seating.

When the functional test is carried out, all the limit switch switch-off points must be approached with care. Check as to whether the controls on the panel show the proper indication. In addition, check as to whether the limit switches switch off properly.

Lighting and Sockets 2.1.7

Description

The crane lighting consists of:

- Cab lighting.
- Machinery house lighting.
- One halogen spotlights for crane operation, at the centre in front of cab. **(See figure 'A')**
- A halogen spotlight for crane operation located up behind the superstructure.
- A spotlight located behind the cab for checking the hoist and derricking gears.
- Two adjustable spotlights on the boom head.

In addition, the crane is fitted with four 24 V sockets of which one is located in the cab and one each is located at the front and rear of each crane side.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and outside the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Caution near the overhead lines! Do not climb up onto the crane superstructure!
Mortal Danger!.
Ensure that no one in near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!

Maintenance Instructions:

Check all the lighting elements of the crane, their mountings, and cable connections for damage, firm seating, and moisture. Damaged or moist lighting fixtures must be replaced. Any damaged or faulty sockets must also be replaced.

Clean the lighting fixtures with a suitable aid.

Check the lighting elements for proper functioning. Any faulty lamps or lighting element with broken glass must be replaced immediately.

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Figure 'A'

Railway Crane
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Hydraulic System (S/S & U/C) 2.2

Railway Crane
Maintenance Manual

Description
The Crane has a main pump assembly which is located directly downstream of the pump distributor gearbox on the diesel engine.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and outside the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!
Use caution when dealing with oil danger of being burnt or scalded!
***Caution** – Hydraulic system! Work may only be performed on the hydraulic system when there is no pressure in the system and the diesel engine is stationary. This also applies to the tightening of hydraulic connections.*
Use caution when releasing connections that higher mounted components could drain dry. In these cases, ensure an adequately sized drip pan is available. Observe disposal regulations!
***Caution! -** Sections of the hydraulic and air pressure systems are still under pressure even when the crane is at standstill.*

Maintenance Instructions
Check the pumps **(See Figure 'A')** and their connections for external damage and leakages.

The running noises of the pumps must be checked. An increase in the running noises coupled with an increase in pressure indicate pump damage. In this case, the crane must not be operated and the pump must be replaced.

During operation, the operating pressure can be checked by means of pressure gauges mounted on right side panel in the cab **(See Figure' B ').** Faulty pressure gauges must be replaced;

Item No: 1	Control Oil	Operating Pressure: Max: 30 bar
Item No: 2	Slewing Gear	Operating Pressure: Max: 200 bar
Item No: 3	Pump 1	Operating Pressure: Max: 280 bar
Item No: 4	Pump 2	Operating Pressure: Max: 280 bar

Note: After work has been completed on the hydraulic system, during which oil has been lost out of the hydraulic circuit, top up the hydraulic oil in the housings of the hydraulic pumps and hydraulic motors via their respective leakage oil connections. Otherwise, the hydraulic system could suffer severe damage. To replace or top up oil, an external oil filter with a minimum retaining rate 10 µm must be used.
Caution! - If the oil stop cocks below the hydraulic oil tank are closed for work being performed on the hydraulic system, check as to whether the stop cocks have been re-opened prior to re-starting as otherwise the hydraulic system could suffer severe damage.

Railway Crane
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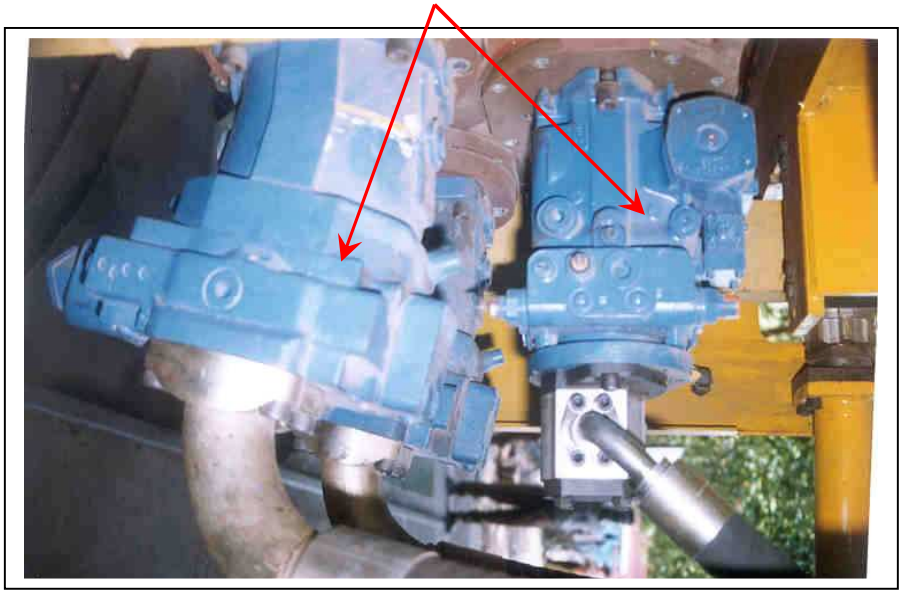
Figure 'A' **Main Pumps**



Figure' B '

Secondary pumps 2.2.2

Description

The secondary pump for emergency operation is located on the emergency diesel engine.
(See Figure 'A)

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling. In addition, a "Maintenance Work" warning sign must be visibly posted both in and outside the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one in near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!
Use caution when dealing with oil danger of being burnt or scalded!
Caution*- Hydraulic system! Work may only be performed on the hydraulic system when there is no pressure in the system and the diesel engine is stationary. This also applies to the tightening of hydraulic connections.*
Use caution when releasing connections those higher mounted components could drain dry. In these cases, ensure an adequately sized drip pan is available. Observe disposal regulations!
Caution! - *Sections of the hydraulic and air pressure systems are still under pressure even when the crane is at a standstill.*

Maintenance Instructions:

As the secondary pumps on the emergency diesel engine do not run in normal operation, it is necessary to carry out a trial run. The trial run must last at least 5 minutes against a minimum pressure 5 bar to a maximum pressure of 200 bar.

Check the pumps and their connections for external damage and leakages.

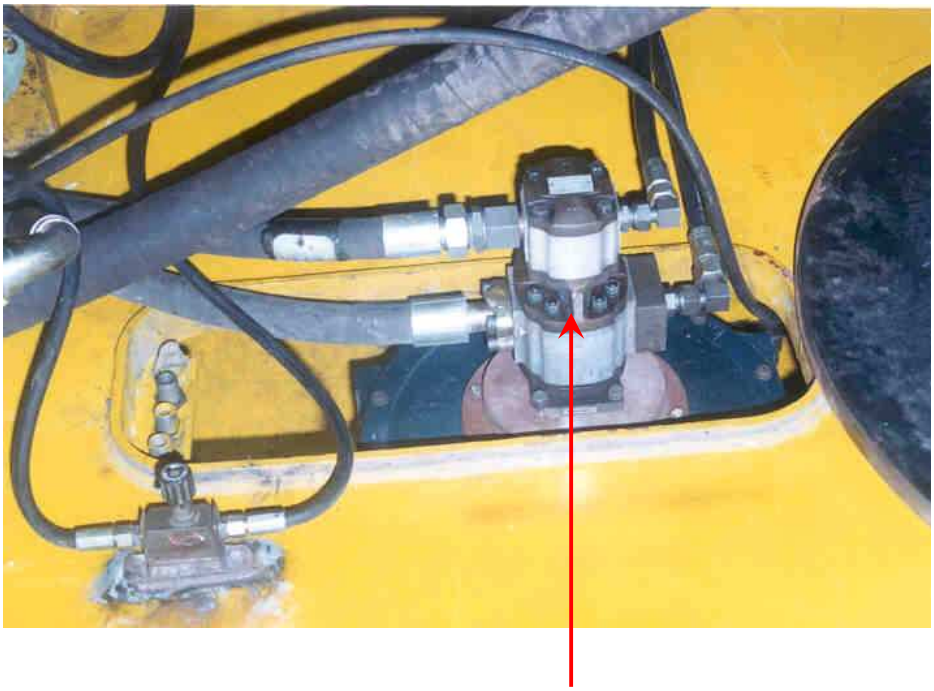
The running noises of the pumps must be checked. An increase in the running noises coupled with an increase in pressure indicates pump damage. In this case, the crane must not be operated and the pump must be replaced.

Note: After work has been completed on the hydraulic system, during which oil has been lost out of the hydraulic circuit, top up the hydraulic oil in the housings of the hydraulic pumps and hydraulic motors via their respective leakage oil connections. Otherwise, the hydraulic system could suffer severe damage. To replace or top up oil, an external oil filter with a maximum retaining rate of 10 µm must be used.

Caution !- If the oil stop cocks below the hydraulic oil tank are closed for work being performed on the hydraulic system, check as to whether the stop cocks have been re-opened prior to re-starting as otherwise the hydraulic system could suffer severe damage.

Railway Crane
Maintenance Manual

Figure 'A'



Secondary Pump

Railway Crane
Maintenance Manual

Description
The hydraulic oil tank serves to store the hydraulic oil for the hydraulic system. The hydraulic oil is added, topped and drained via the tank. The tank capacity is approx. 1400 Ltrs.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured the crane can not be switched on and is secured against rolling.
In addition, a" Maintenance Work" warning sign must be visibly posted both in and outside the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
Use caution when dealing with oil danger of being burnt or scalded!
***Caution!** Hydraulic System! Work may only be performed on the hydraulic system when there is no pressure in the system and the diesel engine is stationary. This also applies to the tightening of hydraulic connections.*
Use caution when releasing connections that higher mounted components could drain dry. In these cases ensure adequately sized drip pan is available.
Observe disposal regulations!
***Caution!** Sections of the hydraulic and air pressure systems are still under pressure even when the crane is at a standstill.*

Maintenance Instructions

Check the hydraulic oil tank and its connections for external damage and leakages.

The oil level can be read off by means of the dipstick (**See Figure 'A '**)
on the tank side. The oil level must be checked at operating temperature. The maximum oil level has been reached when all the cylinders are retracted. The oil must not fall below a minimum level when all the cylinders are completely extended.

When oil is added, it must be poured through an external mounted filter assly. with a filter absolute fineness of 10 μm.
Caution!- only use oil of the same brand for topping up.

The oil is drained via the oil drain plug below the hydraulic tank. (**See Figure 'B')**

Caution- oil quantity approx.1400 ltrs!

The breather filters are installed on the tank upper side (**See Figure 'A'**) whenever hydraulic oil is topped up, the filter cartridges of the breather filter must be checked and if required, replaced. To do so, unscrew the filter cover, change the cartridges, and screw on the cover again tightly.

There are two gauges (0-16 bar or 0-10 bar). If the impact pressure in running condition is 3-4 bar. Filters must be replaced by new.

Figure 'A '

Hyd. Tank Oil dipstick

Figure 'B'

Drainage Cock

Note: After work has been completed on the hydraulic system, during which oil has been lost out of the hydraulic circuit, top up the hydraulic oil in the housings of the hydraulic pumps and hydraulic motors via their respective leakage oil connections.

Otherwise, the hydraulic system could suffer severe damage. To replace or top up oil, an external oil filter with a minimum retaining rate of 10 µm must be used.

Caution! If the oil stop cocks below the hydraulic oil tank are closed for work being performed on the hydraulic system, check as to whether the stopcocks have been re-opened prior to re-starting as other wise the hydraulic system could suffer severe damage.

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Description

The hydraulic oil flow of the slewing gear pump is cleaned via line filter.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be insured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and outside the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near to or moving parts- danger of getting burnt, crushed or drawn into the equipment!
Use caution when dealing with oil danger of being burnt or scalded!

Caution*- Hydraulic system! Work may only be performed on the hydraulic system when there is no pressure in the system and the diesel engine is stationary. This also applies to the tightening of hydraulic connections.*

Use caution when releasing connections that higher mounted component could drain dry. In these cases, ensue an adequately sized drip pan is available. Observe disposal; regulations!

Caution! *– Sections of the hydraulic and air pressure systems are still under pressure even when the crane is at a standstill.*

Maintenance Instructions

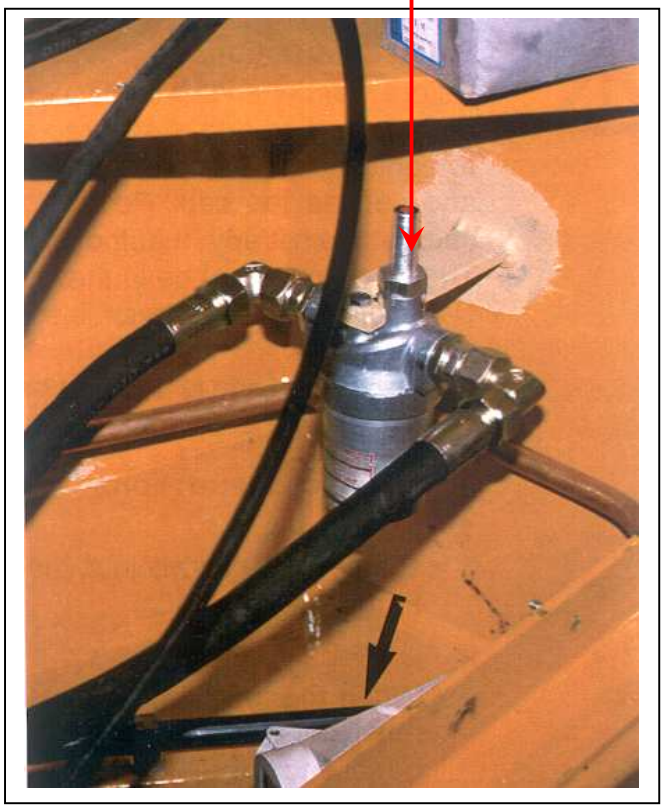
Check the filter and its connections and mountings for external damage, leakages, or firm seating.

The filter is fitted with a visual pollution indicator. **(See Figure 'A')** When the oil is at operating temperature, the red indicator on the filter must not be visible.

To change the filter;
* It is not possible to clean the filter insert. It must be replaced when clogged.
* Prior to changing the filter insert, first release the pressure via the pressure drain plug on the under side of the filter body.
* Then unscrew the filter body, remove the filter insert, empty the filter body and clean thoroughly. Check the thread and the seals as to whether they are in good condition and then wet with hydraulic oil.
* Prior to inserting the new filter element, screw the pressure drain plug tightly on.
* Screw in the filter body by hand until the mechanical stop. Then it must be loosed by ¼ rotations. The sealing effect is not better as a result of increased tightening.
* On completion of maintenance, check filter for proper sealing.

Figure 'A'

Slewing Gear Pump Filter



Note: After work has been completed on the hydraulic system, during which oil has been lost out of the hydraulic circuit, top up the hydraulic oil in the housings of the hydraulic pumps and hydraulic motors via their respective leakage oil connections.

Otherwise, the hydraulic system could suffer severe damage. To replace or top up oil, an external oil filter with a minimum retaining rate of 10 µm must be used.

Caution! If the oil stop cocks below the hydraulic oil tank are closed for work being performed on the hydraulic system, check as to whether the stopcocks have been re-opened prior to re-starting as otherwise the hydraulic system could suffer severe damage.

Railway Crane
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Description

The rotary lead-through is a rotary hydraulic connection between the undercarriage and the superstructure. **(See Figure 'A')** In addition, it houses the ducts for the air pressure supply.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and outside the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed or drawn into the equipment!
Use caution when dealing with oil danger of being burnt or scalded!
***Caution-** Hydraulic system! Work may only be performed on the hydraulic system when there is no pressure in the system and the diesel engine is stationary. This also applies to the tightening of hydraulic connections.*
Use caution when releasing connections those higher mounted components could drain dry. In these cases, ensure an adequately sized drip pan is available.
Observe disposal regulations!
***Caution**- Sections of the hydraulic and air pressure systems are still under pressure even when the crane is at a standstill.*

Maintenance Instructions

Check the hoses, their connections, and attachments for external damage, firm seating, and proper sealing.

- **a.** Replace any damaged components immediately. Any loose or leaky connections must be tightened or if required, replaced.
- **b.** Check the carrier for the rotary lead- through for correcting seating and damage.

Caution- The rotary lead- through must not be twisted, as otherwise the built-in seals will be damaged
Note: After work has been completed on the hydraulic system, during which oil has been lost out of the hydraulic circuit, top up the hydraulic oil in the housings of the hydraulic pumps and hydraulic motors via their respective leakages oil connections.
Otherwise, the hydraulic system could suffer severe damage. To replace or top up oil, an external oil filter with a minimum retaining rate of 10 μm must be used.
Caution!- If the oil stop cocks below the hydraulic oil tank are closed for work being performed on the hydraulic system, check as to whether the stop cocks have been re-opened prior to re-starting as otherwise the hydraulic system could suffer severe damage.

Railway Crane
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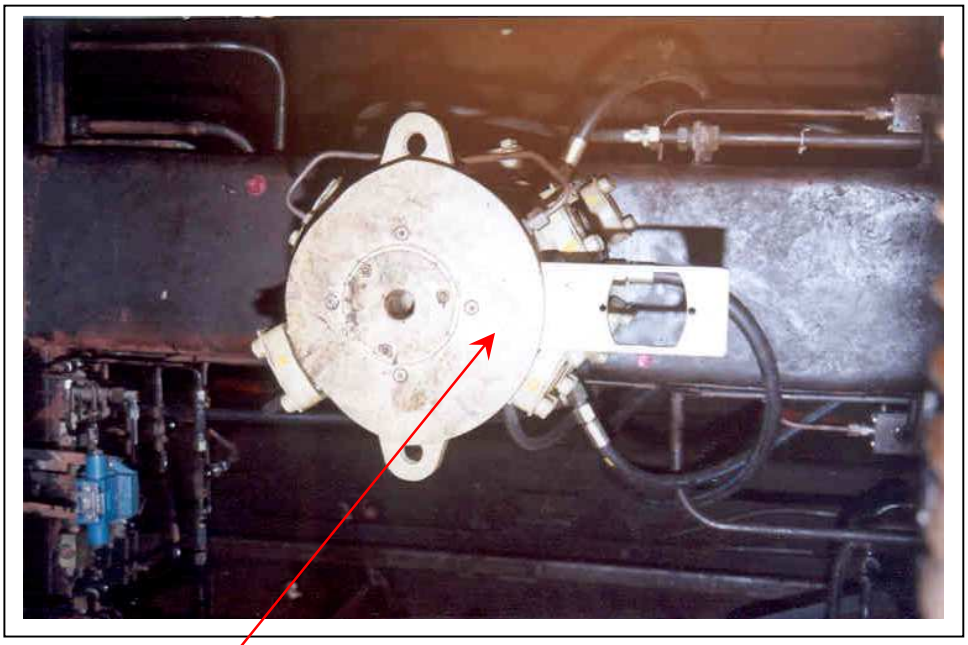
Figure 'A'



Rotary Lead Through

Railway Crane
Maintenance Manual

Description

The suspension blocking cylinders serve to lock the suspension spring deflection to the wheel set springs during crane operation **(See Figure 'A').** The suspension blocking cylinders are single-acting plunger-type cylinders spring-return mechanism. The undercarriage hydraulics must be switched on via the respective selector switch in the cab.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in
and outside the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed or drawn into the equipment!
Use caution when dealing with oil danger of being burnt or scalded!
Caution*- Hydraulic system! Work may only be performed on the hydraulic system when there is no pressure in the system and the diesel engine is stationary. This also applies to the tightening of hydraulic connections.*
Use caution when releasing connections that higher mounted components could drain dry. In these cases, ensure an adequately sized drip pan is available.
Observe disposal regulations!
Caution! *– Sections of the hydraulic and air pressure systems are still under pressure even when the crane is at a standstill!*
Use caution when opening the suspension blocking cylinders! The pistons are spring-loaded- Danger of accidents! Mortal danger!

Maintenance Instructions

Check the suspension blocking cylinders and their connections for external damage, proper sealing, and firm seating.

Retract and extend the cylinders. In particular, check for proper retraction and at the same time carry out an inspection of the piston rods.
Note: After work has been completed on the hydraulic system, during which oil has been lost out of the hydraulic circuit, top up the hydraulic oil in the housings of the hydraulic pumps and hydraulic motors via their respective leakage oil connections.

Otherwise, the hydraulic system could suffer severe damage. To replace or top up oil, an external oil filter with a minimum retaining rate of 10 µm must be used.

Caution! If the oil stop cocks below the hydraulic oil tank are closed for work being performed on the hydraulic system, check as to whether the stop cocks have been re-opened prior to re-starting as otherwise the hydraulic system could suffer severe damage.

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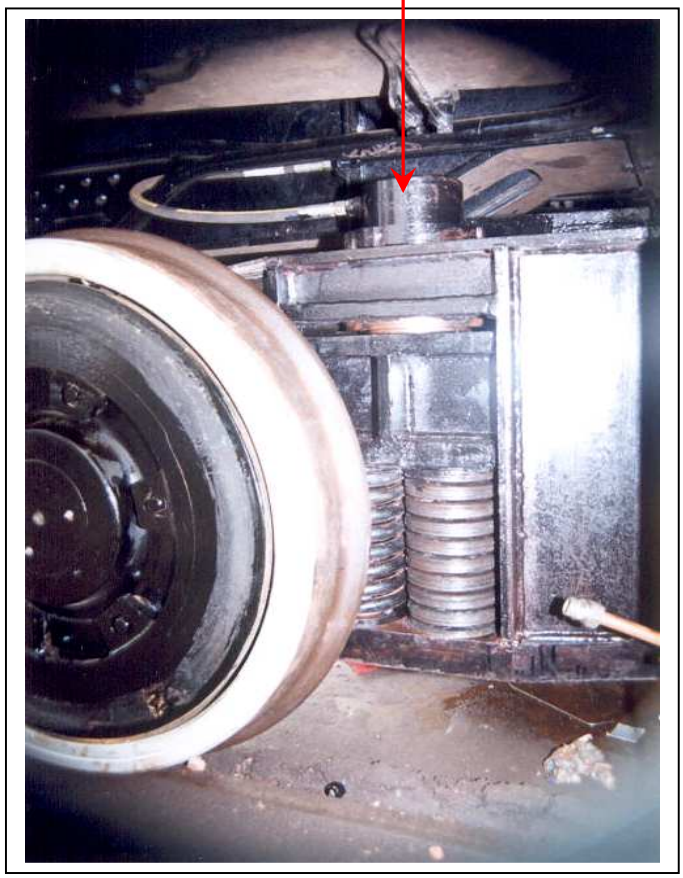
Figure 'A'

Suspension Blocking Cylinder



Railway Crane
Maintenance Manual

Description

The control blocks in the undercarriage serve to retract and extend, raise and lower the outriggers, operate the suspension blocking and to disengage the travel gear pinion **(See Figure 'A').** The undercarriage hydraulic must be switched on via the selector switch in the cab.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in
and outside the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed or drawn into the equipment!
Use caution when dealing with oil danger of being burnt or scalded!
***Caution**- Hydraulic system! Work may only be performed on the hydraulic system when there is no pressure in the system and the diesel engine is stationary. This also applies to the tightening of hydraulic connections.*
Use caution when releasing connections that higher mounted components could drain dry. In these cases, ensure an adequately sized drip pan is available.
Observe disposal regulations!
***Caution!** – Sections of the hydraulic and air pressure systems are still under pressure even when the crane is at a standstill!*

Maintenance Instructions

Check the valve blocks and their connections for external damage and leakages.
* Tighten the fittings, if required, but only when they are not under pressure. Then carry out a sealing test under pressure.

