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सत्यमेव जयते

भारत सरकार
रेल मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

Maintenance Schedule
of
140 t Diesel Hydraulic Gottwald Break down Crane (upgraded)

Report No.-MP. MI-19 (Rev. 00)
September -2001

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General Description

1. Introduction:

The schedule for examination and maintenance of 140t crane has been prepared taking into account the recommendation of original equipment manufacturers and suitably modified keeping in view the experience of the other Gottwald cranes operating in Indian Railways.

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

2 REFERENCES:

The following documents are also required to be referred for further information.

i) Operating Maintenance & Service Manuals (No. GS-140.08 H 1997) Issued by M/ s Gottwald.
ii) Operating and Maintenance Manual NT/ NTA 855 Big Cam III (Bulletin No. 3666002-02 1994) Issued by Cummins Engine Company ,USA.
iii) Operating Maintenance Manual HA-294 (No. . 03.066.01.0.01 Feb` 96) Issued by M/s Kirloskar Oil Engine Limited.
iv) Brake system:
    a) Manual BSI Brake Caliper (No. V/H 97/065-01 /1997) issued by SAB WABCO.
    b) Manual for wheel mounting brake disc R 780 G (No. V/H 97/065-03 /1998) issued by SAB WABCO.
    c) Maintenance manual for brake cylinder adjuster unit type PBACF (53 72GB / 1992) issued by SAB WABCO.
v) Safe Load Indicator (SLI):
    a) User Manual (IK350/1327 /17.06.1997) issued by PAT.
    b) Trouble Shooting Manual (24 350 19 0688/ Rev A 20-04-1998) issued by PAT.
vi) Repair instruction manual for hydraulic motors (RDE-91001-01/1996) issued by Rexroth.
vii) Operating instruction for pump distribution gear box (GFC 230 1048 /Feb 1998) issued by Lohmann & Stolterfohnt

3. Scope of Maintenance Schedule:

i) Part – I: Schedule for Main Engine.(NTA 855 L)
ii) Part - II: Schedule for Auxiliary Engine (KOEL HA -294).
iii) Part – III: Schedule for Hydraulic system including all pumps, motors, Cylinders & Valves etc.
iv) Part - IV : Schedule for Slewing Gear , Gear boxes and Reduction gear units.
v) Part – V: Schedule for Electrical & Control system.
vi) Part –VI: Schedule for Pneumatic system & Brake systems.
vii)Part –VII: Schedule for Structural Items (Super structure, Undercarriage, Bogie, Cab, Ropes, Sheaves, Drums).

4 Periodicity of Maintenance of Major Sub- assemblies and systems .

4.1 Periodicity of maintenance of CIL Main Engine. NTA 855 L :

i) Daily schedule
ii) Monthly schedule or after 125 Hours*
iii)Half Yearly schedule or after 250 Hours*
iv) Yearly schedule or after 1500 Hours*
v) 2- Yearly schedule or after 6000 Hours*
vi) 3- Yearly schedule or after 6000 Hours*
vii) Major Overhaul after 8 Years at the time of POH.

Note : * Whichever is earlier

4.2 Periodicity of maintenance of KOEL Auxiliary Engine HA –294

i) Daily schedule .
ii)Monthly schedule or after 125 Hours*
iii)Half Yearly schedule or after 250 Hours*
iv) Yearly schedule or after 1000 Hours *
v) 2- Yearly schedule or after 2000 Hours*
vi) 3- Yearly schedule or after 3000 Hours*
vii) Major Overhaul after 8 Years at the time of POH.

Note : * whichever is earlier.

4.3 Periodicity of maintenance of Hydraulic System, Gear boxes and reduction gear unit, Electric and control system, Pneumatic & brake system, and Basic construction.

i) Daily Schedule
ii) Monthly Schedule or after 125 Hours*.

iii)Half Yearly Schedule or after 750 Hours*.
iv) Yearly Schedule or after 1500 Hours*.
v) 2- Yearly schedule or after 3000 Hours*.
vi)POH after 8 Years.

Note : * whichever is earlier.

5. The **filters, lubricants, oil change** etc. provided in the various systems of **engine** are required to be changed as per the instructions of OEM. These are summarized below for information.

5.1 Filters of Main Engine(NTA-855) & Auxiliary Engine (HA-294):

Description		Periodicity
1	Full flow lube oil filter	250 hrs / 6 month*
2	By-pass filter	do
Fuel system		
1	Fuel filter	250 hrs / 6 month*

Note : * whichever is earlier.

5.2 Lube oil change of Main Engine(NTA-855) & Auxiliary Engine (HA-294):

Description		Periodicity
1	Lube oil	250 Hrs. / 6 monthly*

Note : * whichever is earlier.