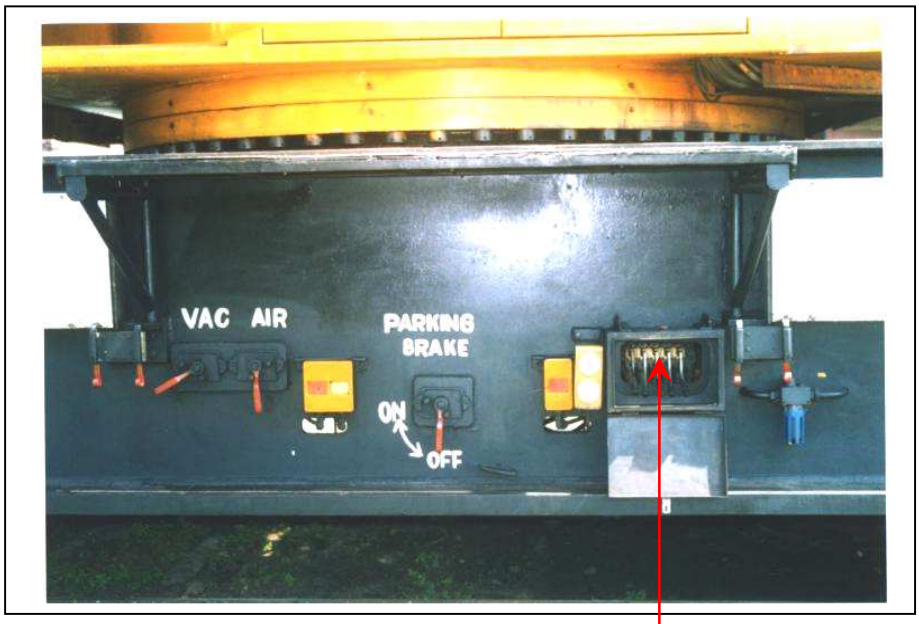
Check each of the Propping and Outrigger cylinders directly by means of the hand levers.

The suspension blocking and travel gear pinion disengagement device are operated by means of one hand lever.
Note: After work has been completed on the hydraulic system, during which oil has been lost out of the hydraulic circuit, top up the hydraulic oil in the housings of the hydraulic pumps and hydraulic motors via their respective leakage oil connections.
Otherwise, the hydraulic system could suffer severe damage. To replace or top up oil, an external oil filter with a minimum retaining rate of 10 μm must be used.

Caution! If the oil stop cocks below the hydraulic oil tank are closed for work being performed on the hydraulic system, check as to whether the stopcocks have been re-opened prior to re-starting as otherwise the hydraulic system could suffer severe damage.

Railway Crane
Maintenance Manual

Figure 'A'



Control block lever

Railway Crane
Maintenance Manual

Description
The crane is fitted with four outrigger beams. Each outrigger beam has a swing-out cylinder **(See Figure 'A')** and a propping cylinder **(See Figure 'B')**

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and outside the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near to or moving parts- danger of getting burnt, crushed or drawn into the equipment!
Use caution when dealing with oil- danger of being burnt or scalded!
Caution*- Hydraulic system! Work may only be performed on the hydraulic system when there is no pressure in the system and the diesel engine is stationary. This also applies to the tightening of hydraulic connections.*
Use caution when releasing connections that higher mounted component could drain dry. In these cases, ensure an adequately sized drip pan is available. Observe disposal; regulations!
Caution! *– Sections of the hydraulic and air pressure systems are still under pressure even when the crane is at a standstill.*

Maintenance Instructions

Check the cylinders and their connections for external damage, firm seating, and proper sealing.

Tighten or replace loose or leaky connections when the system is not under pressure.

On completion of maintenance work, carry out a sealing test under pressure.

The piston rods of the propping latch into retracted position automatically.

Note: After work has been completed on the hydraulic system, during which oil has been lost out of the hydraulic circuit, top up the hydraulic oil in the housings of the hydraulic pumps and hydraulic motors via their respective leakage oil connections.
Otherwise, the hydraulic system could suffer severe damage. To replace or top up oil, an external oil filter with a minimum retaining rate of 10 µm must be used.

Caution! If the oil stop cocks below the hydraulic oil tank are closed for work being performed on the hydraulic system, check as to whether the stop cocks have been re-opened prior to re-starting as otherwise the hydraulic system could suffer severe damage.

Figure 'A'

Figure' B'

Swing-out Cylinder

Propping Cylinder

Railway Crane
Maintenance Manual

Description
Both hoists **(See figure 'A', item 1 and 2)** , the derricking gear **(item 3)**, the slewing gear **(item 4)** , the two travel gears **(item 5)** and the recovery winch (not illustrated) are driven by the axial piston constant motor. The motors are lubricated by means of the hydraulic oil system and are thus more or less maintenance-free.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and out side the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of being burnt or scalded!
Caution*- Hydraulic system! Work may only be performed on the hydraulic system when there is no pressure in the system and the diesel engine is stationary. This also applies to the tightening of hydraulic connections.*
Use caution when releasing connections those higher mounted components could drain dry. In these cases, ensure an adequately sized drip pan is available.
Observe disposal regulations!
Caution! - *Sections of the hydraulic and air pressure systems are still under pressure even when the crane is at a standstill.*

Maintenance Instructions

Check the motors and their connections for firm seating, external damage, and proper sealing.
Note: Motors are lubricated by means of leakage oil- this is why no oil change is required!

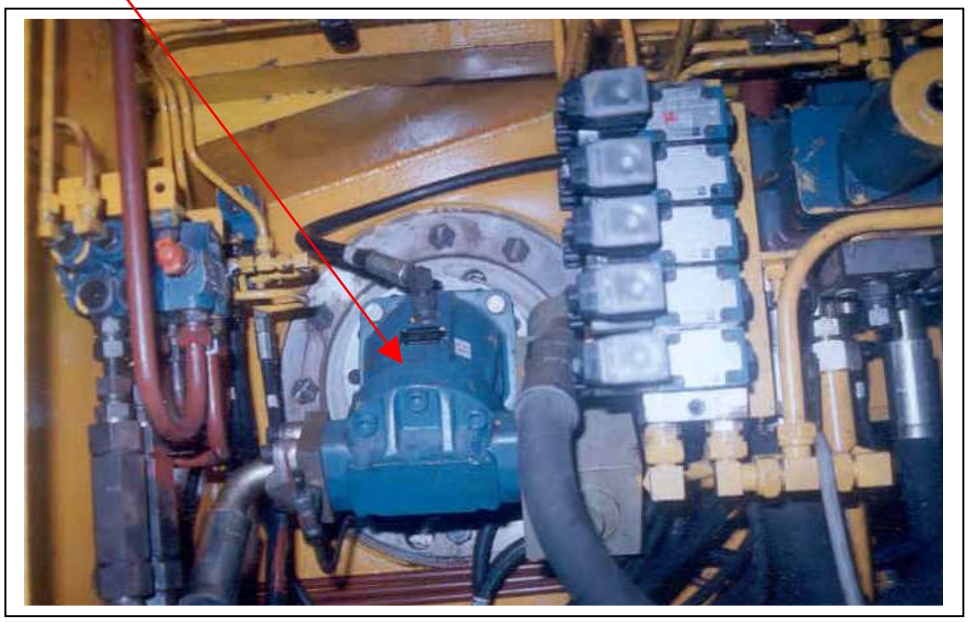
Check the running noises of the motors; if the level of the running noise has increased in connection with an increase in pressure, the motors could be damaged.

* The maximum permissible leakage oil quantity of the hydraulic motor is 15 l /min at operating pressure. The leakage oil connection must not be closed under any circumstances as the hydraulic motors could be destroyed as a result.

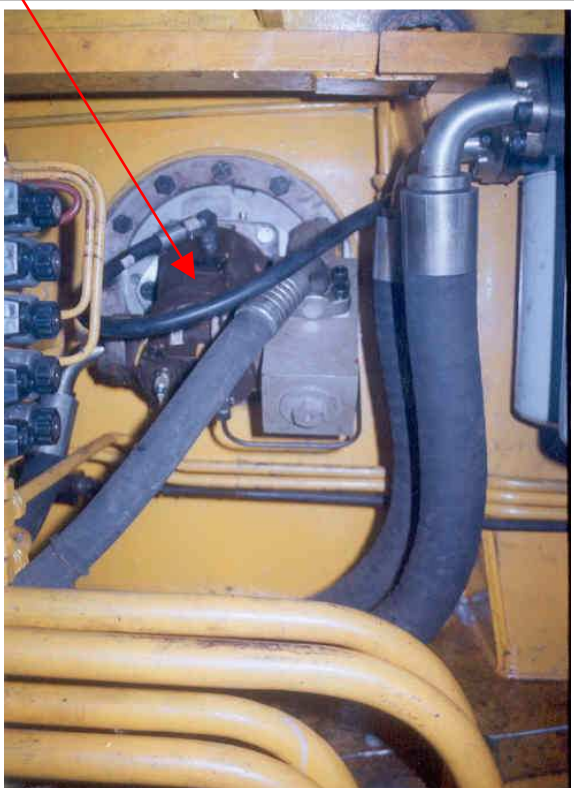
Note: After work has been completed on the hydraulic system, during which oil has been lost out of the hydraulic circuit, top up the hydraulic oil in the housings of the hydraulic pumps and hydraulic motors via their respective leakage oil connections. Otherwise, the hydraulic system could suffer severe damage. To replace or top up oil, an external oil filter with a minimum retaining rate of 10 µm must be used.
Caution:! If the oil stop cocks below the hydraulic oil tank are closed for work being performed on the hydraulic system, check as to whether the stopcocks have been re-opened prior to re-starting as otherwise the hydraulic system could suffer severe damage.

Railway Crane
Maintenance Manual

Main Hoist Motor (Item 1)



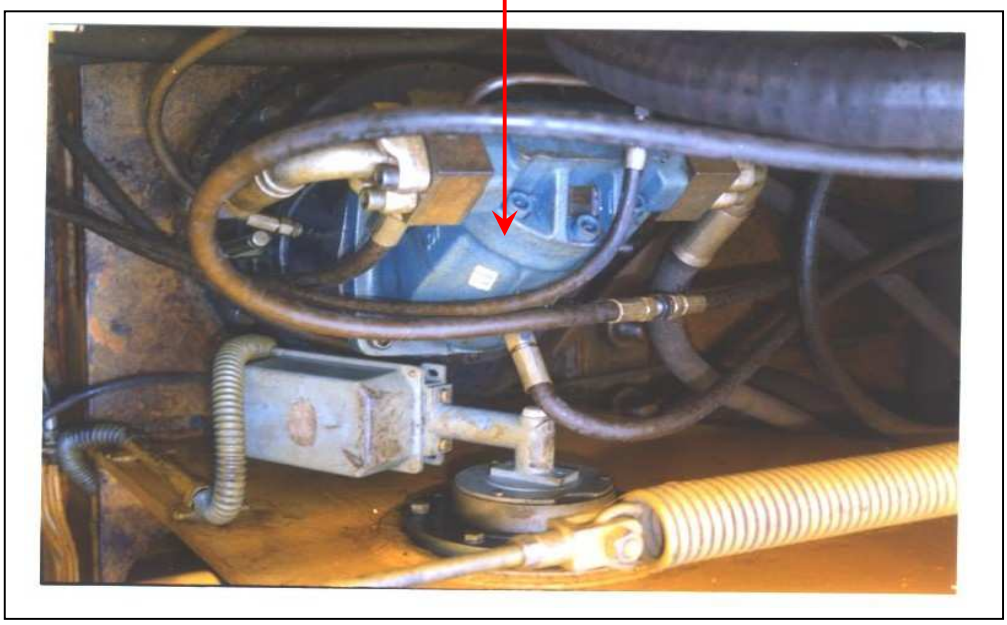
Aux. Hoist Motor (Item 2)



Derricking Motor (Item 3)

Figure 'A'

Slewing Motor (Item 4)



Travelling Motor (Item 5)

Railway Crane
Maintenance Manual

Description

The superstructure control blocks control the crane's all motions except slewing. The individual control levers (gate valves) are operated via pilot control valves from within the cab. **(See Figure 'A')**

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and out side the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of being burnt or scalded!
***Caution-** Hydraulic system! Work may only be performed on the hydraulic system when there is no pressure in the system and the diesel engine is stationary. This also applies to the tightening of hydraulic connections.*
Use caution when releasing connections those higher mounted components could drain dry. In these cases, ensure an adequately sized drip pan is available.
Observe disposal regulations!
***Caution! -** Sections of the hydraulic and air pressure systems are still under pressure even when the crane is at a standstill.*

Maintenance Instructions

Check the control blocks and their connections for external damage and leakages.

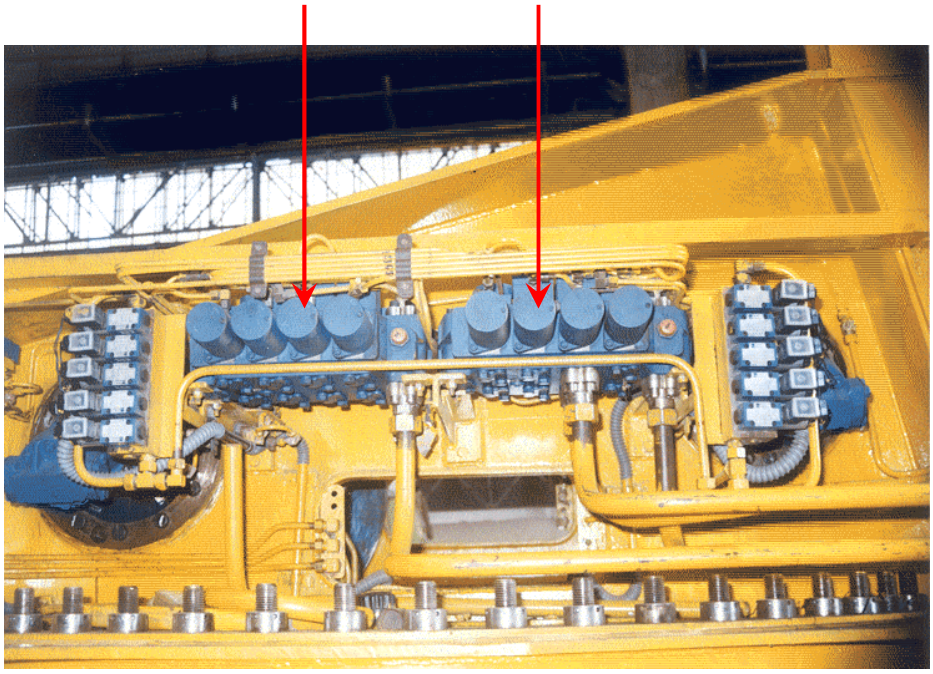
Tighten the fittings; if required, but when the system is not under pressure. Then carry out a sealing test under pressure.

Note: After work has been completed on the hydraulic system, during which oil has been lost out of the hydraulic circuit, top up the hydraulic oil in the housings of the hydraulic pumps and hydraulic motors via their respective leakage oil connections. Otherwise, the hydraulic system could suffer severe damage. To replace or top up oil, an external oil filter with a minimum retaining rate of 10 µm must be used.

Caution: If the oil stop cocks below the hydraulic oil tank are closed for work being performed on the hydraulic system, check as to whether the stop cocks have been re-opened prior to re-starting as otherwise the hydraulic system could suffer severe damage.

Figure 'A'

Control Block-M 1 **Control Block-M 2**



Railway Crane
Maintenance Manual

Description

The counter weight is fitted with two hydraulic cylinders **(See Figure 'A').**

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly posted both in and out side the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of being burnt or scalded.
***Caution-** Hydraulic system! Work may only be performed on the hydraulic system when there is no pressure in the system and the diesel engine is stationery. This also applies to the tightening of hydraulic connections.*
Use caution when releasing connections that higher mounted components could drain dry. In these cases, ensure an adequately sized drip pan is available. Observe disposal regulations!
***Caution!** Sections of the hydraulic and air pressure systems are still under pressure even when the crane is at a standstill.*

Maintenance Instructions

Check the cylinders and their connections for external damage, firm seating, and proper sealing.

Tighten or replace loose or leaky connections when the system is not under pressure.

On completion of maintenance work, carry out a sealing test under pressure.

The piston rods are lubricated on retraction automatically.

Note: After work has been completed on the hydraulic system, during which oil has been lost out of the hydraulic circuit, top up the hydraulic oil in the housings of the hydraulic pumps and hydraulic motors via their respective leakage oil connections. Otherwise, the hydraulic system could suffer severe damage. To replace or top up oil, an external oil filter with a minimum retaining rate of 10 µm must be used.

Caution! - If the oil stop cocks below the hydraulic oil tank are closed for work being performed on the hydraulic system, check as to whether the stop cocks have been re-opened prior to re-starting as otherwise the hydraulic system could suffer severe damage.

Railway Crane
Maintenance Manual

Figure 'A'

Counterweight Cylinder

Railway Crane
Maintenance Manual

Air pressure System (S/S & U/C) 2.3

Railway Crane
Maintenance Manual

Description

The Crane No: 142032 t0 142043 & 143001 to 143002 has three 50L, one 25L & three 14L air pressure tanks and Crane No: 143003 to 143010 has three 50L, two 25L & two 14L air pressure tanks **(See Figure 'A').**

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and out side the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of being burnt, crushed or drawn into the equipment!
***Caution!** Observe air pressure tank regulations!*
Use caution when dealing with the air pressure system! Work may only be carried out on when the system is without pressure and the diesel engine is at a standstill! This also applicable when air pressure connections are being tightened.

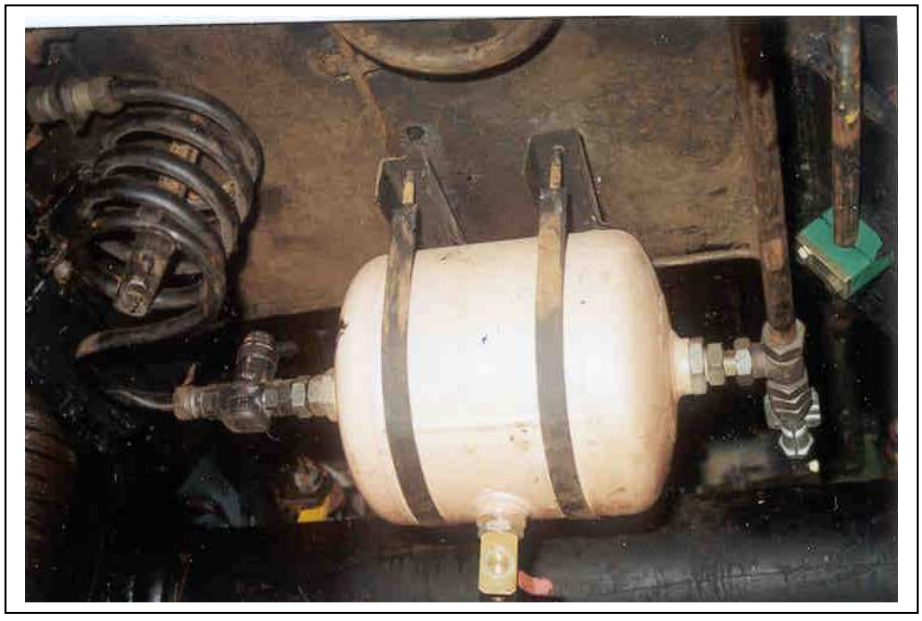
Maintenance Instructions

Check the air pressure tanks and their components for external damage, firm seating and proper sealing. Tighten fittings, if required, when the system is not under pressure.

Loosen the drainage plugs until no more moisture emerges. A high degree of moisture can damage the air pressure system. In this case, the air pressure fine filter must also be checked; if required, the filter element must be changed in between normal intervals and / or the air pressure filter must be drained more frequently.

Railway Crane
Maintenance Manual

Figure 'A'



Railway Crane
Maintenance Manual

Description

In Crane No. **142032 to 142043 & 143001 to 143002**, 3-types of brake cylinders have been used for service brake and parking brake (Hyd.). These are the three types of brake cylinders **Figure 'B' , i)** PB 254- 140- D,67370 D-02-4 K-270 degree- 06 nos. **ii)** PB 254- 140- D, 60699 D-01-4K-90 degree -05 nos and **iii)** PB 254- 140- D, 60702 D-01--4K-270 degree- 01 no.

In Crane No. **143003 to 143010**, 2- types of brake cylinders have been used for service brake and parking brake (Pneu.). These are the two types of brake cylinders **Figure 'A', i)** PBAF 254- 160, 200278 D-01-6-PF 13-90 degree– 06 nos. and **ii)** PBA 254-160, 200277 D-00-6-270 degree-06 nos**.**

The twelve brake cylinders are single-acting air pressure cylinders with automatic brake expander cups and spring –return mechanism. Six brake cylinders are fitted with a spring-loaded assembly which can be activated by means of a mechanical emergency release device connected to Bowden cables on the axles.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and out side the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of being burnt, crushed or drawn into the equipment!
***Caution!** Some sections of the system are not pressure less until the accumulators have been emptied!*
Before work is carried out on the air pressure system, ensure the system is without pressure.
***Caution! -** Observe air pressure tank regulations!*
Use caution when dealing with the air pressure system! Work may only be carried out on when the system is without pressure and the diesel engine is at a standstill. This also applicable when air pressure connections are being tightened.
***Caution!-** In this case, braking cannot be carried out until the brake system is re-pressurised with air pressure.*
Use caution when the brake cylinders are opened! The brake cylinders are under spring-loaded tension! Danger of accidents! Mortal Danger!

Maintenance Instructions

Carry out the maintenance work on brake cylinder according to the documentation supplied by SAB WABCO.

Check the air pressure tanks and their components for external damage, firm seating and proper sealing. Tighten fittings, if required, when the system is not under pressure.

Carry out a brake test and inspection when the crane is at a standstill! Check whether all cylinders are extended properly.

Figure 'A' **P-2/3**

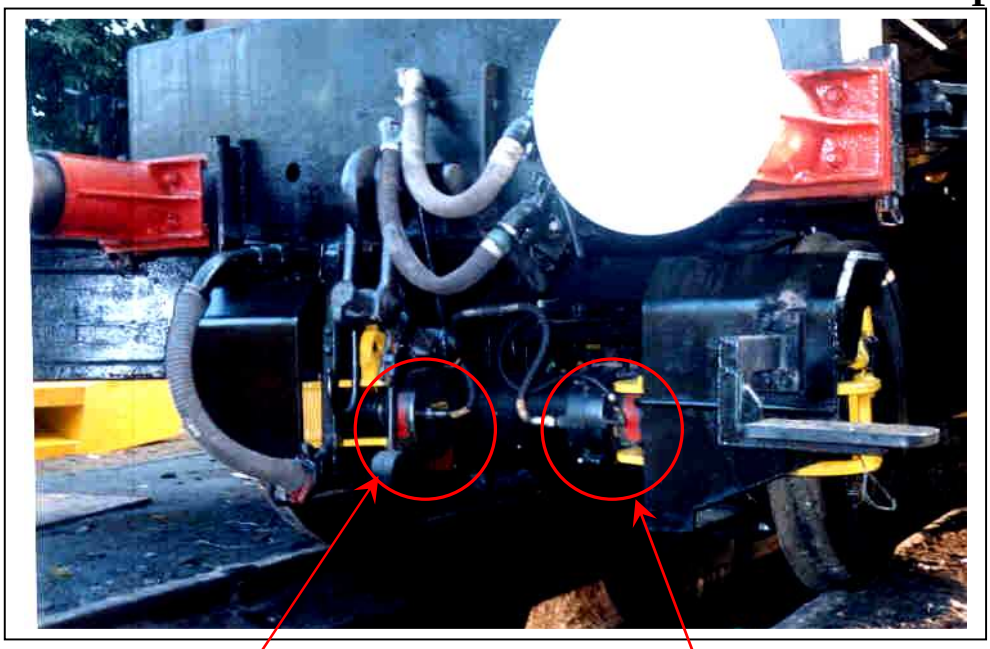


Figure 'A', Item-ii **Item-i**

Railway Crane
Maintenance Manual

Figure 'B' Item-ii

Railway Crane
Maintenance Manual

Description

The three brake couplings (Brake pipe, Feed pipe and Vacuum hose) on each face side together with the stop cocks serve in train formation to couple the crane to the customary train air pressure brake system **(See Figure 'A').** The air pressure brake system consists of a main air line, the main air tank line and the vacuum line.

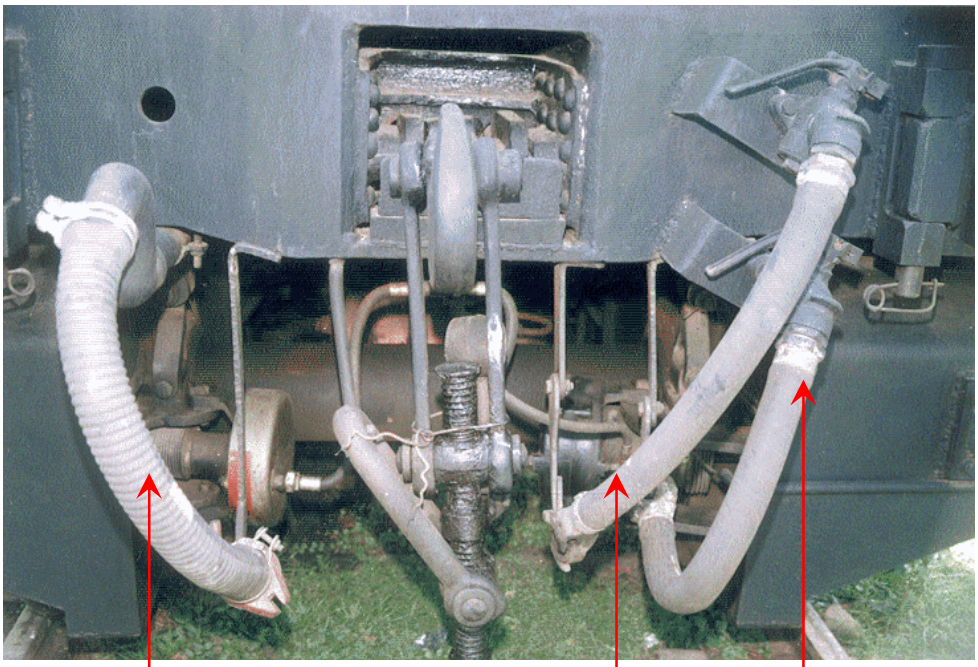
SAFETY INSTRUCTIONS

Before maintenance work is performed , it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and out side the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of being burnt, crushed or drawn into the equipment!
***Caution!** Some sections of the system are not pressure less until the accumulators have been emptied!*
Before work is carried out on the air pressure system, ensure the system is without pressure.
***Caution!**- Observe air pressure tank regulations!*
Use caution when dealing with the air pressure system! Work may only be carried out on when the system is without pressure and the diesel engine is at a standstill! This also applicable when air pressure connections are being tightened.

Maintenance Instructions:

Check the brake couplings, their connections and pertaining cock stops and dummy couplings for external damage, proper sealing, and firm seating.

Figure 'A'



Railway Crane
Maintenance Manual

Description

The air pressure system is fitted with an air pressure fine filter. The fine filter has a drainage option and a filter element **(See Figure 'A').**

SAFETY INSTRUCTIONS

Before maintenance work is performed , it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and out side the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of being burnt, crushed or drawn into the equipment!

Caution! *Some sections of the system are not pressure less until the accumulators have been emptied!*

Before work is carried out on the air pressure system, ensure the system is without pressure.

Caution! - *Observe air pressure tank regulations!*
Use caution when dealing with the air pressure system! Work may only be carried out on when the system is without pressure and the diesel engine is at a standstill. This also applicable when air pressure connections are being tightened.

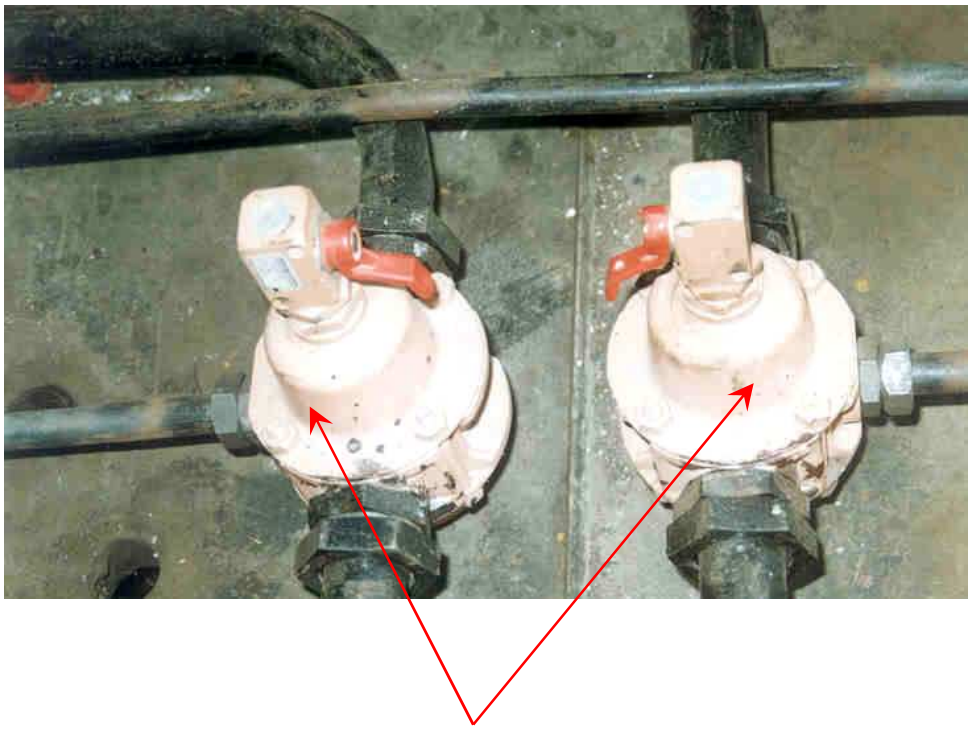
Maintenance Instructions

Check the air pressure fine filter, its mountings, and connections for external damage, firm seating and proper sealing. In addition, clean the cooling spiral.

Unscrew the air pressure fine filter and check the fine filter element for its degree of pollution or damage; if required, replace.

Railway Crane
Maintenance Manual

Figure 'A'



Air Pressure Fine Filter

Railway Crane
Maintenance Manual

Description **Brake Pedal**

The brake pedal in the cab serves to smoothly and directly brake the travel motion.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and out side the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of being burnt, crushed or drawn into the equipment!
***Caution!** Some sections of the system are not pressure less until the accumulators have been emptied!*
Before work is carried out on the air pressure system, ensure the system is without pressure.
***Caution!**- Observe air pressure tank regulations!*
Use caution when dealing with the air pressure system! Work may only be carried out on when the system is without pressure and the diesel engine is at a standstill! This also applicable when air pressure connections are being tightened.

Maintenance Instructions

Check the brake pedal and its mountings for external damage and firm seating.
Clean the brake pedal with a suitable aid.
Dirty or oily pedals can endanger safety!

Railway Crane
Maintenance Manual

Signal Horn Actuating Valve

Description

The two signal horns serve as an audible warning during travel and crane operations. They are located on the crane at the front.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and out side the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of being burnt, crushed or drawn into the equipment!
***Caution!** Some sections of the system are not pressure less until the accumulators have been emptied!*
Before work is carried out on the air pressure system, ensure the system is without pressure.
***Caution!** - Observe air pressure tank regulations!*
Use caution when dealing with the air pressure system! Work may only be carried out on when the system is without pressure and the diesel engine is at a standstill! This also applicable when air pressure connections are being tightened.

Maintenance Instructions

Check the signal horns and their connections for external damage, firm seating, and proper sealing.
Clean the horn elements and test the signal horns.

Railway Crane
Maintenance Manual

Description

The two air pressure compressors in the undercarriage supply the required air pressure during the operation in train formation to the air pressure brake system **(See Figure 'A')**. The compressors are driven via a coupling. When the required air pressure has been reached, the line is opened and the air pressure compressors continue to run but without pressure. The compressors are fitted with an air cooling system.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly posted both in and out side the cab. Remove the ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of being burnt, crushed or drawn into the equipment!

Caution! *Some sections of the system are not pressure less until the accumulators have been emptied!*
Before work is carried out on the air pressure system, ensure the system is without pressure.
Caution*!- Observe air pressure tank regulations!*
Use caution when dealing with the air pressure system! Work may only be carried out on when the system is without pressure and the diesel engine is at a standstill! This also applicable when air pressure connections are being tightened.

Maintenance Instructions

Check the air pressure compressors, their attachments, and all connections for external damage and leakage. Check all connections and lines for firm seating.

Check the oil level via a dipstick, if required, top up the oil until it reaches the upper marking of the dipstick using the brand as classified in the chart in **Section -3** of this manual.

Check the air filter, if required, clean or replace a filter element.

Lubricate the lubrication nipple on the compressor shaft.
(See Figure -1, 2 & 3)

Railway Crane
Maintenance Manual

Figure 'A'

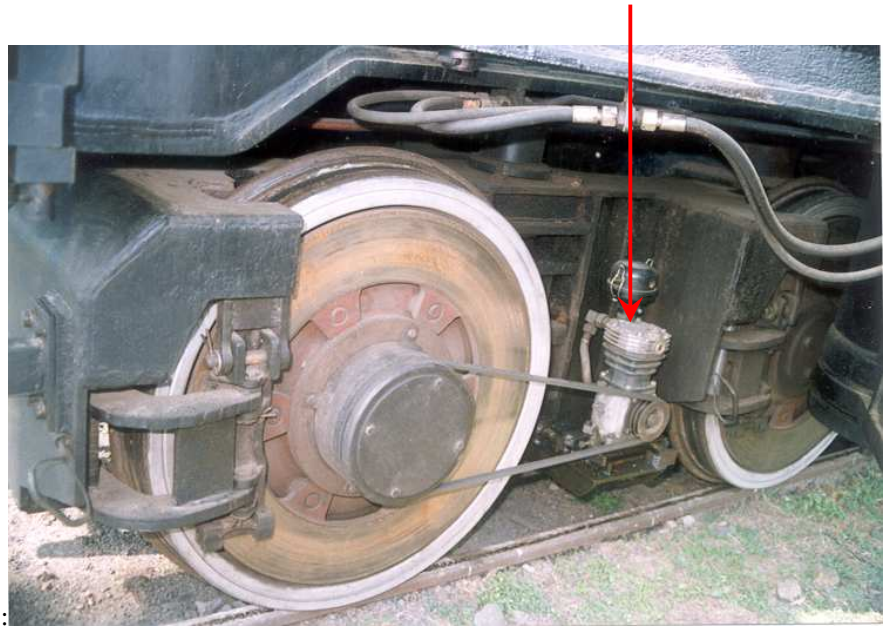
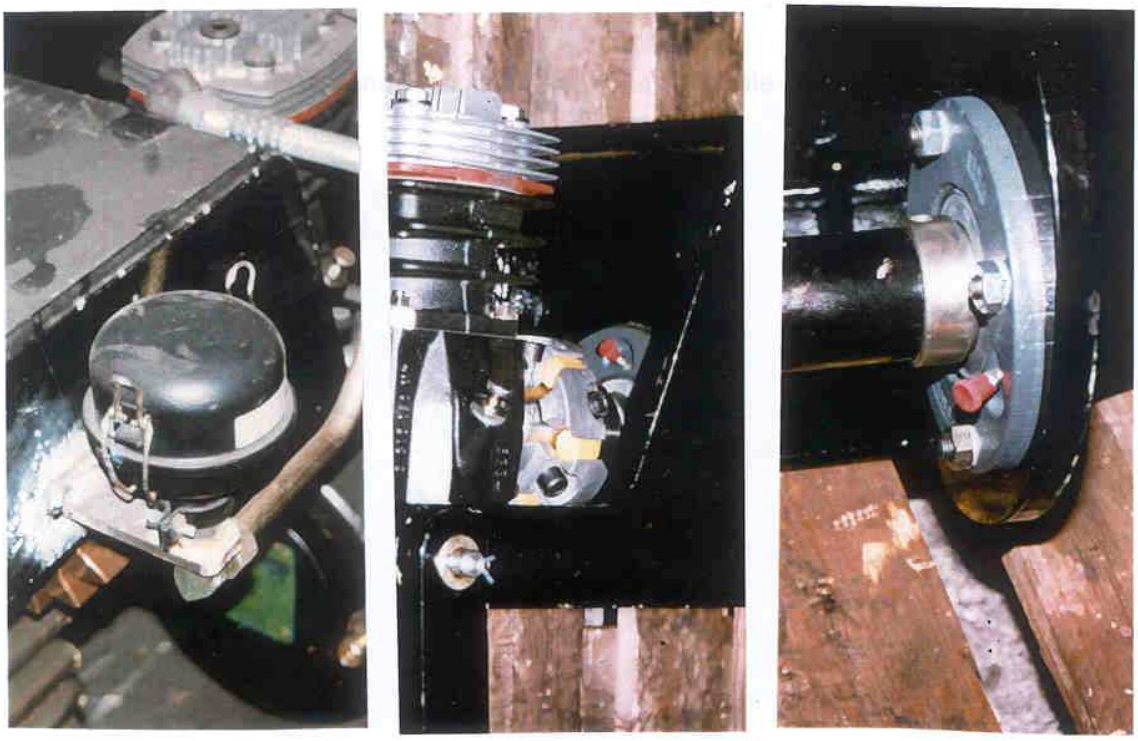


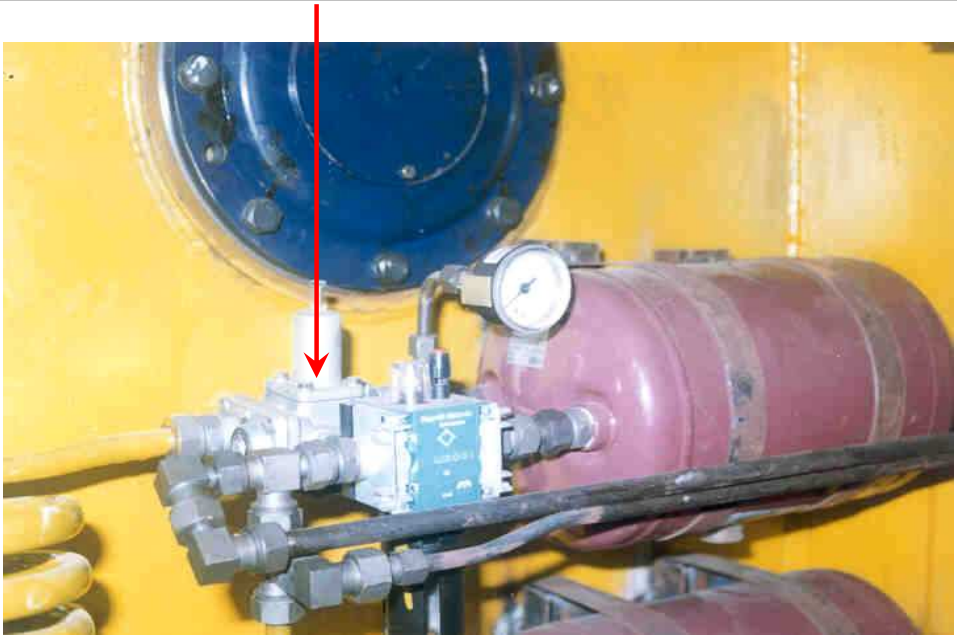
Figure 1, 2 & 3



Railway Crane
Maintenance Manual

Pressure Regulator **2.3.8**

P-1/1



Description

The pressure regulator maintains the operating pressure of the air pressure system at a constant pressure. It switches off at a pressure of 7.3 bar and switches on at 6.2 bar.

SAFETY INSTRUCTIONS

Before commencing with maintenance work, remove the battery main switch.
In addition, a "Maintenance Work" warning sign must be securely affixed here and in the cab. If the diesel engine must be started for test purposes, ensure that no one is near moving or hot components-Danger of being crushed! Danger of being burnt!
***Caution** – ensure without fail that a "Maintenance Work" sign is posted in the cab during the test phase.*
On completion of the test, shut off the crane without fail and secure accordingly. Use caution when dealing with the air pressure system! Work may only be carried out on when the system is without pressure and the diesel engine is at a standstill! This also applicable when air pressure connections are being tightened.
***Caution**- some sections of the system are not pressure less until the accumulators have been emptied.*

Maintenance Instructions

Check the pressure regulators and its pipe connections for external damage, firm seating, and proper sealing.

The switch-off pressure is attained when the pressure regulators can be heard to let off pressure; the switch-on-pressure is attained when the indicator on the pressure gauge for the air reservoir begins to climb.

Railway Crane
Maintenance Manual

Diesel Engine System 2.4

Railway Crane
Maintenance Manual

Description

The diesel engine drives the hydraulic pumps for travel and crane operations via the pump distributor gearbox.

The diesel engine supply the air pressure via the attached air compressor to the air pressure system, the batteries with power via the attached 3 phase generator Out-put 24V DC and thus also the electrical equipment with power.

Two Types of diesel engine has been fitted in 1986 Design 140T Crane. The types are given in **Section – 2.4.1.1** and Crane wise engine fitted is given in **Section – 2.4.1.2.**

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab. Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed, or squashed!
Observe safety and disposal regulations for the respective product when dealing with oil and fuel.
No smoking, no naked flame or light, sparks or glowing ashes near the fuel or diesel engine system-Danger of explosion and fire!
Use caution when dealing with oil-danger of being burnt or scalded!

Caution- *Hydraulic system work may only be performed on the hydraulic system when there is no pressure and the diesel engine is stationary. This also applies to the tightening of hydraulic connections.*
Use caution when releasing connections because higher mounted components could drain dry. In these cases, ensure an adequately sized drip pan is available.
Caution- *air pressure system! Work may only be performed on the air pressure system when the diesel engine is not running and the entire air pressure system is without pressure. This is also applicable for the tightening of the air pressure connections.*
Caution- *sections of the hydraulic and air pressure systems are still under pressure even when the crane is at a standstill!*
Ensure that no one is in the danger zone.
Observe the safety instructions provided in the Cummins User's Manual.

Maintenance Instructions

The following maintenance work on the diesel engine system is to be carried out according to the information in the Cummins User's Manual:
Please note: All the maintenance work listed in the interval before hand must be carried out as well.

Check the oil level; if required top up oil using the brand as classified in the chart in **Section- 3** of this manual.
Oil Changing: -
Filter Changing: -

Check the coolant level, if required, top up coolant using the brand as classified in the chart in **Section- 3** of this manual. In this case, the coolant concentration must be checked.

Check the fan belt condition and tension; if required, readjust tension.

Monthly or every 125 hours: Change oil.
Note: The interval for changing the oil must be determined based on the Cummins User's Manual and the operating data recorded, i.e. Average fuel and oil consumption or after an oil analysis.

for oil drain plug.

- Change fuel filter elements.
- Clean or change crank house ventilation.
- Change DCA coolant filter.

Semi-yearly or every 750 hours: Change oil filter elements
Note: The interval for changing the oil must be determined based on the Cummins User's Manual and the operating data recorded, i.e., average fuel and oil consumption or after an oil analysis.

for oil drain plug.

- Change air compressor filter elements.

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Maintenance Manual

Following two types of Diesel Engine has been fitted in 1986 Design 140T Crane:-

Type: - "A" - Diesel Engine

For Crane No.142032 to 1422043

Make	Cummins USA (Brazil)
Type	NT- 855 R4
Model	6-cylinders in series Water –cooled, Exhaust turbo charger
Output	224 kW at 1,800 rpm
Torque	1,158 Nm at 1,400 rpm
Generator	28 V 55 A

Type: - "B" - Diesel Engine

For Crane No.143001 to 143010

Make	CIL/PUNE
Type	NTA- 855 R-FFC
Model	6-cylinders in series Vertical Water –cooled, Exhaust turbo charger
Output	224 kW at 1,800 rpm
Torque	1,158 Nm at 1,400 rpm
Generator	28 V 55 A

Railway Crane
Maintenance Manual

Crane wise Engine fitted: -

Crane Number	Crane Type	Type of Engine fitted
142032	Fully Imported	A
142033	Fully Imported	A
142034	Fully Imported	A
142035	Fully Imported	A
142036	Fully Imported	A
142037	Fully Imported	A
142038	Knock down	A
142039	Knock down	A
142040	Knock down	A
142041	Kit Crane	A
142042	Kit Crane	A
142043	Kit Crane	A
143001	Jamalpur Manufactured	B
143002	Jamalpur Manufactured	B
143003	Jamalpur Manufactured	B
143004	Jamalpur Manufactured	B
143005	Jamalpur Manufactured	B
143006	Jamalpur Manufactured	B
143007	Jamalpur Manufactured	B
143008	Jamalpur Manufactured	B
143009	Jamalpur Manufactured	B
143010	Jamalpur Manufactured	B

Railway Crane
Maintenance Manual

Description

The exhaust system emits the exhaust fumes into air, reduces the emission speed of the exhaust and silence the noise level of the diesel engine. The system consists of manifold, compensator, and silencer.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed, or squashed!
Observe safety and disposal regulations for the respective product when dealing with oil and fuel.
No smoking, no naked flame or light, sparks or glowing ashes near the fuel or diesel engine system-Danger of explosion and fire!
Ensure that no one is in the danger zone.

Maintenance Instructions

Check the exhaust system, its connections and mountings elements for external damage and firm seating.

Railway Crane
Maintenance Manual

Description

The fuel system supply the fuel required to operate the diesel engine. The fuel capacity is 1000 litres. The system is fitted with an electric indicator for fuel level.