5.3 Recommended Lubricants for Main & Auxiliary Engine .

S.No	Name of Manufacturer	Brand name
1	Indian Oil Corporation	SERVO-PREMIUM CF4 15W40
2	Bharat Petroleum Corporation	MAKCF4-15W40
3	Hindustan Petroleum Corporation	Hylube Milcy Power
4	Valvoline Cummins Ltd	Volvoline power Supreme 15 W 40

5.4 Hydraulic oil for pumps and motors

M/s Gottwald had earlier recommended ATF Suffix A for use as hydraulic oil on the new crane. It has been confirmed by them that either ATF Suffix A or HLP – 68 can be used on the new Gottwald cranes. While converting from ATF Suffix A to HLP – 68, it must be ensured that the entire system is drained and flushed ,other wise it will not operate smoothly.

5.4.1 **Recommended brands of anti wear Hydraulic Oil HLP-68 to IS: 11656-1992are as under:**

S.No.	Recommended equivalent brands	
1	IOC	Servosystem HLP 'N'- 68
2	HPC	Enklo HLP- 68
3	BPC	Bharat Hydrol – HLP-68
4	IBP	IBPEXHD-68

5.4.2 **Recommended brands of ATF suffix A** .

S.No.	Recommended equivalent brands	
1	IOC	Servo Transfluid A
2	HPC	HP ATF
3	BPC	ATF A

5.4.3 **Topping up/ Replacement of Hydraulic oil**

a) During oil change and also during top-up, oil is recommended to be added through two stage filtration cart as per following specifications:

Stage – I :- 25 micron absolute
Stage – II :- 10 micron absolute
Pump flow rate : - 20 lpm.

Note : The details of the hydraulic oil filtration trolley is provided separately in RDSO instruction bulletin No**. MP.IB. HY.02.18.01 (Rev: 0.00)**

b) In the absence of filtration trolley, oil must be added through at least an external oil filter with minimum retaining rate of 10 µm so that cleanliness of oil is maintained.

5.5 High speed Diesel:

The high speed diesel oil shall be to IS 1460: 1995 read with Amendment 2 (February'1999).

5.6 Oils and Lubricants for other items .

SN	Fluid / filling capacity	Recommended oil and Grease				
		Mobil	Shell	IOC	BPC	HPC
1.	Lube oil for pump distribution gear box (capacity approx.5.5 litres)	Mobil gear 629 Mobil gear XMP 150	Shell Omala 150 Shell HD 150	Servo-mesh SP150	Amocam 150	Parthan EP-150
2	Chassis air compressor lubrication oil (capacity 0.5 litre)	Mobil Devec 1340	Rimula X Mono-grade SAE 40	Servo - Pride 40	Mak T40	HP Milcy 40
3	Lube oil for : i) Slewing gear unit (Capacity approx. 15.5 ltres) ii) Main hoist gear unit (Capacity approx. 6.5 ltres) iii)Auxiliary hoist gear unit (Capacity approx. 6.5 ltres). iV) Derricking gear unit (Capacity approx. 9.5 ltres) V) Recovery winch gear (Capacity approx. 3.4 ltres) Vi) Travel gear unit (Capacity approx. 12 ltres)	Mobil Gear 629 Mobil Gear XMP - 150	Shell Omela - 150 Shell - Omela HD- 150	Servo-mesh SP100	Amocam 100	Parthan EP - 100

4	Lube oil for bearing: I) Main hoist gear unit ii) Auxiliary hoist gear unit iii) Derricking gear unit	Mobil EP 2	Shell Retinex EP 2	Servo-gem EP2	MP Grease3	Lithon EP - 2
5	Lube grease for gear wheel / pinion	Mobiltac 375 NC	Shell Malleus	Servo-gem EP1		Lithon EP - 1
6	Lube grease for slew ring	Mobilux EP 2 Mobilgrease XHP 222	Shell Retinex EP 2 Shell Alvania EP (LF)2	Servo-gem EP2		Lithon EP - 2
7	Lube grease for axle gear unit	Mobilux EP 2 Mobilgrease XHP 222	Shell Retinex EP 2 Shell Alvania EP (LF)2	Servo-gem EP2		Lithon EP - 2

6 Wire Rope Details:

6.1 Terminology used in rope details:

i) Wire (Round) : A single circular rope of continuous length of metal drawn cold – drawn from a rod.
ii) Strand : An element of rope consisting of an assembly of appropriate shape and dimensions helically wound wires in one or more layer.
iii) Core : The center of a strand or the center of a wire rope(which may be of steel or fiber).

6.1.1 Wire Rope Specification:

Wire rope shall be of standard 6x37[18/12/6/1F(C)] , construction to IS specification No. IS –2266. Breaking strength of the rope shall not be less than six times the maximum static load on the rope.