SAFETY INSTRUCTIONS

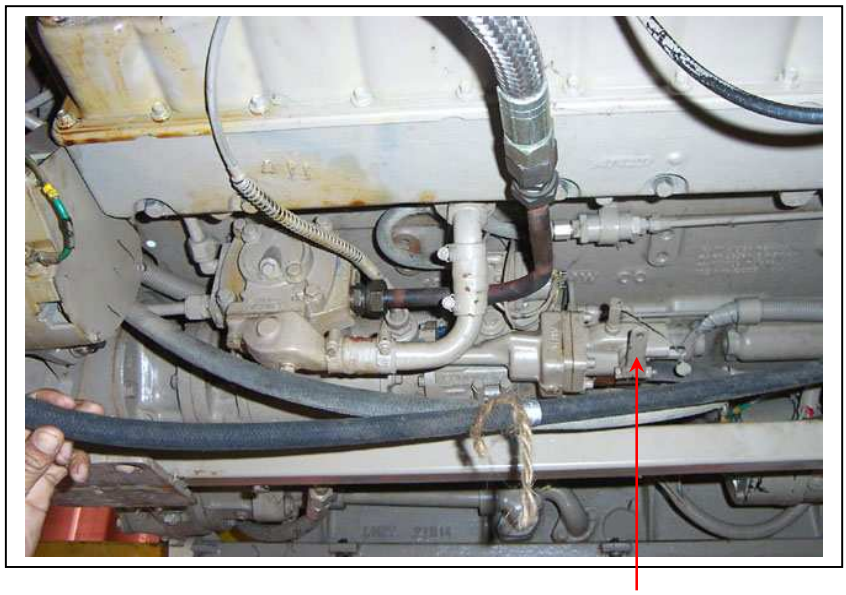
Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed, or squashed!
Observe safety and disposal regulations for the respective product when dealing with oil and fuel.
No smoking, no naked flame or light, sparks or glowing ashes near the fuel or diesel engine system-Danger of explosion and fire!
Use caution when releasing connections because higher mounted components could drain dry. In these cases, ensure an adequately sized drip pan is available.
Ensure that no one is in the danger zone.

Maintenance Instructions

Check the fuel system, its pipe and hoses connections for external damage, firm seating and. Any damaged fuel lines must be replaced immediately. Also check the connections on the electric indicator for firm seating.
The tank has a filler neck on the superstructure. Check the tank cover for proper functioning. A faulty tank cover must be replaced.

To avoid corrosion damage, drain the condensation via the drain plug on the tank under side. To do so, open the plug until clean diesel fuel emerges. When re-closing, ensure the seal is seated properly! For details, use Cummins user's manual.

Railway Crane
Maintenance Manual



Description **Accelerator lever**

The accelerator controls the injection pump of the engine. The accelerator is operated via a Bowden cable by means of a pedal in the cab.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed, or squashed!
Observe safety and disposal regulations for the respective product when dealing with oil and fuel.
No smoking, no naked flame or light, sparks or glowing ashes near the fuel or diesel engine system-Danger of explosion and fire!
Use caution when releasing connections because higher mounted components could drain dry. In these cases, ensure an adequately sized drip pan is available.
Ensure that no one is in the danger zone.
Observe the safety instructions provided in the Cummins User's Manual.

Maintenance Instructions

Check the accelerator and the pertaining linkage including Bowden cable for external damage and firm seating.

Start the diesel engine for the functional test and operate the gas pedal in the cab. Check whether the diesel engine runs evenly in the various speed ranges.

Railway Crane
Maintenance Manual

Description

The pump distributor gearbox (PTO) is mounted on the diesel engine through centa max coupling and transfers the drive output of the diesel engine to the pumps flanged-mounted on the gearbox. The pump distributor gearbox is a spur gear seated on a roller bearing and fitted with an oil bath lubrication system.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed, or squashed!
Observe safety and disposal regulations for the respective product when dealing with oil and fuel.
No smoking, no naked flame or light, sparks or glowing ashes near the fuel or diesel engine system-Danger of explosion and fire!

Use caution when dealing with hot oil- danger of being burnt or scalded!

Pump Distributor Gearbox 2.4.5

Maintenance Instructions

The following maintenance work on the diesel engine system must be carried out according to the information in the Lohmann and Stolterfoht User's Manual.

Check the pump distributor gearbox, in particular, near the flange connection for external damage, leakages, and firm seating.

Note: To check the oil level of the distributor box, the railway crane must be in horizontal position. Switch off the engine when it has reached operating temperature and wait approx. 10 minutes to check the oil level.

- Pull out the oil dipstick of the pump distributor gearbox.
- The oil level must be between the upper and lower markings of the dipstick; if required top up oil using the brand as classified in the chart in **Section -3** of this manual.

Note: Add or top up oil via the filler opening, the plug of which is screwed out for this purpose. The screw in the plug and tighten.

An oil analysis should be carried out every 750 operating hours to test the oil quality. If required, adjust the oil changing intervals.

- Flush the gearbox with flushing oil.

Note: To change the oil of the distributor gearbox, the crane must be in horizontal position. Switch off the engine when it has reached operating temperature and wait approx 10 minutes to check the oil level.

- To drain the oil, screw out the oil drain plug on the gearbox under side and collect the waste oil in a suitable and sufficiently large enough pan.

- Clean the magnet plug on the oil drain plug, screw in, and tighten according to regulations.
- To carry out an oil analysis: if there is considerable metal abrasion in the oil or the drain plug, this means that there is high degree of wear or considerable gearbox damage. If required, consider a gearbox inspection.
- Top up oil as per the classification in the chart until the upper marking on the dipstick is reached.
- To add or top up on, observe the information in the section on the oil level check.

Check the vent filter on the housing upper side; if required, clean or replace.

Check the screw-on connection for firm seating, taking into account the torque on the installation drawing.

Railway Crane
Maintenance Manual

Emergency Diesel Engine System 2.5

Railway Crane
Maintenance Manual

Description

The emergency diesel engine drives a hydraulic pump in emergency operation**. (See Figure 'A'** Two types of emergency engine has been fitted in 1986 design cranes of Gottwald & Jamalpur make. The brief specification is given in **Section -2.5.1.1** and Crane wise emergency engine fitted is given in **Section -2.5.1.2.**

SAFETY INSTRUCTIONS

Caution*- fuel is inflammable! When working near fuel related parts, fire, naked light, and smoking are prohibited!*
Caution- *Lubrication oil, etc. are drained at operating temperature- danger of scalding!*
Caution*- Hydraulic system! Work may only be performed on the hydraulic system when there is no pressure and the diesel engine is stationary. This also applies to the tightening of hydraulic connections.*
Use caution when releasing connection because higher mounted components could drain dry. In these cases, ensure an adequately sized drip pan is available.
Observe disposal regulations!
Caution- *air pressure system! Work may only be performed on the air pressure system when the diesel engine is not running and the entire air pressure system is without pressure. This is also applicable for the tightening of the air pressure connections.*
Caution!- *sections of the air pressure systems are under pressure until the accumulators have been emptied.*
Prior to commencing work, remove the battery main switch. In addition, a "Maintenance Work" warning sign must be affixed here and in the cab. When work is being performed in the cab, ensure that the switches and levers are not operated by accident or unknowingly.
Ensure that no one is in the danger zone.
Observe the safety regulations in the SCHULE / Kirloskar User's Manual.

Maintenance Instructions

The following maintenance work on the diesel engine must be carried out according to the information provided in the Kirloskar User's Manual.
Check the emergency diesel engine, its attachments, and connections for external damage and leakages. Check all connections and lines for firm seating.

Note: To check the oil level, the crane must be in horizontal position. The oil should be changed when the oil is at operating temperature.

- Switch off the engine when it has reached operating temperature and wait until the oil has run back into the oil tray.
- To check the oil level, pull out the oil dipstick and wipe off with a clean, lint-free rag. Then insert the oil dipstick and pull out again. The oil level must be between upper and lower markings of the dipstick If required, top up with oil using the brand as classified in the chart in section 6 of this manual.
- Switch off engine and Screw out the oil drain plug on the bath and drain the waste oil into a sufficiently large enough collection tray (approx. 4.5 ltrs). Then screw in the drain plug with a new seal tightly.
- Then top up oil via oil filler neck using the brand as classified in the chart in **Section- 3** of this manual until the oil level is between upper and lower markings on the dipstick.
- Clean the different types of filter as per SCHULE / Kirloskar maintenance manual.

Railway Crane
Maintenance Manual

Figure 'A'

Railway Crane
Maintenance Manual

Following two types of Emergency Diesel Engine has been fitted in 1986 Design 140T Crane:-

Type: - "A" - Emergency Diesel Engine

For Crane No.142032 to 1422043

Type	SCHULE- TAF 2
Model	2-Cylinder in series Vertical Air -cooled
Output	10.5 kW at 1800 rpm

Type: - "B" - Emergency Diesel Engine

For Crane No.143001 to 143010

Type	KIRLOSKAR- TA 2
Model	2-Cylinder in series Vertical Air -cooled
Output	10.5 kW at 1800rpm

Railway Crane
Maintenance Manual

Crane wise Emergency Engine fitted: -

Crane Number	Crane Type	Type of Engine fitted
142032	Fully Imported	A
142033	Fully Imported	A
142034	Fully Imported	A
142035	Fully Imported	A
142036	Fully Imported	A
142037	Fully Imported	A
142038	Knock down	A
142039	Knock down	A
142040	Knock down	A
142041	Kit Crane	A
142042	Kit Crane	A
142043	Kit Crane	A
143001	Jamalpur Manufactured	B
143002	Jamalpur Manufactured	B
143003	Jamalpur Manufactured	B
143004	Jamalpur Manufactured	B
143005	Jamalpur Manufactured	B
143006	Jamalpur Manufactured	B
143007	Jamalpur Manufactured	B
143008	Jamalpur Manufactured	B
143009	Jamalpur Manufactured	B
143010	Jamalpur Manufactured	B

Railway Crane
Maintenance Manual

Travel and Running Gear 2.6

Railway Crane
Maintenance Manual

Description

The travel gear reduction unit reduces the drive speed of the hydraulic motor to the required pinion speed. The crane has a total of two travel drives and thus two travel gear reduction units.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed or drawn into the equipment.
***Caution**- When dealing with hot oil- Danger of being burnt or scalded!*
***Caution**- Hydraulic system! Work may only be performed on the hydraulic system when there is no pressure and the diesel engine is stationary. This also applies to the tightening of hydraulic connections. Use caution when releasing connections because higher mounted components could drain dry. In these Observe disposal regulations!*
***Caution**! – Some sections of the hydraulic and air pressure systems are still under pressure even when the crane is at a standstill.*

Maintenance Instructions

Check the travel gear reduction units for external damage, leakages, and firm seating.
Note: To check the oil level, bring the railway crane into horizontal position and switch off the engine at operating temperature.

- The oil level is checked via an overflow gauge.
- To do so, clean the exterior of the oil filler plug **(See Figure 'A' on the bottom left)** and screw out.
- If required, add oil until the oil level remains constant.
- Screw in the oil filler plug and tighten.

To change the oil, the railway crane must be in a horizontal position and switch off the engine at operating temperature.

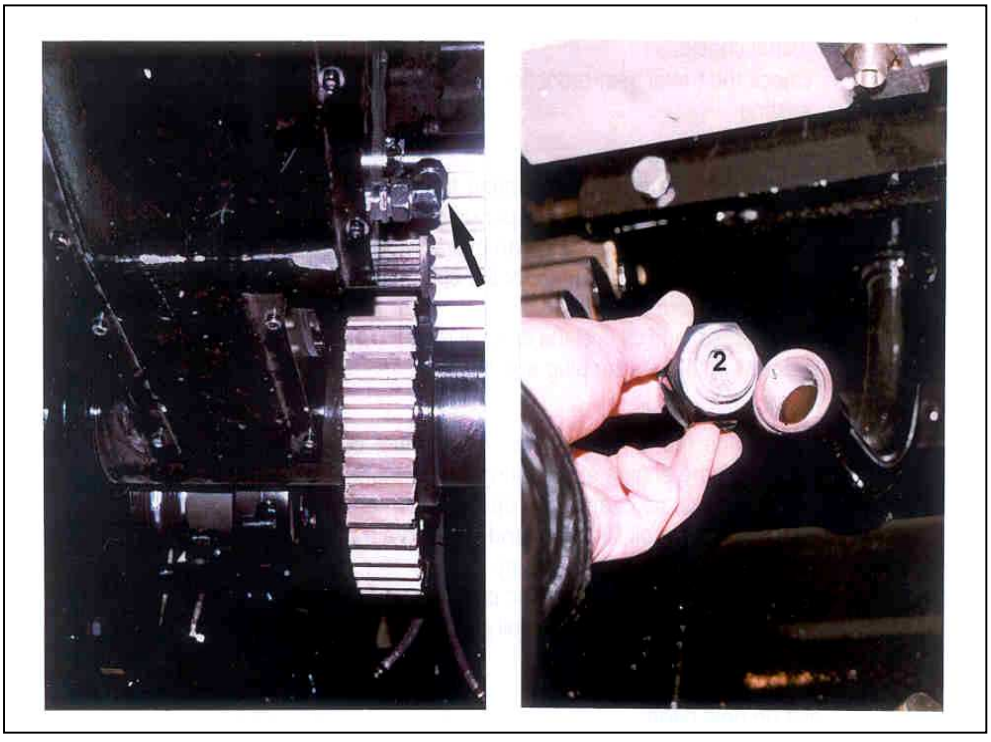
- The oil must be changed at operating temperature.
- Screw out the oil filler plug and the oil drain plugs **(See Figure 'B' at the top item-1**) and drain the oil completely.
- Check drained oil for metallic pollution and excessive abrasion.
- In the event of considerable oil pollution the gear unit must be filled with preheated oil.
- Then tighten the oil drain plug using a new sealing ring.
- Add oil until the oil level remains constant.
- Screw in the oil filter plug and tighten.

To check the vent:

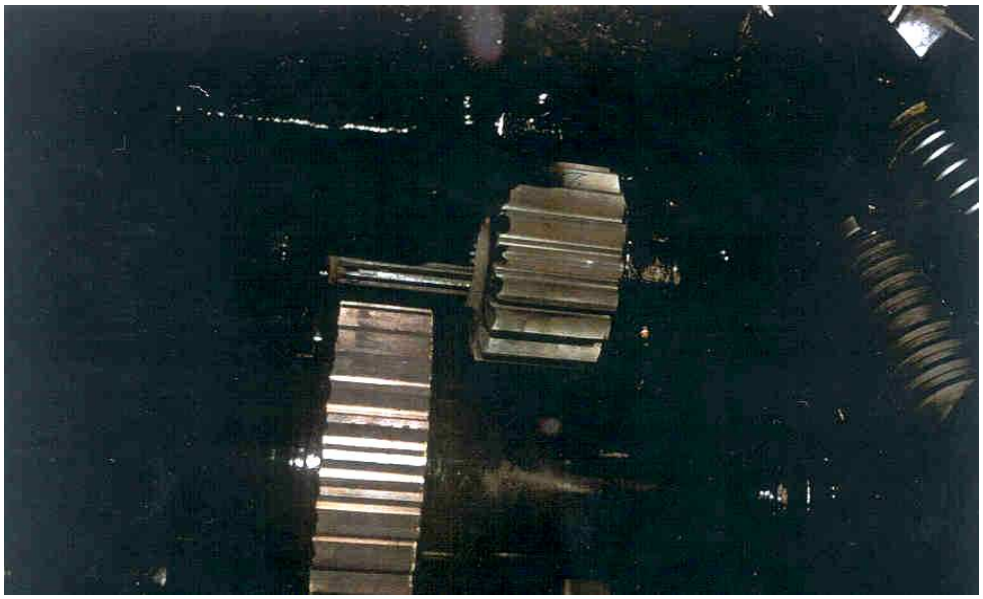
- If the vent is seriously closed, screw out the vent (**See Figure 'C' on the bottom right item-2**) from the gear unit, wash in a suitable solution and dry with compressed air.

Figure 'A'

Figure 'B' & 'C'



Railway Crane
Maintenance Manual



Description

The pinion and gear wheel on the wheel shafts forms the last stage of the disengaging travel gear drive. The crane has a total of two travel drives and thus two pinion and gear wheels.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed or drawn into the equipment.
***Caution-** When dealing with hot oil- Danger of being burnt or scalded!*
Observe disposal regulations!

Maintenance Instructions

Check the pinions and gear wheel for external damage.

Clean the pinion and gear wheels with a suitable aid.

Caution- Grease using the lubrication brand as per the chart in the **Section -3** of this manual.

Railway Crane
Maintenance Manual

Description

By means of the disengaging device, the pinion and the gear wheel of the travel drive are disengaged prior to transport. The disengaging device is attached via an air pressure cylinder. The crane has a total of two travel drives and thus two disengaging devices **(See Figure 'A')**.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.

In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed or drawn into the equipment.
***Caution**- When dealing with hot oil- Danger of being burnt or scalded!*
Observe disposal regulations!
***Caution**- Some sections of the system are under pressure until the accumulators have been emptied.*
Prior to commencing work on the air pressure system, ensure the system is completely without pressure!
Use caution when dealing with air pressure system! Work may only be performed on the air pressure system is without pressure. This is also applicable for the tightening of the air pressure connections.

Maintenance Instructions

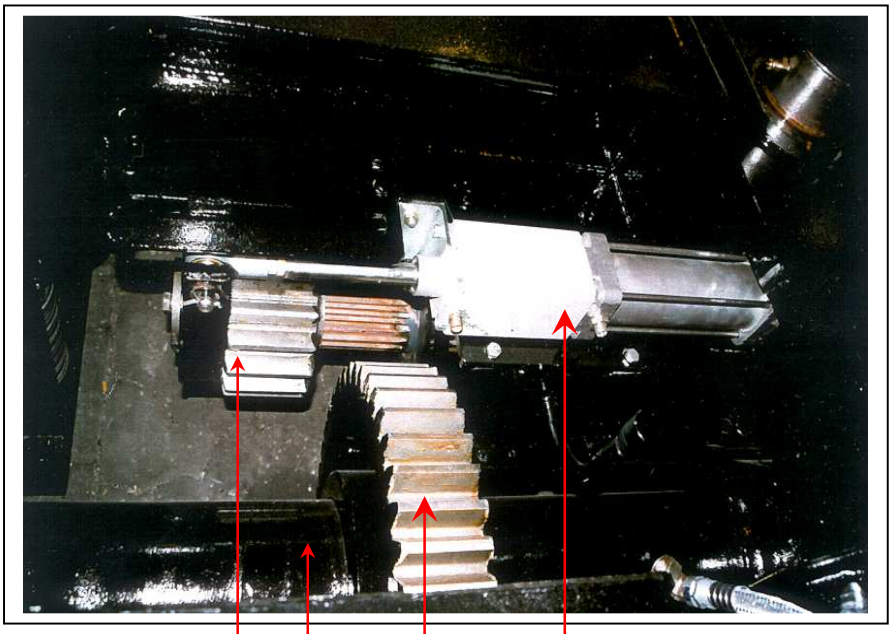
Check the disengaging devices, their connections, and mountings for external damage and firm seating.

- Check the air pressure cylinders, their connections, and mountings for external damage, firm seating, and proper sealing.
- Tighten and replace loose and leaky connections when the system is not under pressure.
- On completion of the maintenance work, a sealing test under pressure must be carried out.

The spline shaft teething for dirt: - if required, clean, then grease.

Check the disengaging devices for proper functioning.

Figure 'A'



Railway Crane
Maintenance Manual

Description

The six wheel sets are specially manufactured sets, which are suited to absorbing all the forces and stresses which occur during crane and travel operation **(See Figure 'A' & 'B').**

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed or drawn into the equipment.
Caution*- when dealing with hot oil- Danger of being burnt or scalded!*
Observe disposal regulations!

Maintenance Instruction

The following maintenance work on the wheel sets must be carried out according to the information in the Gutehoffnungshutte Radsatz GmbH User's Manual.

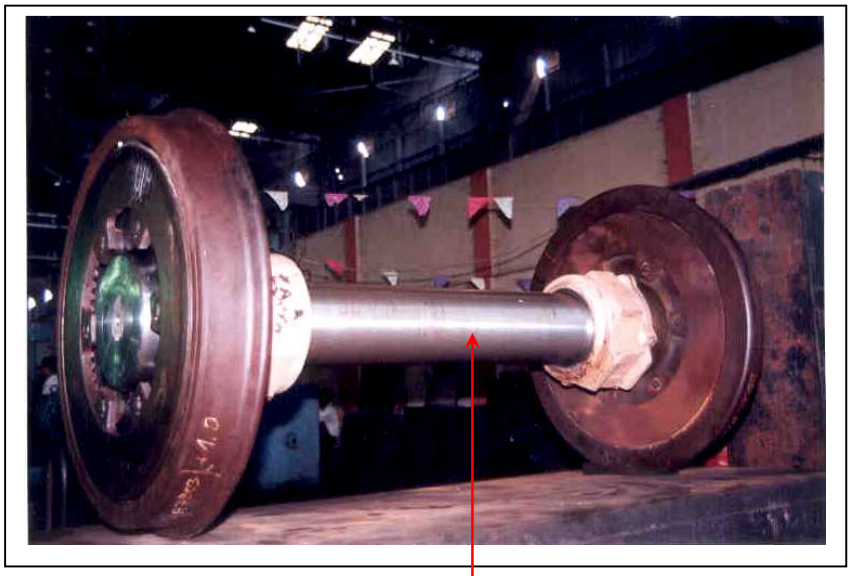
Check the wheel sets for cracks, fractures, and damage. Watch for the following features. If required, repair or replace:

- Cracks in the hub or disk of the solid wheels
- Indicating groove on the solid wheels is no longer visible on the circumference.
- Shape and location of the wheel contours.
- Surface finish of wheel treads
- Broken or cracked wheel rims on the solid wheels
- Wheel flats on the wheel tread
- Heat cracks in the disk wheels
- Clamping nicks on the solid wheels
- Spalling on the wheel treads
- Wheel shift
- Cracks in the wheel axle
- Deformed wheel axle
- Heavy rusting on axles and disk wheels

Check the mountings of the brake discs for proper and firm seating.
Wheel Back to back distance:
The wheel back to back distance (crane unloaded) 1596 mm + _2 mm.

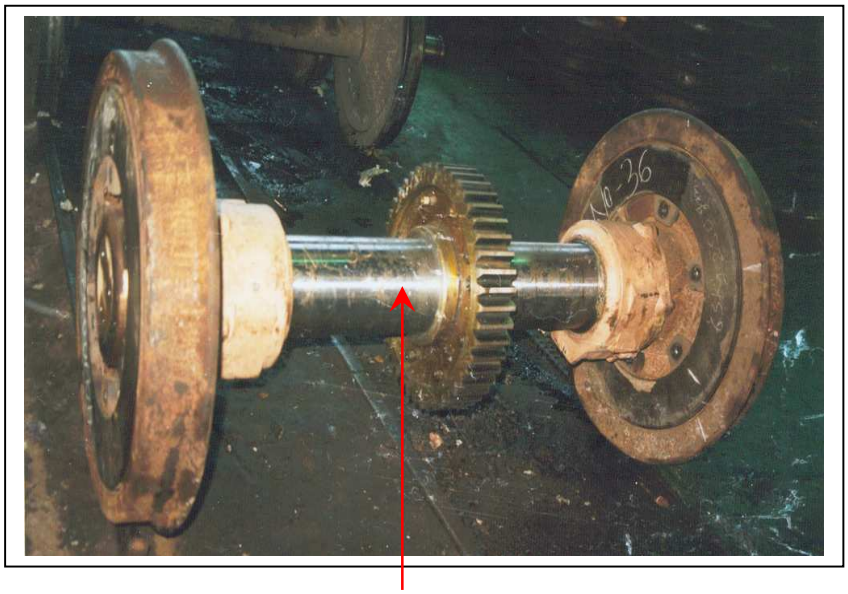
Wear Test/ Operating limit size:
Diameter, N**ew** 915 mm, +_ 1 mm
Diameter**, Min**: 860 mm

Figure 'A'



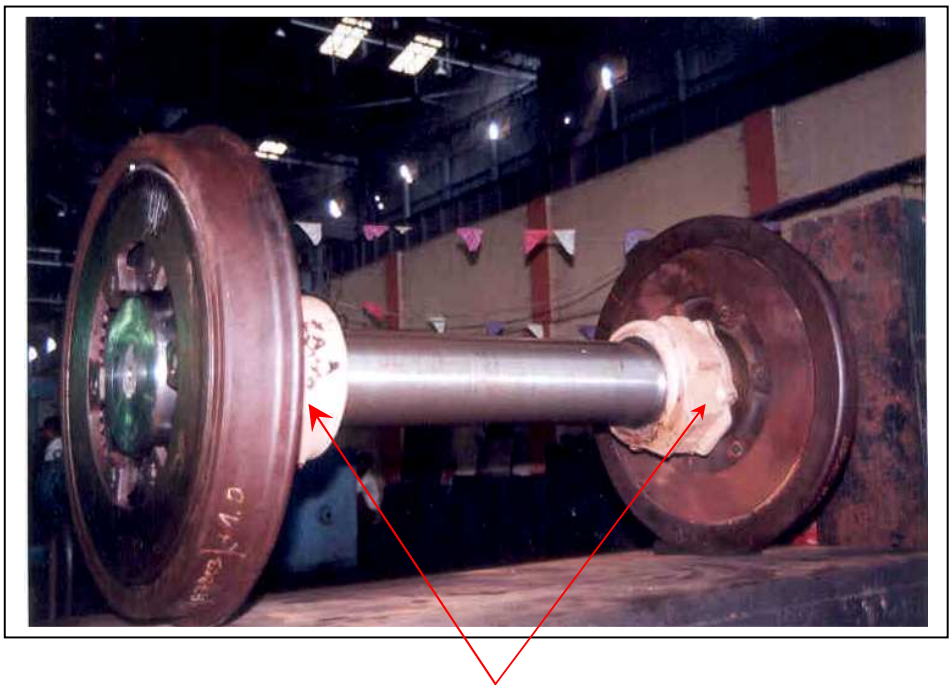
Non-driving

Figure 'B'



Driving

Railway Crane
Maintenance Manual



Wheel set bearings

Description

The wheel set bearings are anti-friction bearings with a grease filling.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed or drawn into the equipment.
***Caution**- When dealing with hot oil- Danger of being burnt or scalded!*
Observe disposal regulations!

Maintenance Instructions
Check the wheel set bearings and their guides for external damage.

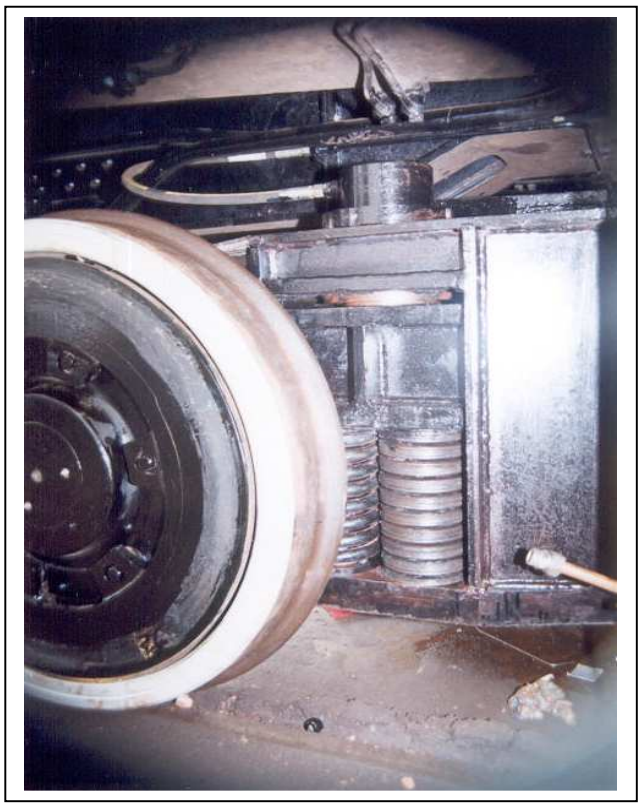
The bearings have grease filling. To replace the filling, open the bearing and remove the bearing housing. Then clean the entire anti-friction bearing and the housing and filled with fresh grease, Re-assembly in reverse order.

Note: The inner bearings should not be opened.

Railway Crane
Maintenance Manual

Spring Suspension **2.6.6**

P-1/1



Description

To provide optimal suspension, the crane is fitted with a spring system. The system consists of combinations of cup spring and the helical springs. In crane operation, the spring suspension clearance is blocked during crane operation by means of hydraulic cylinders.

SAFETY INSTRUCTIONS

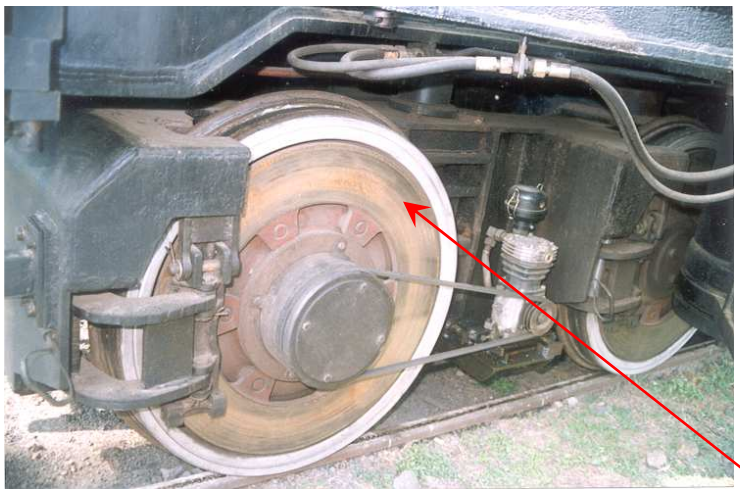
! Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a “Maintenance Work” warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed or drawn into the equipment.
Caution- When dealing with hot oil- Danger of being burnt or scalded!
Observe disposal regulations!

Maintenance Instructions

Check the components of the spring assembly for external damage as well as for cracks and fractures. Any damaged spring elements must be replaced immediately.

If required, clean spring suspension with a suitable aid.

Railway Crane
Maintenance Manual



Description

The brake discs in connections the brake cylinder adjuster unit and the brake cylinder forms the wheel disc brakes. These wheel brake discs are used as the service brakes. The brake discs are mounted on the wheels of the wheel set axles.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
***Caution-** The brake discs must be cooled down- Danger of injury through burns as a result of contact with the brake discs!*
When the following work is performed on the brake discs, observe the safety instructions in the BSI Verkehrstechnik User's Manual.
The brake discs may first be used again when all the criteria in the BSI-Verkehrstechnik User's Manual have been met.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed or drawn into the equipment!

Maintenance Instructions

The following maintenance work on the brake disc must be carried out in accordance with the instructions in the BSI- Verkehrstechnik User's Manual.
* Check the brake discs for external damage, cracks, (great thermal shock cracks) and fractures:
* In addition, when the wear markings on the discs have been reached, check the pads and the clearance.

Wear markings:

Disk wear limit: max. 7.0 mm
Hollow wear: max. 2.5 mm
Grooves : max. 1 mm
Carry out a functional test (brake test)

Railway Crane
Maintenance Manual

Description

The crane can either be operated by means of an air pressure brake system or a vacuum brake system. The brake system can be changed from the air pressure system to the vacuum system and vice versa by means of two levers which can be operated on both sides of the crane **(See Figure 'A').**
The status of the brakes can be read off the respective indicators (red and green).
If required, the spring-loaded cylinders of the brakes can be relieved of pressure by means of the Bowden cables.
Caution! In this case, braking cannot be carried out again until the brake system has been re-pressurised with air pressure.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
***Caution-** The brake discs must be cooled down- Danger of injury through burns as a result of contact with the brake discs!*
When the following work is performed on the brake discs, observe the safety instructions in the BSI Verkehrstechnik User's Manual.
The brake discs may first be used again when all the criteria in the BSI-Verkehrstechnik User's Manual have been met.
Ensure that no one is near hot or moving parts- danger of getting burnt, crushed or drawn into the equipment!

Maintenance Instructions

Check all the components of the brake system, in particular the change- over devices and the Bowden cables as well as their pertaining mountings for external damage and firm seating. Also check the indicators for firm seating.

Clean the change- over devices and the Bowden cables.

Check the six pull cables of the emergency release device for proper functioning.

Carry out a functional test on the entire brake system. The brake must be operated and then released. Observe the indicators during this procedure

Railway Crane
Maintenance Manual

Figure 'A'

Railway Crane
Maintenance Manual

Cab **2.7**

Description

The cab protects the operating personnel and the sensitive controls against the influences of weather **(See Figure 'A').**

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts-danger of getting burnt, crushed or drawn into the equipment!
When working with paint and solvents, ensure to observe without with out fail the respective safety instructions on the packages.
When dressing with a flame- use caution- danger of explosion near fuel and oil related components!
When work is being performed on the crane, ensure that the switches and levers cannot be operated by accident or unknowingly.
Ensure that no one is in the danger Zone.

Maintenance instructions

Check the entire cab for external damage and deformations.
Caution: Check material before commencing with straightening work! In some cases, the cab has aluminium profile, which must not be heated by flame.

Check the glass for damage. Any damaged panels must be replaced immediately.

Clean the cab width a suitable aid. This applies, in particular to the walkways and stair areas; oily and greasy components increase the danger of slipping!

Clean, grease and check the hinges and door lock for proper functioning.

Clean the paintwork damage immediately and protect against corrosion with primer and paint.

Railway Crane
Maintenance Manual

Figure 'A'

Control Panels 2.7.2

Description

By means of the control panels, all crane and travel motions can be affected and most functions can be monitored.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts-danger of getting burnt, crushed or drawn into the equipment!
When working with paint and solvents, ensure to observe without fail the respective safety instructions on the packages.
When dressing with a flame- use caution- danger of explosion near fuel and oil related components!
When work is being performed on the crane, ensure that the switches and levers cannot be operated by accident or unknowingly.
Ensure that no one is in the danger Zone.

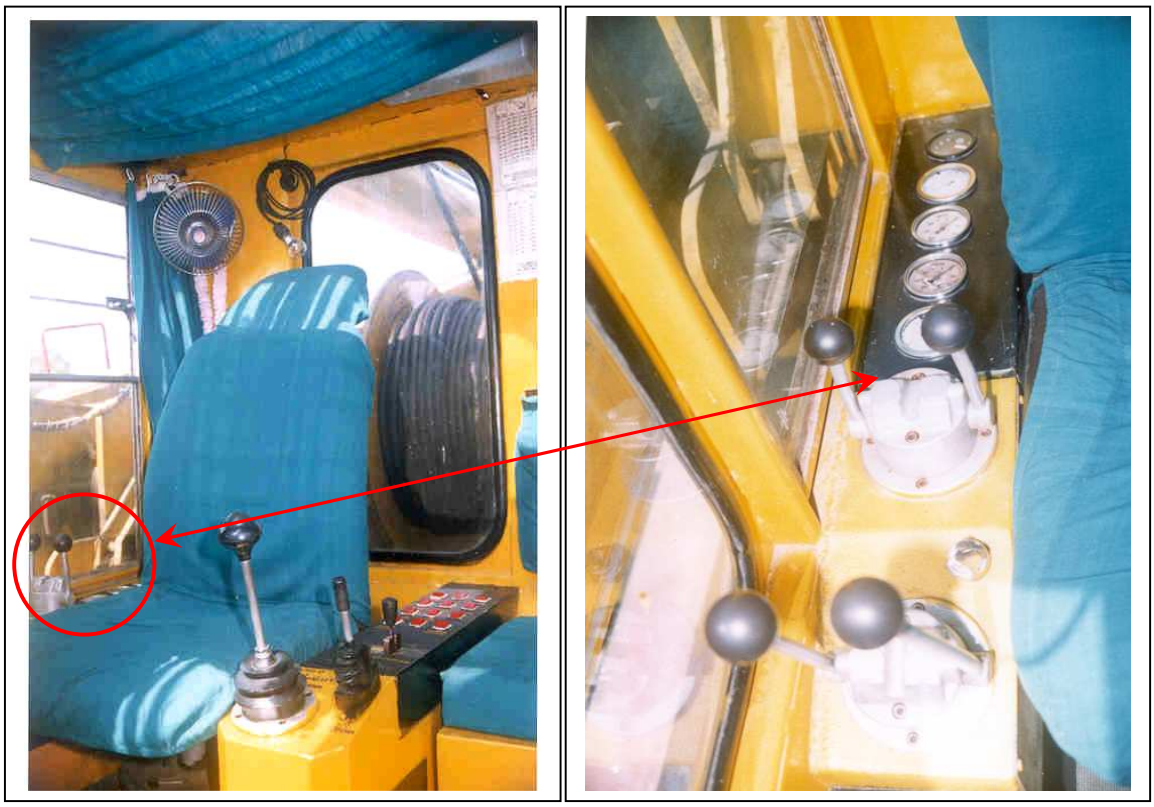
Maintenance instructions

Check the control panels for external damage and firm seating.
Damaged components must be replaced immediately.

Clean the control panels with a suitable aid.
Ensure that water and other wet-cleaning agents cannot damage the sensitive electrical components.

Railway Crane
Maintenance Manual

Figure 'A'



Railway Crane
Maintenance Manual

Description
The crane has an electrically operated wiper system its front and roof wind screens.

SAFETY INSTRUCTIONS

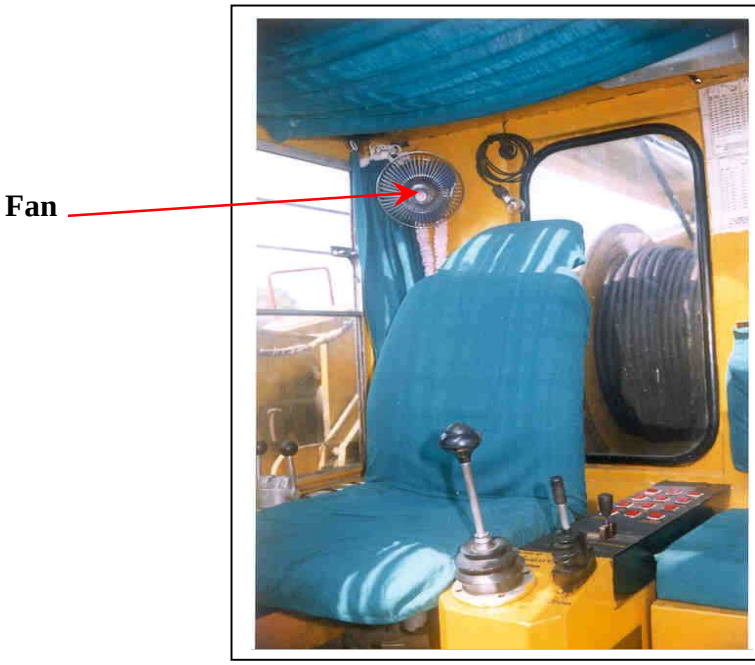
Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts-danger of getting burnt, crushed or drawn into the equipment!
When working with paint and solvents, ensure to observe without with out fail the respective safety instructions on the packages.
When dressing with a flame- use caution- danger of explosion near fuel and oil related components!
When work is being performed on the crane, ensure that the switches and levers cannot be operated by accident or unknowingly.
Ensure that no one is in the danger Zone.

Maintenance instructions
Check the entire system for external damage and firm seating. In particular, ensure the wiper blades are in good condition. Any damaged or worn wiper blades must be replaced immediately.
Check the system for proper functioning.
Caution: - When the diesel engine is at a standstill, the screen wipers should only be switched on momentarily as other the batteries will run flat and the charged status will not be sufficient to start the diesel engine.

Railway Crane
Maintenance Manual

Fan **2.7.4**

P-1/1



Description
The fans built into the cab rear wall at the top serve to suction off and intake the cab air.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane can not be switched on and secured against rolling.
In addition, a "maintenance Work" warning sign must be visibly affixed to both in and out side the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts- danger getting burnt, crushed, or drawn into the equipment.
The crane must not be operated in enclosed areas without an exhaust fumes discharges.
When work is being performed on the crane; ensure that the switches levers can not be operated by accident or unknowingly. Ensure that no one is in the danger zone.

Maintenance Instructions
Check the fans and their cover grates for external damage and firm seating.

Screw off the vent grates when the fans are switched off and clean with a suitable aid.

Activate the respective switch on the control panel and test whether both fans run properly.

Caution! When the diesel engine is stationary, the fans should run only shortly as otherwise the battery will run flat and the charging rate will not be sufficient to start the diesel engine.

Railway Crane
Maintenance Manual

Description

There are various pieces of additional equipment on the crane, in particular, in the cab. Nevertheless, they do not serve to affect any crane functions directly, but are required for smooth- running and proper operation.

SAFETY INSTRUCTIONS

When work is being performed on the crane, ensure that the switches and levers cannot be operated by accident on unknowingly. Ensure that no one is in the danger zone!

Maintenance instructions

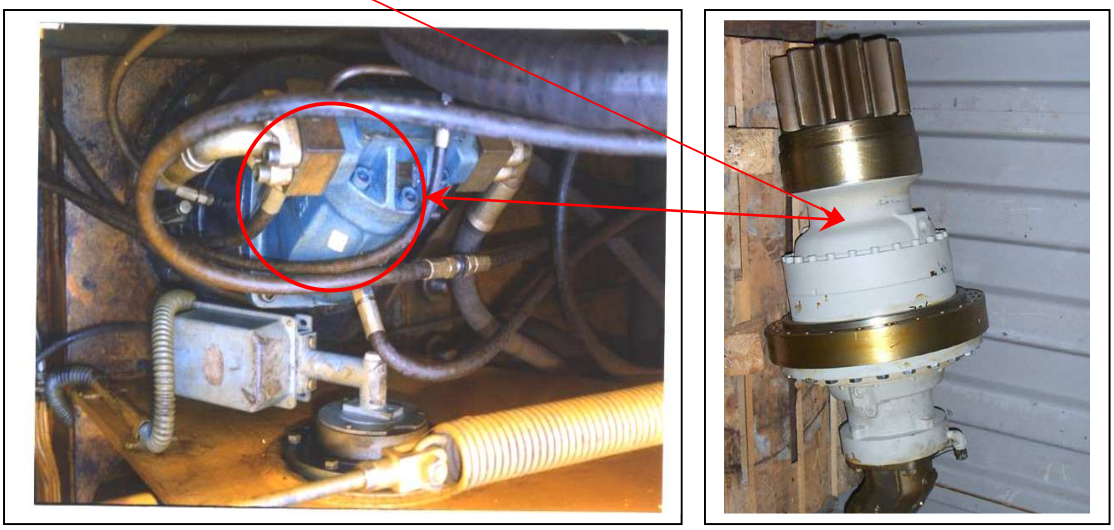
Check the entire cab equipment for proper functioning.
Any damaged parts must be repaired or replaced.

Caution- Remember that fire extinguishers and first aid kits, etc. have expiry dates. Then they must be serviced or replaced accordingly!

Railway Crane
Maintenance Manual

Slewing Gear **2.8**

Railway Crane
Maintenance Manual



Description

The slewing gear reduction unit is a three-stage planetary gearbox. The equipment consists of an integrated, hydraulically lifted multi-disk holding brake with free wheeling option.

The wheels with external toothing have been hardened. The entire gearbox is seated on a anti-friction bearing and is fitted with an oil bath lubrication system. The bearing of the drive pinion in the stay pipe is lubricated continuously with grease.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts-danger of getting burnt, crushed or drawn into the equipment!

Maintenance instructions

Carry out the maintenance work on the planetary gearbox according to documentation supplied by Lohmann && Stolterfoht GmbH.

Check the planetary gearbox, its attachments, and connections for damage and leakages. Check for all connections, lines and connections for firm seating.

Carry out a running noises check.

To check the oil level:

Note: The crane must be in horizontal position to check the oil level.

- Screw out the oil dipstick and wipe off with a clean, lint-free cloth. Then screw in the oil dipstick and then screw out again. The oil level must be between the upper and lowering markings on the dipstick, if required, top up the oil using the brand as classified in the chart in **Section-3** of this manual via the oil dipstick opening.
- Then screw in the oil dipstick.

Carry out an oil analysis according to the intervals laid down in the maintenance manual.

To change the oil:

Note: The crane must be in horizontal position to change the oil level.

- The oil must be changed when the oil has reached operating temperature.
- Direct the hose for the oil drain (below the slew reduction gear unit) into an external outlet.
- Screw out the oil dipstick and the oil drain plug on the hose end.
  Drain the oil into a suitable and sufficiently large enough tray. Always check the drained oil for metal pollution and excessive abrasion.
- Screw out the oil drain plug on the hose end and direct the hose back into the opening.
- Add oil using the brand as classified in the chart in **Section- 3** of this manual.
  Monitor the oil level via the oil dipstick.
- Wait a few minutes.
- If the oil level falls, top up the oil until the oil level maintains constant.
- Then screw in the oil dipstick.

Check the screw connections, taking into the account the torque moment in the installation drawing and check for firm seating.

Unscrew the breather filter adjacent to the pipe whenever oil is topped up and check for pollution; if required, clean or replace the filter.

Railway Crane
Maintenance Manual

Description

The pinion and gear wheel forms the last stage of the slewing gear drive. The pinion and gear wheel must be checked regularly for damage and lubricated according to the maintenance check list.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts-danger of getting burnt, crushed or drawn into the equipment!
To check and clean the pinion and gear wheel, the superstructure must be rotated several times on the undercarriage.
Prior to commencing with the actual work, ensure, using the above measures that the crane cannot be set into operation- danger of being crushed of being crushed or drawn into the equipment!

Maintenance instructions

Check the gear wheel and, in particular, the pinion for external damage such as cracks, broken teeth, dimples and steel pits.

Clean the gear wheel and pinion of waste grease and dirt. Then grease with spray grease brand as classified in the chart in **Section -3** of this manual.

Railway Crane
Maintenance Manual

Description
The roller bearing slew ring is the 360 degree rotatable connection between the superstructure and the undercarriage.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts-danger of getting burnt, crushed or drawn the equipment!
To check and clean the pinion and gear wheel, the superstructure must be rotated several times on the undercarriage.
Prior to commencing with the actual work, ensure, using the above measures that the crane cannot be set into operation- danger of being crushed of being crushed or drawn into the equipment!

Maintenance instructions
To carry out the running noises check, the superstructure must be rotated slowly on the undercarriage; ensure that the bearing assembly runs smoothly and quietly.