Explanation of 6x37[18/12/6/1] with fiber core: It consists of 6 strands wounded helically over a fiber core. Each strand contains 37 wires wounded helically in succession i.e. 6 wires on one steel wire (core), then 12 wires, and then 18 wires respectively.

6.2 Rope Inspection Criteria

Wire ropes are consumable items with a limited life. Therefore, the complete length of wire ropes and rope fittings must be inspected daily. In addition, the wire rope must be examined by competent person at regular intervals. An examination should be necessarily carried out, if the rope is to be put back into service after a long period.

6.2.1 Condition for discarding wire rope:

Wire rope must be discarded immediately, if following condition were observed

a) Breakage in wire of strand:

- Main Hoist and Derrick wire rope (rope diameter 26 mm):

If the rope shows more than 5 wire breakages on a length of 6 X rope diameter (e. g. 6 X 26 mm = 156 mm) or 10 wire breakages on a length of 30 X rope diameter (e. g. 30X 26 mm = 780 mm).

- Auxiliary Hoist (rope diameter 22 mm):

If the rope shows more than 5 wire breakages on length of 6 X rope diameter
(e. g. 6 X 22 mm = 132 mm length) or 13 on a length of 30 X rope diameter(e. g. 30 X 22 mm = 660 mm) .

b) Check for Rope diameter:

If the rope diameter is reduced by 15% or more from the actual rope diameter in new condition over a length of 10x rope diameter (i.e. 260m for main hoist, derrick and 220 mm for auxiliary hoist rope). The part of rope passing over sheaves and drum are more vulnerable.

c) Wear through friction:

If the rope diameter is reduced by 10% or more, due to wear or friction with any member.

d) Rope deformations:
If deformations like waviness, loop formations, loose wires, nodes, rope thinning, misplaced outer wires, kinks and flat areas, are noticed on the rope.

6.2.2 Special observation on wire rope :

The wire breakages generally occur after a certain number of operating hours and then the number increases more quickly. It is recommended to keep watch on the condition of wire after any of wire breakage has started. Action for the discarding should to be taken as indicated in Para 6.2.1 (a) above.

6.3 Functional Test:

After every rope change, functional test without load must be carried out. During the test, it should be ensured that rope runs smoothly.

6.4 Cleaning & Greasing:

Periodically cleaning & greasing of ropes should be done for proper and smooth running of ropes on drums & sheaves.

6.5 Rope Change:

If 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 wire 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 placed and guided in the grooves of the rope drum , rope pulleys and the compensation rollers. It is advisable always to change both main hoist & derricking ropes together to ensure the same quality and maintain the same inspection and maintenance intervals

7 General Instruction for Gears

Generally, gears with considerable back-lash will continue to function reasonably well but with excessive noise. Abnormal back-lash on gears affects the life of other components in gear box, due to vibration. Care should be taken while checking the back lash on primary side gears because of cyclic variation of torque and speed of diesel engine. If premature gear wear or damage is noticed, it would be found generally that the cause was due to bearing trouble, misalignment, presence of foreign matter or insufficient lubrication. The first indication of a defective gearing would be an increase in the noise level, which indicates rough operation. The following indications of undue wear and tear may be looked for if gear damage is suspected:

i) Fractures

a) Tooth face fracture generally occurs due to shock loads or foreign matter such as broken pieces of metal forced through gear teeth in mesh.
b) Fatigue fracture generally occurs from the root of the tooth.
c) Tooth corner fracture or tooth splinter occurs, generally due to misalignment of gear. Misalignment of gears also results in a great load on tooth corners.

ii) Tooth face damage:

a) Pitting- The working surface of the teeth is severely damaged by pitting or spalling over entire surface or at the base of the gear teeth.

b) Deformation- This is due to too little back-lash which leads to frictional heating and softening of the case.

c) Wear due to sliding- This is due to inadequate lubrication especially on gear meshes of high gear ratio.

d) Development of grooves, roughing of the face or cavitation- This is due to abrasive foreign matter coming between the meshing teeth.
e) Cracking of the Case- Hardened surface.

f) Running hot- This is indicated by the development of blue colorations due to heat concentration which may be caused by inadequate lubrication. Pipelines may be choked or spray jet dislocated. Lubrication is vital to gears and therefore nozzles must always be carefully checked on assembly and dismantling of the gears so as to always ensures a stream of oil to the gears.

Note: It is generally advisable to replace gears subjected to the defects mentioned above.