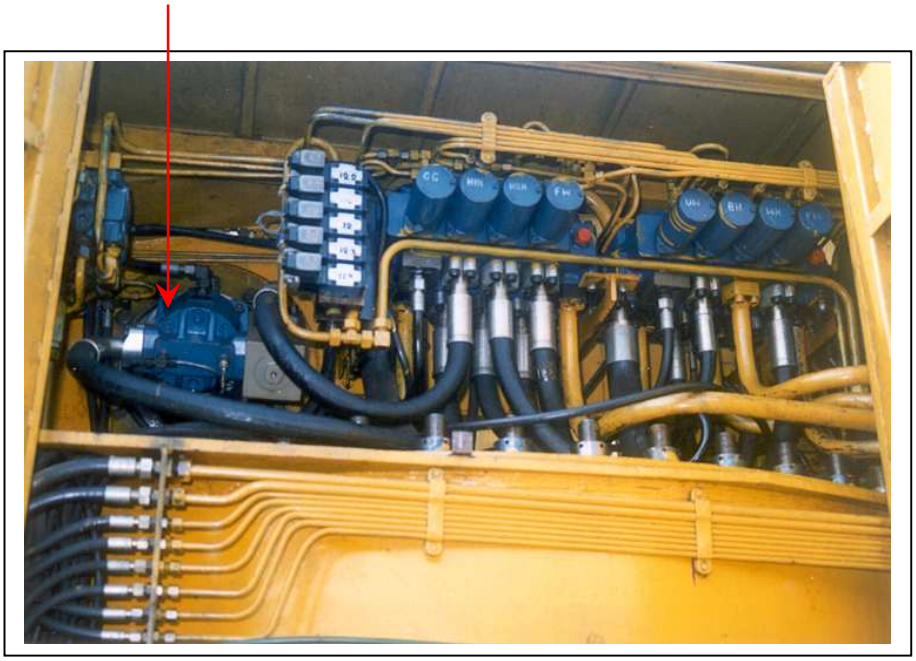
Two lubrication nipples are located in the left machinery house near the slew reduction gear unit. The entire slew ring must be lubricated via these nipples. The grease is fed via a pipeline system to the 20 lubrication points. These points must be lubricated until the slew ring is protected by means of a clean, surrounding bead of grease.

To compensate for settling, the bolts must be tightening with the prescribed torque moment.

Railway Crane
Maintenance Manual

Main Hoist **2.9**

Railway Crane
Maintenance Manual



Description

The main hoist is a three – stage planetary gearbox. The equipment includes an integrated, hydraulically lifted multi-disk brake with free-wheeling option and a counter bearing.
The wheels with external toothing have been hardened. The entire gearbox is seated on anti-friction bearing and is fitted with an oil bath lubrication system. Power take-off and drive motions have counter rotary directions.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts-danger of getting burnt, crushed or drawn into the equipment!
Check and clean the pinion and gear wheel, the superstructure must be rotated several times on the undercarriage.
Prior to commencing with the actual work, ensure, using the above measures that the crane into operation- danger of being crushed of being crushed or drawn into the equipment!

Maintenance Instructions

The maintenance work on the planetary gearbox must be carried out according to the information in the Lohmann & stolterfoht GmbH User's Manual.

Check the planetary gearbox, its attachments, and all connections for external damage and leakages. Check all connections, lines, and links for firm seating.

Carry out a running noise check.
Note: The crane must be in horizontal position to check the oil level.

- The oil is checked via the overflow meter. To do so, screw out the oil filter plug and the oil level inspection plug, if required, top up oil using the brand as classified in the chart in **Section -3** of this manual.

- Then screw in both plugs.

Carry out an oil analysis according to the intervals in the maintenance schedule

Lubricate the lubrication nipple on the counter bearing.

Note: The crane must be in horizontal position to change the oil.

- The oil must be changed when the oil has reached operating temperature.

- Screw out the oil filler plug, the oil level inspection plug and the oil drain plug and allow the oil to drain in suitable and sufficiently large enough tray oil. Always check the drained oil for metallic pollution and excessive abrasion.

- Then screw in the oil drain plug and add oil through the opening using the brand as classified in the chart in **Section -3** of this manual. Monitor the oil level on the oil level inspection plug.

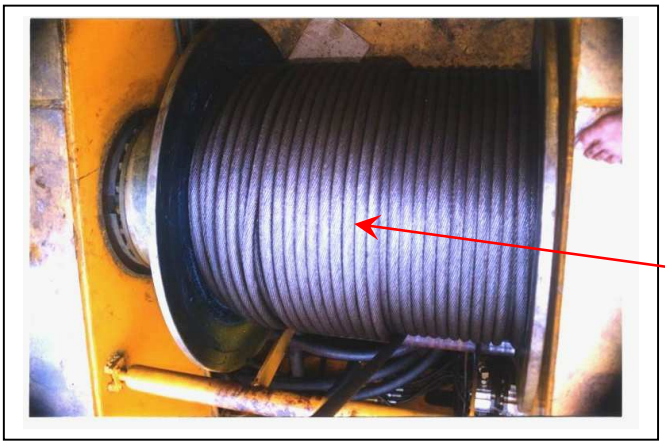
- Wait a few minutes.

- If the oil level falls, top up the oil until the oil level maintains constant.

- Then screw in the oil filler plug and the oil level inspection plug

Check the screw connections taking into the account the torque moment in the installation drawing and check for firm seating.

Railway Crane
Maintenance Manual



Description

The rope drum forms a rigid unit with the main hoist reduction unit. The rope drum coils the hoist rope in several layers automatically.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts-danger of getting burnt, crushed or drawn into the equipment!
To check and clean the pinion and gear wheel, the superstructure must be rotated several times on the undercarriage.
Prior to commencing with the actual work, ensure, using the above measures that the crane cannot be set into operation- danger of being crushed of being crushed or drawn into the equipment!

Maintenance instructions

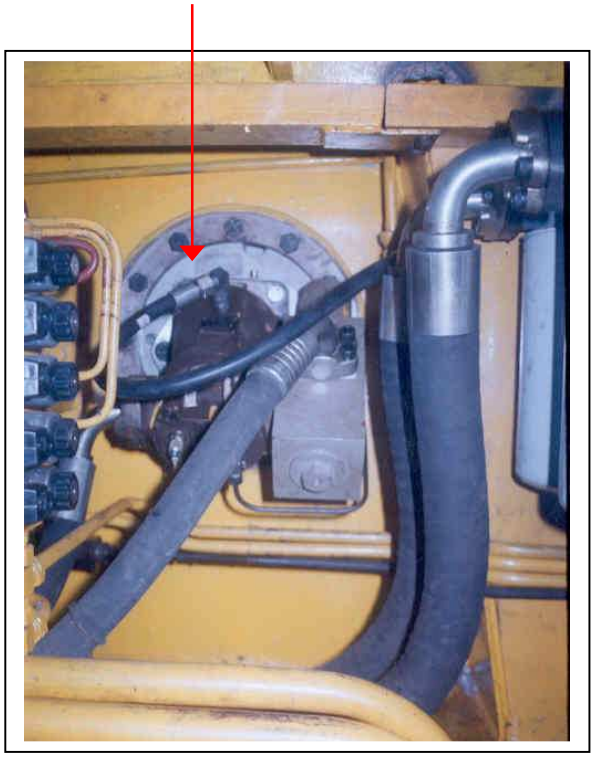
Check the rope drum for external damage and firm seating.

Check the rope clamp for firm seating and damage.

Railway Crane
Maintenance Manual

Auxiliary Hoist **2.10**

Railway Crane
Maintenance Manual



Description

The auxiliary hoist is a two- stage planetary gearbox. The equipment includes an integrated, hydraulically lifted multi-disc brake with free- wheeling option and a counter bearing.
The wheels with external toothing have been hardened. The entire gearbox is seated on an anti-friction bearing and is fitted with an oil bath lubrication system.
Power tale-off and drive motions have counter rotary directions.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane can not be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts-danger of getting burnt, crushed or drawn into the equipment!
To check and clean the pinion and gear wheel, the superstructure must be rotated several times on the undercarriage.
Prior to commencing with the actual work, ensure, using the above measures that the crane cannot be set into operation- danger of being crushed double or drawn into the equipment!

Maintenance instructions

The maintenance work on the planetary gearbox must be carried out according to the information in the Lohmann & Stolterfoht GmbH User's Manual.

Check the planetary gearbox, its attachments, and all connections for external damage and leakages. Check all connections, lines, and links for firm seating.

Carry out a running noise check.

Note: The crane must be in horizontal position to check the oil level.

- The oil is checked via the overflow meter. To do so, screw out the oil filler plug and the oil level inspection plug ,if required, top up oil using the brand as classified in the chart in **Section- 3** of this manual.
- Then screw in both plug.

Carry out an oil analysis according to the intervals in the maintenance schedule

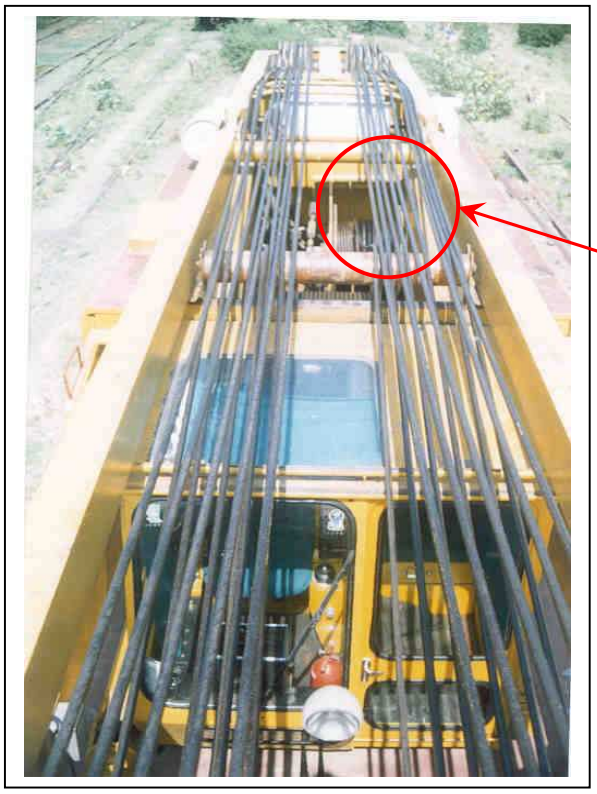
Lubricate the lubrication nipple on the counter bearing.

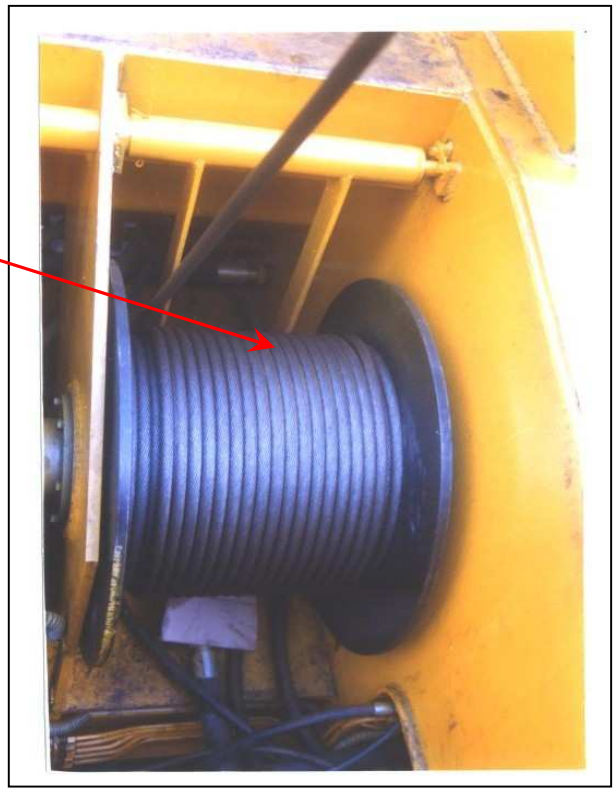
To change the oil:

- The crane must be in horizontal position to change when the oil has reached operating temperature.
- Screw out the oil filler plug the oil level inspection plug and the oil drain plug and allow the oil to drain in a suitable and sufficient large enough tray oil. Always check the drained oil for metallic pollution and excessive abrasion.
- Then screw in the oil drain plug and add oil through the opening using the brand as classified in the chart in **Section -3** of this manual. Monitor the oil level on the oil level inspection plug.
- Wait a few minutes.
- If the oil level falls, top up the oil until the oil level maintains constant.
- Then screw in the oil filler plug and the oil level inspection plug.

Check the screw connections taking into the account the torque moment in the installation drawing and check for firm seating.

Railway Crane
Maintenance Manual





Description

The rope drum forms a rigid unit with the auxiliary hoist reduction unit. The rope drum coils the hoist rope in several layers.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts-danger of getting burnt, crushed or drawn into the equipment!

Maintenance instructions

Check the rope drum for external damage and firm seating.

Check the rope clamp for firm seating and damage.

Railway Crane
Maintenance Manual

Derricking Gear **2.11**

Railway Crane
Maintenance Manual

Description

The derricking gear permits the boom to derricked in and out. The derricking gear is a three- stage planetary gearbox. The equipment includes an integrated, hydraulically lifted multilink-disc brake with free- wheeling option and a counter bearing.

The wheels with external toothing have been hardened. The entire gearbox is seated on an anti-friction bearing and is fitted width an oil bath lubrication system.
Power take-off and drive motions have counter rotary directions

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts-danger of getting burnt, crushed or drawn into the equipment!

Maintenance instructions

The maintenance work on the planetary gearbox must be carried out according to the information in the Lohmann & stolterfoht GmbH User's Manual.

Check the planetary gearbox, its attachments, and all connections for external damage and leakages. Check all connections lines and links for firm seating.

Carry out a running noise check

To check the oil level:

Note: The crane must be in horizontal position to check the oil level.

- The oil is checked via the overflow meter. To do so , screw out the oil filler plug and the oil level inspection plug; if required top up oil using the brand as classified in the chart in **Section -3** of this manual.

Carry out an oil analysis according to the intervals in the maintenance check list

Lubricate the lubrication nipple on the counter bearing.

To change the oil:

Note: The crane must be in horizontal position to change the oil.

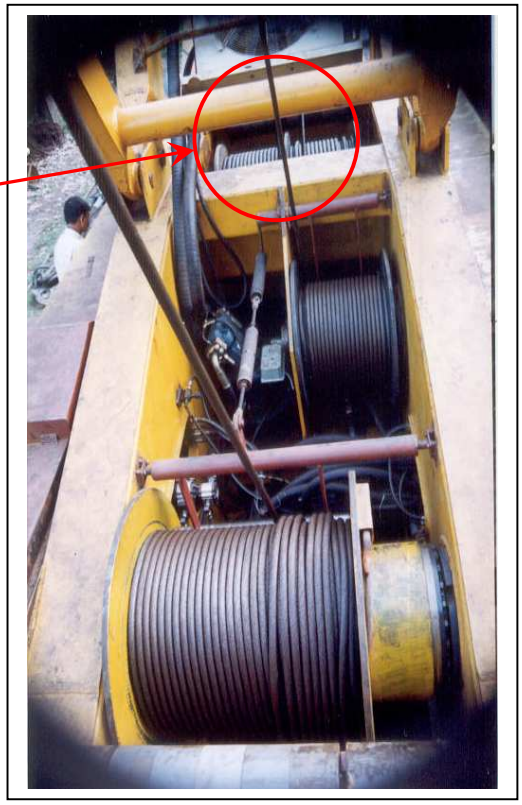
- The oil must be changed when the oil has reached operating temperature.
- Screw out the oil filler plug and the oil level inspection plug. Insert the unattached pipe supplied to the opening on the oil drain plug. Screw out the drain plug and allow the oil to drain in suitable and sufficiently large enough tray oil.
- Always check the oil for metal pollution and excessive abrasion.
  Then remove the pipe, screw in the oil plug and add oil using the brand as classified in the chart in **Section -3** of this manual, Monitor the oil level on the level inspection plug.
- Wait a few minutes.
- If the oil level falls, top up the oil until the oil level maintains constant.
- Then screw in the oil filler plug and the oil level inspection plug.

Check the screw connections taking into the account the torque moment in the installation drawing.

Railway Crane
Maintenance Manual

Rope Drum **2.11.2**

P-1/1



Description

The rope drum serves to coil the rope. The rope drum is rigidly connected with the planetary gearboxes for the winch drive assembly.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!

Maintenance instructions

Check the rope drum for external damage.

Check the rope clamps for firm seating; if required, re-tighten.

The rope grooves in the drum for damage and excessive wear when the rope is coiled.

Check the rope clamp for firm seating and damage.

Rope Pulley Set and Rope Guide on the Superstructure 2.11.3

Description

The pulley set at the rear of the superstructure **(See Figure 'A')** and the rope guide on the front of the crane superstructure **(See Figure 'B')** ensure that the ropes are properly guided in every boom position and thus contribute to safe operation and a long rope service life.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts danger of getting burnt, crushed or drawn into the equipment.

Maintenance Instructions

Rope pulley set:

Check the rope pulleys for external damage and wear. Any damaged or worn pulleys must be replaced.

Check also the rope pulleys for firm seating and whether they move easily; if required, re-tighten.

Carry out a functional test on the rope pulleys and checked as to whether they move easily and run properly.

Rope guide:

Check the rope guide for external damage, firm seating, and wear, any damaged or loose rope guides must be replaced.

Check also the rope pulleys for firm seating and whether they move easily; if required, re-tighten using the torque laid down in regulations.

Carry out a functional test on the rope guide whether it moves easily and runs properly.

Railway Crane
Maintenance Manual

Figure 'A'

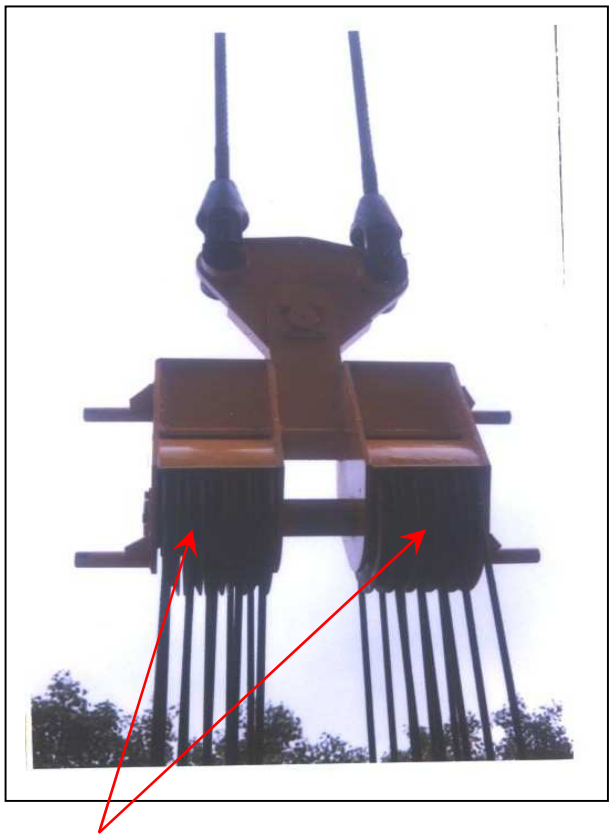
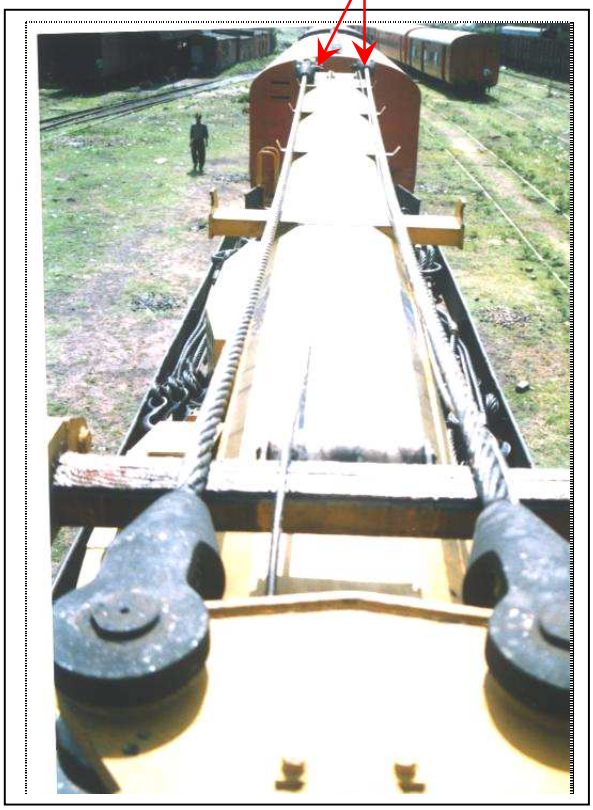
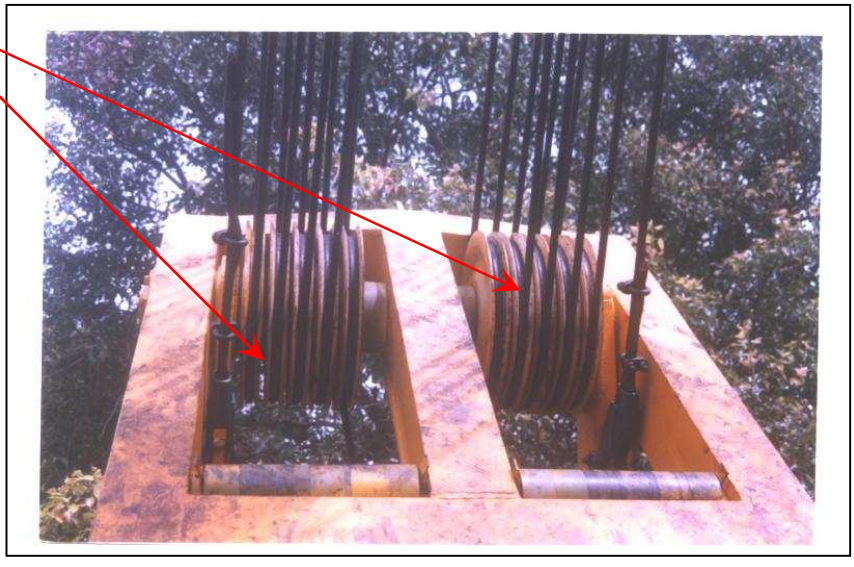


Figure 'B'
Rope Guide Pulleys



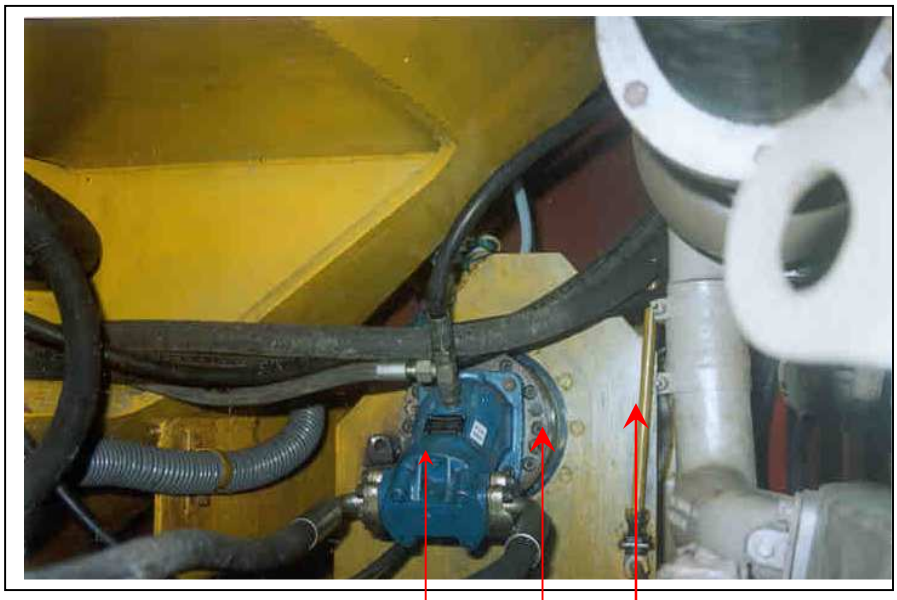
Rope Pulley



Railway Crane
Maintenance Manual

Recovery Winch **2.12**

Railway Crane
Maintenance Manual



Description

The recovery winch is a three – stage planetary gearbox. The equipment consists of an integrated, hydraulically lifted multi-disc holding brake with free-wheeling option.
The wheels with external toothing have been hardened. The entire gearbox is seated on an anti-friction bearing and is fitted with an oil bath lubrication system. The bearing of the drive pinion in the stay pipe is lubricated continuously with grease. Power take-off and drive motions have counter rotary directions.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts-danger of getting burnt, crushed or drawn into the equipment!

Maintenance Instructions

The maintenance work on the planetary gearbox must be carried out according to the information in the Lohmann & Stolterfoht GMBH User's Manual.

Check the planetary gearbox, its attachments, and all connections for external damage and leakages. Check all connections, lines, and links for firm seating.

Carry out a running noise check.

To check the oil level:

Note: The crane must be in horizontal position to check the oil level. The oil level inspection, oil filler, and oil drain plugs are located on the gearbox side. The counterweight support must be lowered to check the oil level or to carry out an oil change.

- The oil is checked via the overflow meter. To do so, screw out the oil filler plug and the oil level inspection plug ; if required, top up oil using the brand as classified in the chart in **Section- 3** of this manual.

- Then screw in both plugs.

Carry out an oil analysis according to the intervals in the maintenance check list.

Lubricate the lubrication nipple on the counter bearing.

To change the oil:

Note: The crane must be in horizontal position to change the oil. The oil level inspection, oil filler, and oil drain plugs are located on the gearbox.

- The oil must be changed when the oil has reached operating temperature.
- Screw out the oil filler plug, which is simultaneously the oil level inspection plug, and the oil drain plug and allow the oil to drain in suitable and sufficiently large enough tray oil. Always check the drained oil for metallic pollution and excessive abrasion.
- Then screw in the oil drain plug and add oil through the opening using the brand as classified in the chart in **Section-3** of this manual. Monitor the oil level on the oil level inspection plug.
- Wait a few minutes.
- If the oil level falls, top up the oil until the oil level maintains constant.
- Then screw in the oil filler plug and the oil level inspection plug.

Check the screw connections taking into the account the torque moment in the installation drawing and check for firm seating.

Railway Crane
Maintenance Manual

Description

The rope drum serves to take up the rope. The rope drum is rigidly connected to the planetary gearboxes for the drive assembly.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane can not be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!

Maintenance Instructions

Check the rope drum for external damage.

Check the rope clamps for firm seating; if required, re-tighten.

Check the rope grooves in the drum for damage and excessive wear when the rope is uncoiled.

Check the rope clamp for firm seating and damage.

Railway Crane
Maintenance Manual

Description

The deflection rolls of the recovery winch ensure that the rope is guided properly and contribute to the safe operation and long service life of the ropes.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!

Maintenance Instructions

Check the deflection rolls for external damage, wear, and firm seating. If required, tighten the mounting elements. Replace any damage or worn deflection rolls.

Check the rope clamp for firm seating and damage.

Lubricate the lubrication nipple on the deflection rolls.

Railway Crane
Maintenance Manual

Basic Construction 2.13

Railway Crane
Maintenance Manual

Steel Construction **2.13.1**

P-1/1

Description

The steel construction supports all the components of the crane and provides it with the required strength and rigidity to carry out its duties for which it is designed. The shape and dimensions of the steel construction have been calculated exactly and thus ensure that crane operation can be carried out safely. The undercarriage has mainly been manufactured in material Fe 540 to IS: 8500, the superstructure and boom in SAILMA 450 HI and ST 55 HTW to IS: 961.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
When working with paint and solvents, ensure to observe without fail the respective safety instructions on the packages.
Please note that the manufacturer must be consulted before any burning, welding, or dressing work is carried out on the crane.

Maintenance Instructions

Check the entire crane steel construction for external damage such as cracks or deformations.

Railway Crane
Maintenance Manual

Description

The protective housing and panelling screen off hot and moving components and protect persons near the components **(See Figure 'A').** Simultaneously, the components are protected against moisture and other external influences.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
When working with paint and solvents, ensure to observe without fall the respective safety instructions on the packages.
When dressing with a flame-use caution-danger of explosion near fuel and oil related components!
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!
When electrical welding work is being performed, the earthling terminal must be connected directly to the part to be welded In addition, the battery pole terminals on the diesel engine system and the emergency diesel engine system must be disconnected.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!

Maintenance Instructions

Prior to commencing with inspection and maintenance work, clean the protective housing and panelling with a suitable aid. This applies, in particular, to the stairway and walkway areas. Oily and greasy components increase the danger of slipping!

Check the protective housing and panelling for external damage.

Clean the damaged areas. Eliminate the damage with suitable knifing filler, glass fibre mats and polyester or corresponding primer and paintwork and then touch-up with paint.

Damage on minor components must be straighten and touched up with paint.

Oil the hinges and locks on the doors and check for proper functioning. Check the storm hooks on the doors for external damage and proper functioning.

Railway Crane
Maintenance Manual

Figure 'A'

Railway Crane
Maintenance Manual

Description

The stairways, footboards, and holding straps provide an easy and safe hold when climbing into the cab and onto the crane **(See Figure 'A')**. They have anti-slip, weather-proof treads.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
When working with paint and solvents, ensure to observe without fall the respective safety instructions on the packages.
When dressing with a flame-use caution-danger of explosion near fuel and oil related components!
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!
When electrical welding work is being performed, the earthling terminal must be connected directly to the part to be welded In addition, the battery pole terminals on the diesel engine system and the emergency diesel engine system must be disconnected.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment

Maintenance Instructions

Clean the stairways, footboards, and the walking surfaces and their mountings thoroughly with a corresponding cleaning agent. The oil and grease film on stairways increase the danger of slipping!

Check the stairways, footboards and holding straps and their mountings for damage and firm seating.

Missing screws must be replaced and loose connection must be replaced.

Clean the paintwork damage immediately and protect against corrosion using primer and the corresponding paint.

Damage on minor components must be straighten and touched up with paint.

Railway Crane
Maintenance Manual

Figure 'A'

Railway Crane
Maintenance Manual

Description

The Four-section steel counterweight, which can be detached for transport purposes, is mounted on the counterweight support **(See Figure 'A').**

SAFETY INSTRUCTIONS

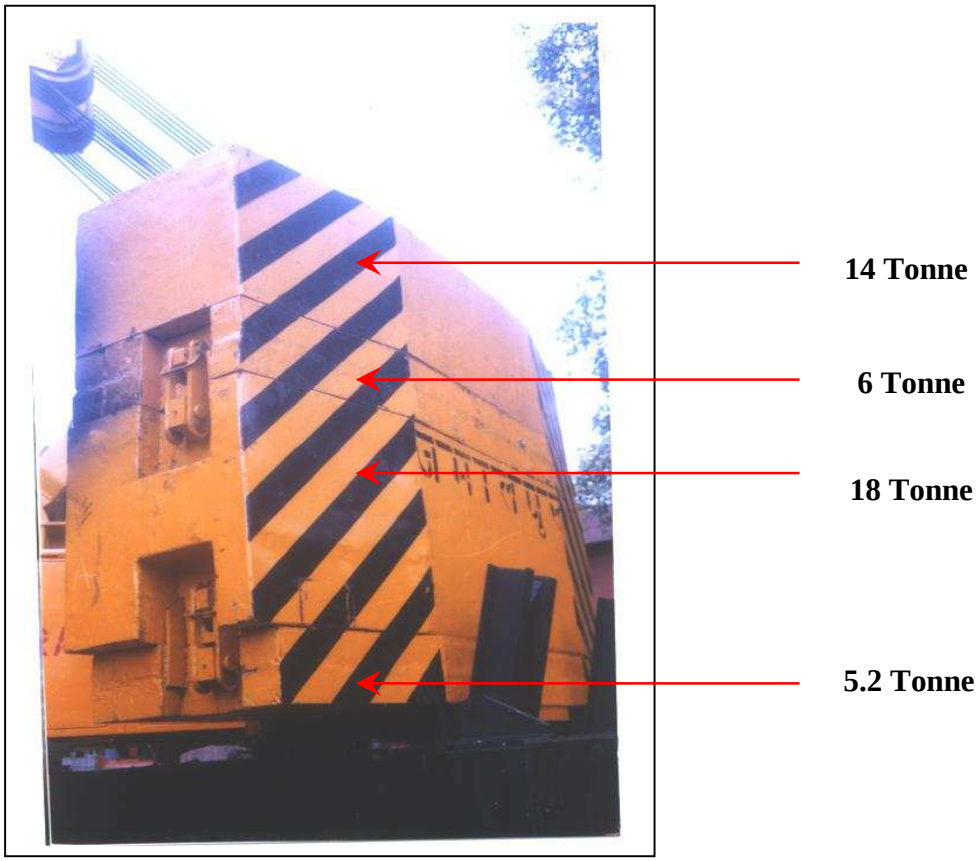
Before maintenance work is performed, it must be ensured that the crane can not be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
When working with paint and solvents, ensure to observe without fall the respective safety instructions on the packages.
When dressing with a flame-use caution-danger of explosion near fuel and oil related components!
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!
When electrical welding work is being performed, the earthling terminal must be connected directly to the part to be welded In addition, the battery pole terminals on the diesel engine system and the emergency diesel engine system must be disconnected.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!

Maintenance Instructions

Check the counterweight and the mountings for external damage and crack.

Clean the paintwork damage immediately and protect against corrosion using primer and the corresponding paint.

Figure 'A'



Railway Crane
Maintenance Manual

Outrigger Beam

Description

The outrigger beams are extended and retracted via a hydraulic cylinder. The outrigger beams are latched in transport position by means of socket pins.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
When working with paint and solvents, ensure to observe without fall the respective safety instructions on the packages.
When dressing with a flame-use caution-danger of explosion near fuel and oil related components!
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!

Maintenance Instructions

Check the outrigger beams for external damage, cracks, fractures, and deformations

Clean the paintwork damage immediately and protect against corrosion using primer and the corresponding paint.

The bearings of the outrigger beams on the undercarriage are fitted with one lubrication nipple each on the upper and lower sides. Remove the waste grease and lubricate until the bearing points are protected by means of a surrounding bead of grease.

Check the outrigger beams as to whether they extend and retract properly and whether they lock properly.

Railway Crane
Maintenance Manual

Outrigger Pads **2.13.6**

P-1/1

Description
The outrigger pads are hinged to transfer the support forces for the crane evenly into the ground.

SAFETY INSTRUCTIONS

Before maintenance work performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
When working with paint and solvents, ensure to observe without fall the respective safety instructions on the packages.
When dressing with a flame-use caution-danger of explosion near fuel and oil related components!
When electrical welding work is being performed, the earthingl must be connected directly to the part to be welded. In addition, the battery pole terminals on the diesel engine system and the emergency diesel engine system must be disconnected.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!

Maintenance Instructions
Check the outrigger pads for external damage, cracks, fractures, and deformations. Likewise check the mounting bolts and the safety pins as to whether they are in good condition.

Clean the Knuckle joints and then protect against corrosion by greasing.

Railway Crane
Maintenance Manual

Description

The crane has 2 -bogies which support 3- wheel sets each **(See Figure 'A').** In addition, a travel gear reduction unit including the disengaging device, a brake system, and a suspension assembly are located in each of the bogies. The undercarriage is seated on the bogies above bogie pivots.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane can not be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
When working with paint and solvents, ensure to observe without fall the respective safety instructions on the packages.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!
Please note that the manufacturer must be consulted before any burning, welding, or dressing work is carried out on the crane.

Maintenance Instructions

Check both bogies for external damage, cracks, and deformations.

Clean the paintwork damage immediately and protect against corrosion using primer and the corresponding paint.

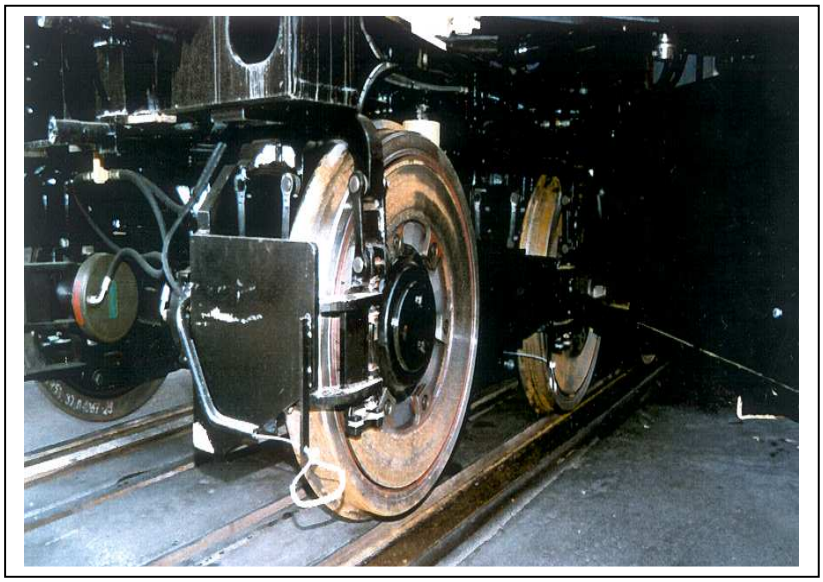
The pivot bearing assembly between the undercarriage and the bogies is maintenance-free.

The side bearers between the undercarriage and the bogie must be lubricated regularly.

The clearance between the side bearers on the undercarriage and on the bogies must be checked.

Railway Crane
Maintenance Manual

Figure 'A'



Railway Crane
Maintenance Manual

Boom **2.14**

Railway Crane
Maintenance Manual

Description

The boom is seated on an open-type root point **(See Figure 'A')**. In transport position, the boom is lowered onto the match truck.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
When working with paint and solvents, ensure to observe without fall the respective safety instructions on the packages.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!
Please note that the manufacturer must be consulted before any burning, welding, or dressing is carried out on the crane.

Maintenance Instructions

Check the boom for external damage and cracks.

Clean the bearing sleeves of the shafts on the boom root point when they are disengaged and then protect against corrosion by greasing. If the crane is subject to extreme external conditions, e.g. sea air, a high degree of dust and sand, maintenance must be carried out on the boom root in-between the intervals indicated.

- Clean the paintwork damage immediately and prime and protect against corrosion with the corresponding paint.

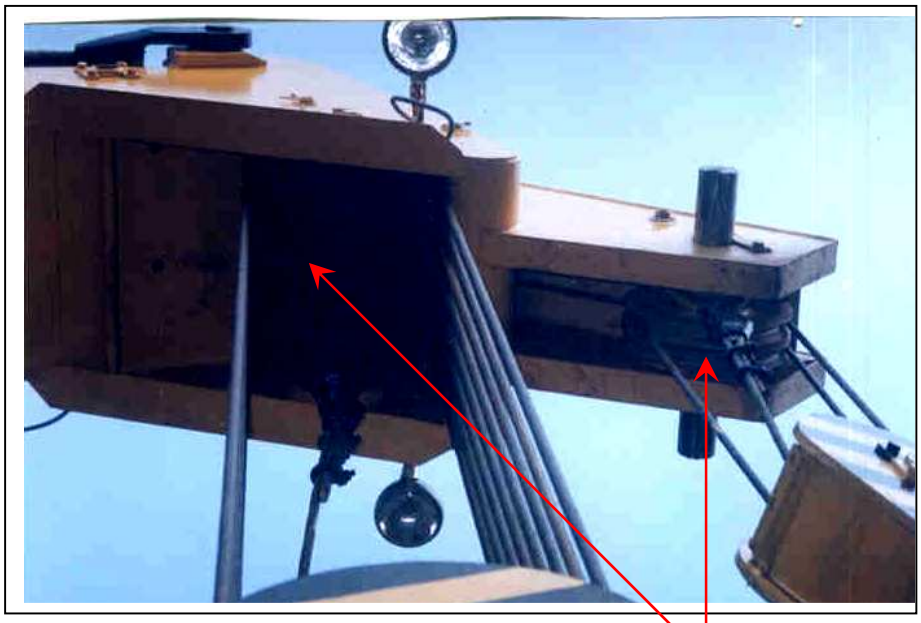
Caution! –The sliding tracks must be not be soiled by paint and should not be painted.

Railway Crane
Maintenance Manual

Figure 'A'

Root Point

Railway Crane
Maintenance Manual



Rope Pulleys

Description

The rope pulleys serve to guide the ropes precisely to the boom head .They ensure that the rope runs properly in every boom position.

The crane is fitted with plastic rope pulleys, which ensure minimum wear of the steel ropes.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
When working with paint and solvents, ensure to observe without fall the respective safety instructions on the packages.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!
Use caution near the overhead lines! Do not climb up onto the crane superstructure! Mortal danger!

Maintenance Instructions

Check for the rope pulleys for external damage, firm seating and excessive wear. Any damaged or worn pulleys must be replaced immediately.

Once the pulleys have been re-installed, carry out a functional test.

The rope fatigue is measured on the diameter contraction of the rope and by a contraction of 5 % compared to the original actual dimension the rope must be replaced. The actual dimension must be measured by the crane user before initial operation. The nominal dimension of the rope is not appropriate as a reference, as the manufacturer's conditions could include a 4% tolerance.

Independent of the above the rope must be replaced, when through faulty handling bends, kinks, flattenings, abrasion, or heavy corrosion appearance occur.

Rope end fittings (rope pendent, rope clamps) are severely exposed to corrosion, as moisture which has penetrated has difficulty in drying. These connections are therefore to be checked more frequently and where necessary shorten the rope to eliminate the corroded section.

According to operating conditions and frequency of use the ropes should be treated from time to time with an acid free corrosion proofing.

When changing ropes ensure, that ropes of the same type and diameter are used. Determine the actual diameter of ropes for wear check.

Railway Crane
Maintenance Manual

Description

The rope guides permit the ropes to be guided cleanly and prevent; in particular, the ropes from being sheared by the boom **(See Figure 'A').**

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
When working with paint and solvents, ensure to observe without fall the respective safety instructions on the packages.
When working with paint and solvents, ensure to observe without fail the related components!
When electrical welding work is being performed, the earthen terminal must be connected directly to the part be welded.
In addition, the battery; pole terminals on the diesel engine system and the emergency diesel engine system must be disconnected.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn into the equipment!
Use caution near the overhead lines! Do not climb up onto the crane superstructure! Mortal danger!

Maintenance Instructions

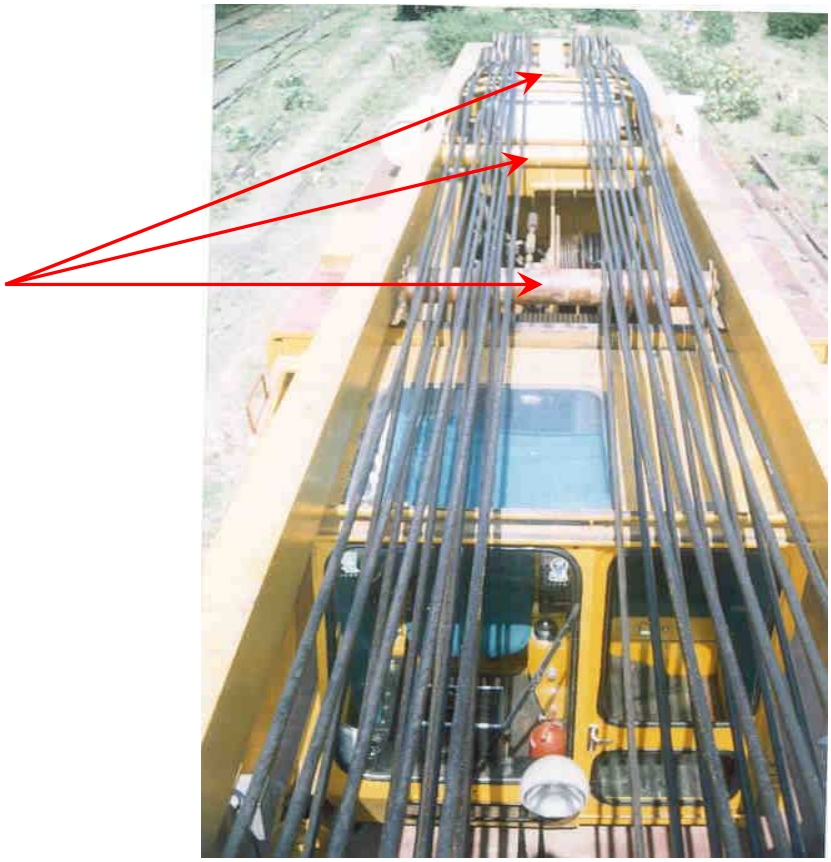
The good condition of the rope guide is important for a long hoist rope service life.

Check the rope guides for external damage and firm seating. Any damaged or loose rope guides can damage the rope.

Clean rope guides with a suitable aid.

Railway Crane
Maintenance Manual

Figure 'A'



Railway Crane
Maintenance Manual

Description

The boom support (not illustrated) on the match truck supports the boom head when the boom is lowered during towing operation.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against unauthorised start.
Crane must not be in the way of other vehicles.
When working with paint and solvents, ensure to observe without fail the respective safety instructions on the packages.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or into the equipment!
Please note that the manufacturer must be consulted before any burning, welding, or dressing work is carried out on the crane.

Maintenance Instructions

Check the boom support for external damage and firm seating. Check the moving latching unit for external damage and firm seating. Check whether it moves easily.

Clean and grease the knuckle joints and sliding surfaces.

- Clean the paintwork damage immediately and prime and protect against corrosion with the corresponding paint.

Railway Crane
Maintenance Manual

Ropes and Lifting Gear **2.15**

Railway Crane
Maintenance Manual

Description

The ropes are of the following types:

Hoist ropes: Rotation resistant, flexible hoist rope with a compacted steel core (Langs lay)
Derricking ropes: 8-Strand rope made out of conventional strands (Langs lay)

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts – danger of getting burnt, crushed or drawn the equipment!
Use caution near the overhead lines! Do not climb up onto the crane superstructure.

Maintenance Instructions

1. Inspection:

Wire ropes are consumable items with a limited life. This is why the wire ropes and rope fittings must be inspected daily. The complete length of the ropes must be inspected. In additions, the wire ropes must be examined for operating safety by a competent person in regular intervals. The intervals should be scheduled so that any damage will be detected early. This is what during the first few weeks after the installations of a new rope and after the first broken wire or other damage the intervals should be reduced accordingly.

If the rope has been overloaded or if non-visible damage is suspected, the intervals between examinations should be reduced accordingly (if required, every few hours).
Moreover, an examination should be carried out when the rope is put back into service after long periods of standstill. A wire rope must be removed in time to maintain crane operating safety. The following criteria detaining a rope must be discarded:

a) Type and number of wire breakages

Main hoist and derricking ropes (rope diameter: 26 mm):
If the rope shows more than 5 wire breakages on a length of 6 x diameter or 10 on a length of 30 x diameter, the rope is unserviceable and must be discarded.

Auxiliary hoist ropes (rope diameter; 22 mm):
If the rope shows more than 5 wire breakages on a length of 6 x diameter or 13 on a length of 30 x diameters, the rope is unserviceable and must be discarded.

b) Position of the wire breakages

When wire basketing occurs or if a stand breaks, the rope is immediately unserviceable.

c) Inevitable wire breakages

As wire breakage occurs after a certain number of operating hours and then the number increases more quickly, it is recommended to observe the times in which breakages occur so as to be able to judge the overall condition of the rope.

2. Rope diameter contraction during operating time:

If the rope diameter over a greater length is reduced by 15 % or more from the actual measured rope diameter in new condition (nominal damage) the rope is no longer serviceable.

3. Corrosion:

To what degree the ropes are subject to corrosion will depend very much on the crane site (e.g. Ocean atmosphere).Should the rope show a high degree of corrosion, the rope is no longer serviceable.

4 Wear through friction:
If the rope diameter is reduced by 10% or more through wear by friction, the rope is no longer serviceable.

5 Rope deformations
Deformations in the rope such as waviness, birdcaging, loop formations, loose wires, nodes, rope thinning, misplaced outer wires, kinks, and flat areas are visible changes in the rope structure. A rope with such deformation is no longer serviceable.

Rope change:

If a rope change is necessary, it must be ensured that a wire rope of the same type and breaking strength as the original wire rope in new condition is fitted. When a new rope is being mounted, ensure that it is not twisted. Prior to operating with a newly fitted rope, it must be ensured that the rope is properly reeved and guided in the grooves of the rope drum, rope pulleys, and the compensation rollers. In particular, for the ropes on the derricking gear (2 ropes on drum),it is advisable to always change both ropes at the same time to ensure the same rope quality and to maintain the same inspection and maintenance intervals.

Functional test:

In particular, a functional test without load is to be conducted after a rope change. During the test it should be ensured that the rope runs smoothly, the rope coils properly and the limit switches function. After a wire rope has been mounted and before it beings its actual works, load tests with very light loads should be carried out for at least an hour.

Cleaning, greasing;

Wire popes must undergo maintenance regularly. However, the kind of maintenance will depend on how much the rope is used. Regular maintenance may considerably increase the service life of steel wire rope. During production, the rope receives intensive lubrication. This in-process treatment will provide the rope with ample protection against corrosion and is meant to reduce the friction between the elements which make up the rope as well as the friction between rope and sheaves or drums. This lubrication, however, only lasts for a limited time and should be re-applied periodically. When choosing the relubricant, it must be ensured that it is in accordance with the recommendations of the rope manufacturer.

It is important that relubrication of steel wire ropes is carried out regularly right from the beginning of the service life of the rope and not only after the first damage has been ascertained !

Clean the ropes with a suitable aid and then lubricate. As dirt can reduce the service life of a rope considerably, depending on crane site, it may be necessary to clean and grease the rope in-between the indicated intervals.

Railway Crane
Maintenance Manual

Hook Blocks **2.15.2**

P-1/1

Description

The crane has two hook blocks, one for the main hoist and other for the auxiliary hoist.

SAFETY INSTRUCTIONS

Before maintenance work is performed, it must be ensured that the crane cannot be switched on and is secured against rolling.
In addition, a "Maintenance Work" warning sign must be visibly affixed to both in and outside the cab.
Remove ignition key and battery main switch and secure against any unauthorised start.
The crane must not be in the way of other vehicles.
Ensure that no one is near hot or moving parts – danger of getting bunt, crushed or drawn into the equipment!
Use caution near the overhead lines! Do not climb up onto the crane Superstructure! Mortal danger!

Maintenance instructions

Check the entire hook block for external damage and cracks. Any damaged parts must be replaced immediately!

Railway Crane
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Fuel, Oil and lubricant Chart 3

P-1/1

Sl. No.	Place of Use	Lubricant/Fuel quantity Approx.	Lubricants	Manu-facturer	Brand
1	Hydraulic Tank	1400 ltrs	Hydraulic Oil HLP-68 to IS-11656-1992	IOC	Sevosystem HLP'N' 68
				HPC	Enklo HLP-68
	Compensation Tank on Match Truck	10 ltrs		BPC	Bharat Hydrol HLP-68
				IBP	IBPEXHD-68
2	Main Engine	36 ltrs	Engine Oil	IOC	Servo-Premium CF 4 15 W 40
				HPC	Hylub Milcy Power
	Auxiliary Engine	5.5 ltrs		BPC	MACKF4-15W40
				Valvo line Cummins Ltd.	Valvoline Power Supreme 15W40
3	Main Hoist Gear Box	08 ltrs	Gear Box Oil	HPC	HP 90
	Auxiliary Hoist Gear Box	04 ltrs			
	Derrick Gear Box	17.5 ltrs			
	Recovery Winch Gear Boxe	1.8 ltrs			
	Travel Gear Box	12 ltrs in each motor			
	Slewing Gear Box	11 ltrs			
	PTO Gear Box	07 ltrs			
4	Compressor Oil	02 ltrs	Compressor Oil	Cummins	15W40
5	Roller bearing slewing Ring and Traction gear reduction unit	Qty. not fix.	Adhesive Lubricant		Adhesive lubricant BB to DIN 51513
6	Lubricating nipples and sliding surfaces	Qty. not fix.	Grease		All purpose grease K2K to DIN 51825
7	Fuel Tank	1000 ltrs	Diesel		

Ref: RDSO's i) Report No. 727/90- Jan'1990
ii) Report No. MP-MI-19(Rev-00)-Sep'2001
iii) L/No. SL.CR.BG.140T.Gott.UP dt. 22/11/2000

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The bolt torque moments indicated here apply when no other values for the torque moments of the individual bolts are provided in the Maintenance Manual. The bolt size is based on the metric system in accordance with DIN (German Industrial Standards) and the bolt quality is based on ISD 898, Section -1.

Bolt Classification

Bolt Size	8.8	10.9	12.9
M 4	2.8 Nm	4.1 Nm	4.8 Nm
M 5	5.5Nm	8.1 Nm	9.5 Nm
M 6	9.6 Nm	14 Nm	16 Nm
M 8	23 Nm	34 Nm	40 Nm
M 10	46 Nm	67 Nm	79 Nm
M 12	79 Nm	115 Nm	135 Nm
M 14	125 Nm	185 Nm	220 Nm
M 16	195 Nm	290 Nm	340 Nm
M 18	280 Nm	400 Nm	470 Nm
M 20	395 Nm	560 Nm	660 Nm
M 22	540 Nm	760 Nm	890 Nm
M 24	680 Nm	970 Nm	1,150 Nm
M 27	1,000 Nm	1,450 Nm	1,700 Nm
M 30	1,350 Nm	1,950 Nm	2,300 Nm
M 8 X 1	25 Nm	37 Nm	43 Nm
M 10 X 1.25	49 Nm	71 Nm	83 Nm
M 12 X 1.25	87 Nm	130 Nm	150 Nm
M 12 X 1.5	83 Nm	120 Nm	145 Nm
M 14 X 1.5	135 Nm	200 Nm	235 Nm
M 16 X 1.5	210 Nm	310 Nm	360 Nm
M 18 X 1.5	315 Nm	450 Nm	530 Nm
M 20 X 1.5	440 Nm	630 Nm	730 Nm
M 22 X 1.5	590 Nm	840 Nm	980 Nm
M 24 X 2	740 Nm	1,050 Nm	1,250 Nm
M 27 X 2	1,100 Nm	1,550 Nm	1,800 Nm
M 30 X 2	1,500 Nm	2,150 Nm	2, 500 Nm

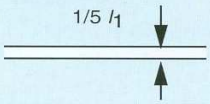
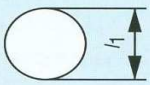
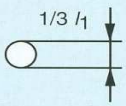
Railway Crane
Maintenance Manual

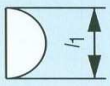
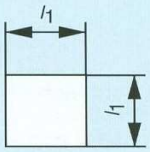
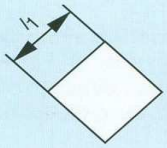
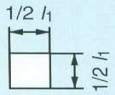
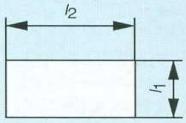
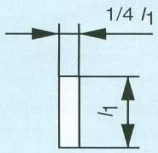
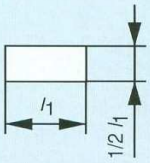
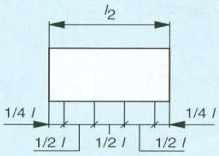
Sl. No	DOs	DON'Ts	Repercussion
1	**MAINTENANCE CHECKING OF ENGINE:**		
	Engine should be maintained as per Manufacture's Maintenance Schedule.		
2	**MAINTENANCE OF HYDRAULIC SYSTEM:**		
a)	Clean hoses and area, around the equipment, to be opened. Clean the tray in which the open parts are kept.	Do not open the Hyd. System in a dirty	
c)		Do not over tighten any leaking joints provided with "O" rings/ seals.	
d)	Connected isolating valves must be closed before opening out any hoses.		
e)	Ensure that no water is mixed with the hyd. Oil in the tank. Oil should be tested in lab as per guideline given in the maintenance manual.		
3	**ATTENTION TO WIRE ROPE:**		
a)	Replace wire ropes when there is a diametrical reduction in its size by 5% or more with respect to its normal diameter.		
b)	Replace wire rope if there is any bend, kink, abrasion, and uncoiling or heavy corrosion.		
c)	While reeving / unreeving the wire rope on the drum a person/ operator must be watchful so that there is no overlapping of wire ropes, which may cause damage to the wire rope.		
d)	Proper greasing of wire rope around fitting clamps / sockets should be done.		Corrosion of wire rope will take place.
4	**MAINTENANCE PRECAUTION FOR SAFETY DEVICES:**		
a)	All limit switches; force and angle sensors must be cabled. Damaged cables must immediately be replaced. They should always be kept operational.	Don't disturb the switching point of the limit switches.	
b)	The crane axis must be vertically levelled.		
c)	Check all limit switches when rigging to ensure their functioning.	Do not operate computer over bridge key and boom over bridge key during crane working. These are slowly for use during rigging / de-rigging.	
d)	The safe load indicator does not relieve the crane user from his responsibility to thoroughly determine the weight of the load to be lifted and check the admissibility of the operation according to be lifting chart.		
e)		Do not keep the electric solenoid valves for cut off function bridged.	

Symbols to DIN ISO 1219

Symbols for hydraulic systems are for functional interpretation and comprise one or more basic symbols and in geneneral one or more function symbols. Symbols are neither dimensioned nor specified for any particular position.

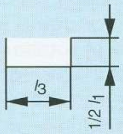
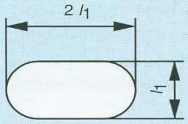
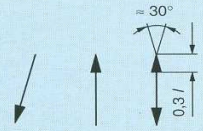
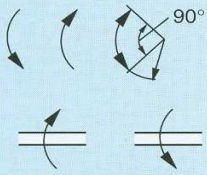
The following list is incomplete. It is designed as an aid for creating symbols.

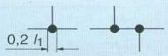
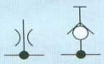
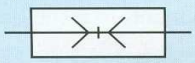
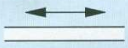
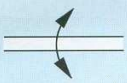
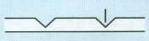
Name/ description/examples	Symbol
Basic symbols	
Lines	
Continuous Main line, electrical line	
Dashed Control line, drain line, transition position	
Chain dotted To group two or more components in a sub-assembly.	
Double Mechanical connection (shaft, lever, piston rod)	
Circle Energy transfer unit	
Measuring device	
Check valves, rotary connection, mechanical pivots, Rollers (always with centre point)	

Name/ description, examples	Symbol
Semi-circle Motor or pump with limited angle of rotation (Rotary actuator)	
Square Connections perpendicular to sides. Control elements Drive unit (except for E motor)	
Connections to corners of preparation devices (filters, separators, lubricating devices, heat exchangers)	
Damping in positioning elements, accumulator weight	
Rectangle Cylinders, valves	
Piston in cylinder	
Adjustment element	
Offsets for connecting lines	

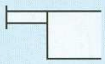
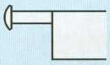
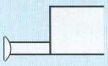
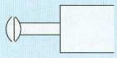
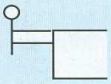
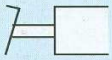
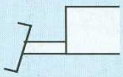
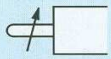
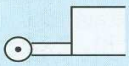
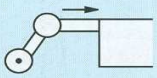
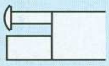
Symbols used in Hydraulic Circuits **6**

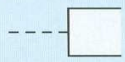
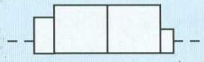
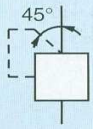
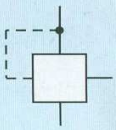
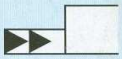
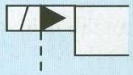
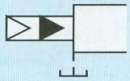
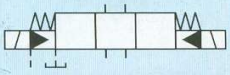
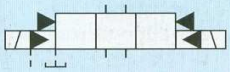
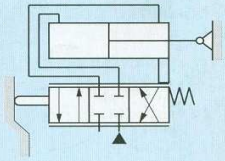
P-2/7

Name/ description, examples	Symbol
Open rectangle Tank	
Oval Pressure tank Accumulator Gas bottle	
Function symbols *Triangle* Shows direction of flow and operating medium	
Filled, hydraulic	
Open, pneumatic	
Arrows Straight Linear movement, path and direction of flow through a valve, direction of heat flow	
Curved Rotational movement, direction of rotation viewed on shaft end	
Diagonal arrow Adjustability in pumps, motors, springs, solenoids	
Electrical	
Closed path or connection	
Linear electrical positioning elements acting in opposition	

Name/ description, examples	Symbol
Temperature display or control	
Drive unit	M
Spring	
Throttle	
Seat of check valve	
Flow lines Connection	
Cross-over	
Flexible line	
Connections Breather connection (continuous)	
Limited with respect to time Open / closed	
Quick release coupling without mechanically opening check valves	
With mechanically opening check valves	
Rotary coupling with 1 through channel	
Rod, linear movement	
Shaft, rotational movement	
Detent, maintains specified position	

Railway Crane
Maintenance Manual

Name/ description, examples	Symbol
Operational modes General symbol	
Push button	
Pull-out knob	
Push button/pull-out knob	
Lever	
Pedal, 1 direction of operation	
Pedal, 2 directions of operation	
Push rod	
Push rod with stroke limitation	
Spring	
Roller shaft	
Roller lever	
Electrical, 1 winding	
Electrical, 2 windings which act in opposition to each other	
Electrical, 2 windings which act in opposition to each other and which may be steplessly adjusted	
2 parallel acting operators	

Name/ description, examples	Symbol
Operation by means of pressurisation or pressure relief Directly acts on positioning element	
By means of opposed control areas of different sizes	
Internal control channel	
External control channel	
Pneumatic/hydraulic operation	
2 stage hydraulic operation	
2 stage electro-hydraulic operation, external pilot oil supply	
2 stage pneumatic-hydraulic operation, external pilot oil return	
2 stage electro-hydraulic operation, spring centering of mid-position, external pilot oil feed and return	
2 stage electro-hydraulic operation, pressure centering of mid-position, external pilot oil feed and return	
External feedback of actual position of positioning element	
Internal feedback of actual position of positioning element	

Symbols used in Hydraulic Circuits **6**

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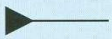
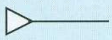
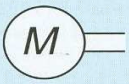
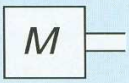
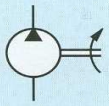
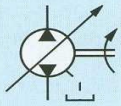
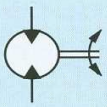
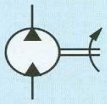
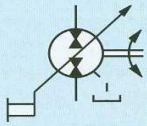
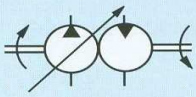
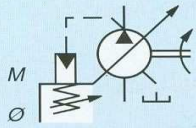
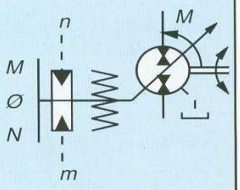
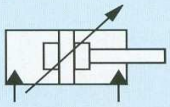
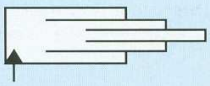
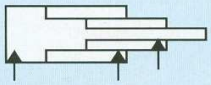
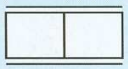
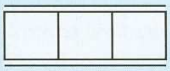
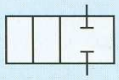
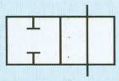
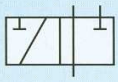
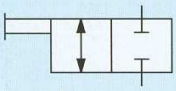
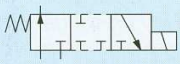
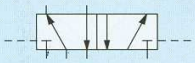
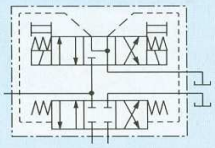
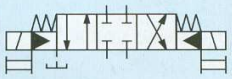
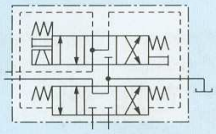
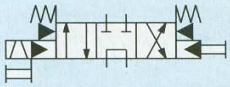
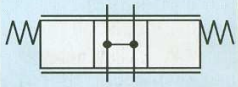
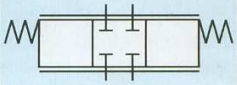
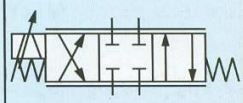
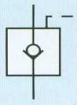
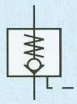
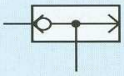
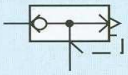
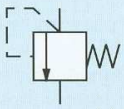
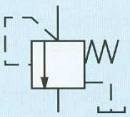
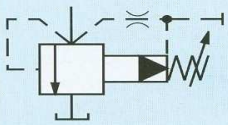
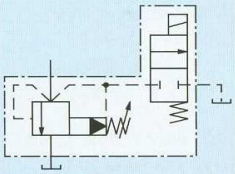
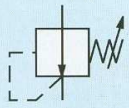
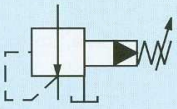
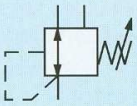
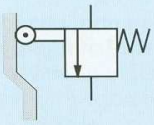
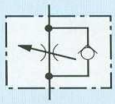
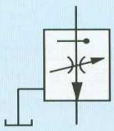
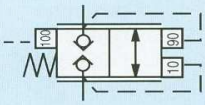
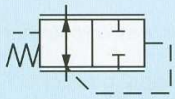
Name/ description, examples	Symbol
Energy sources Hydraulic	
Pneumatic	
Electrical motor	
Drive unit, except for electrical motor	
Energy transfer and storage *Hydraulic pumps and motors*	
Fixed displacement pump, general	
Fixed displacement pump, 1 direction of flow, 1 direction of rotation	
Variable displacement pump, 2 directions of flow, 1 direction of rotation, Case drain port	
Fixed displacement motor, 2 directions of flow, 2 directions of rotation	
Fixed displacement pump/motor, 1 direction of flow, 1 direction of rotation	
Variable displacement pump/motor, manual adjustment 2 directions of flow, 2 directions of rotation, Case drain port	
Hydraulic rotary actuator	

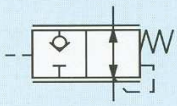
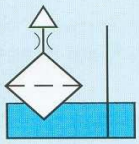
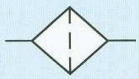
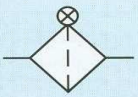
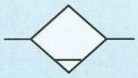
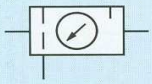
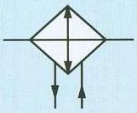
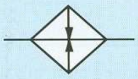
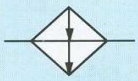
Name/ description, examples	Symbol
Hydraulic compact drive	
Variable displacement pump with pressure compensator, 1 direction of flow, 1 direction of rotation, Case drain port	
Variable displacement pump/motor with pressure compensator, 2 directions of flow, 2 directions of rotation, Case drain port	
Hydraulic cylinders Single acting hydraulic cylinder, return stroke via pressurisation, full bore connected to tank	
Double acting single rod hydraulic cylinder, adjustable damping at both ends of stroke	
Telescopic hydraulic cylinder, single acting	
Telescopic hydraulic cylinder, double acting	
Accumulators Without initial pressure	
With initial gas pressure	

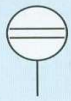
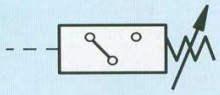
Name/ description, examples	Symbol
Gas bottle in upright position only	
Open and closed loop control of energy *Directional valves* Two position valve with 1 cross-over point	
Two position valve with stepless control of spool position	
Three position valve with stepless control of spool position	
Two position valve, 2 ports, normally closed, 2 directions of flow	
Two position valve, 2 ports, normally open, 2 directions of flow	
Two position valve, 3 ports, normally open, 2 directions of flow	
2/2 way directional valve, 2 ports, 2 spool positions	
3/2 way directional valve, 3 ports, 2 spool positions, 1 cross-over point, solenoid operation, spring offset	
5/2 way directional valve, 5 ports, 2 spool positions, pressure operated in both directions	

Name/ description, examples	Symbol
4/3 way directional valve, (detailed diagram) electro-hydraulically operated, 4 ports, 3 spool positions, spring centered mid-position, emergency stop operation, external pilot oil return	
(simplified diagram)	
4/3 way directional valve, (detailed diagram) electro-hydraulically operated, 4 ports, 3 spool positions, pressure centered mid-position, emergency stop operation, external pilot oil return	
(simplified diagram)	
Continuously variable (modulating valves) Modulating valve, negative overlap	
Modulating valve, positive overlap	
4/3 way servo valve (typical example)	
Check valves/ isolating valves Check valve, without spring loading	
Check valve, spring loaded	
Check valve, pilot operated, without spring pre-load	

Name/ description, examples	Symbol
Check valve, pilot operated, with spring pre-load	
Shuttle valve	
Air bleed valve	
Pressure control valves Pressure relief valve, direct operated, internal pilot oil feed	
Pressure relief valve, direct operated, external pilot oil feed	
Pressure relief valve, pilot operated, internal pilot oil feed and return	
Pressure relief valve, pilot operated, electrically operated relief, internal pilot oil feed, external pilot oil return	
2 way pressure reducing valve, direct operated, internal pilot oil feed	
2 way pressure reducing valve, pilot operated, internal pilot oil feed, external pilot oil return	
3 way pressure reducing valve, direct operated, internal pilot oil feed	

Name/ description, examples	Symbol
Flow control valves Throttle valve, adjustable	
Shut-off valve	
Deceleration valve	
Throttle/check valve	
2 way flow control valve, pressure compensated	
2 way flow control valve, pressure and temperature compensated	
3 way flow control valve, pressure and temperature compensated	
Flow divider	
2 way cartridge valves (logic elements) Directional valve, leakage free, differing effective areas	
Flow control valve	

Name/ description, examples	Symbol
Directional valve, leakage free in one direction, identical effective areas	
Fluid storage and preparation Ventilated tank	
Pressure tank	
Filter	
Filter with clogging indicator	
Separator	
Filter with separator	
Preparation unit comprising: filter, separator, pressure reducing valve, pressure gauge and lubricator	
Cooler	
Heater	
Temperature control	

Name/ description, examples	Symbol
Measuring devices and indicators Pressure indicator, general	
Pressure gauge	
Differential pressure gauge	
Fluid level measuring device	
Thermometer	
Flow indicator	
Flowmeter	
Tachometer	
Torque meter	
Hydro-electric pressure switch	
Limit switch