8 Tool Kit:

Tool kit is located behind the seat in the cab. The following is the list of tools ;

1 Hammer – 800 gm
2 Flat chisel
3 Oil spray can

4 Hand lever operated grease gun
5 17 Double - ended open jawed spanners, 8x10-55x60
6 6 Single –ended open-jawed spanners, 8/41/65/70/75/80 mm
7 8 Hex socket head wrench, SE 6/8/12/14/22/27/32
8 4 Tubular hex. Box spanners, 13X7/19X22/24X30/30X36
9 4 Tommy bars for spanners, A 10/12/16/18
10 Standard ratchet, ½"
11 Extension piece, 10"
12 Articulated square-drive socket adapter, 70 mm
13 Socket for wrenches, SW 17/19
14 3 screw drivers
15 Light tester
16 Pressure gauge, 0-400 bar
17 Hose, DN 6/222bX5000
18 Pressure gauge connection fitting
19 Union nuts
20 Cutting ring
21 Seeger circlip ring pliers, A3/A4
22 Flat-nosed and cutting nippers
23 Pipe wrench
24 Sickle spanner
25 Hose, NW18X3 5000

9 General Instructions:

The high reliability of availability of cranes necessitates properly laid down maintenance schedules to be followed. A well-organized inspection is essential to ensure reliability and freedom from failure in service.
There are certain fundamental requirements that are important to any successful maintenance program. These are:-

.1 Adequate provision of well trained supervisors and skilled workmen.
.2 Adequate provision of proper maintenance facilities and tools.
.3 Provision of lubricating oil, coolant etc. required to ensure satisfactory engine performance.
.5 A well-scheduled maintenance program including an adequate system of maintenance of records.
.6 While carrying out the work of the schedule, all missing nuts, bolts, set-screws, cotters, split pins etc. must be REPLACED as and when found defective. Split pins and cotters once removed must not be used again, but new ones must be fitted. All loose nuts, setscrews etc. must be tightened. Wherever cotters or split pins are fitted, they must be of the correct size and so fitted that they bear against the nut or washer properly. Examine and ensure that all locking devices, wherever provided, are properly secured.

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

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

.9 All work done including methods and tools used must be in accordance with the manufacturers instructions, maintenance manual or any technical orders issued.

.10 Do not mix different brands of greases. Excessive lubrication is as harmful as inadequate lubrication.

.11 Use of waste cotton on crane is PROHIBITED. Use lintless rags or wiping towels. The underframe and top surface of fuel tanks should be cleaned to remove dirt and oil. Spraying of water directly on electrical equipment should be avoided.

.12 The fire extinguishers should be refilled and maintained as per the schedule. Under no circumstances, should crane be allowed to leave the shed without its required number of fire extinguishers in working order.

.13 Periodic maintenance of the crane should be done after it is placed on level track and parking brakes of crane and match truck applied.

.14 The staff while working under the crane or while standing over footboards/ super structure must not smoke or strike up fire nearby.

.15 In case any structural part is damaged and is to be rectified, ensure the following:

a) Direct flame should not damage cables, hoses, pipes; must take all fire prevention measures for hoses, cables etc. from direct heat by shielding the flame.

b) For any structural repair, ensure proper preheating, use only recommended electrodes and argon shield welding.

c) If welding is carried out on the crane it is a wise precaution to disconnect SLI from both sides of the crane. Disconnect main battery. While welding, earth the respective structure directly.

.16 **Whenever any schedule examination except the daily is carried out all the items of the lower schedules should also be attended to.**

Part – I

Schedule for Main Engine.(Cummins NTA 855 L)

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Main Engine, NTA 855 L)

Daily Schedule

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

S.No	Details of work to be carried out	Condition/action	Sign.	Remarks
A.	**CONDITION: DIESEL ENGINE STOPPED**			
1.	Oil filling Check and top-up if necessary: a) Lube oil b) Fuel oil			
2.	Coolant filling Check coolant level and top up if necessary.			
3.	Engine fuel system Drain sediments from a) fuel-water separator			
4.	Check and clean fuel tank level gauge for proper indication.			
5.	V-Belts Check the belts for : i) Correct tension ii) Unwanted grease & oil on it. iii) Any misalignment.			

6.	Engine air intake system i) Remove and clean dust pan and check air pollution indicator. ii) Check for complete red band on vacuum indicator. Clean outer element only with dry compressed air from inside to outside. iv) Check piping. Visually inspect hoses and pipes for damages/cracks and clamps for looseness. Rectify, if required.			
7.	**Radiator Fan** Visually inspect the fan for cracks, loose rivets, bent or loose blades and contact between the fan blade and fan shroud.			
	A. CONDITION : DIESEL ENGINE RUNNING			
9.	Mechanical (General examination) b) General visual checking to be made to detect loose, defective, missing or leaky parts in the following systems: i) Cooling water ii) Lube oil iii) Fuel oil iv) Air intake & exhaust			
10.	Check and record:		Idle	1800 rpm
	Engine lube oil pressure: Permissible values; *1-2 kg/ $cm.^2$ for idle *3-7 kg/ $cm.^2$ for 1800rpm			
	Lube oil temp: Should lie between 75°C – 105°C .			
	Cooling water temp : Not more than 95°C			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Main Engine, NTA 855 L)

Monthly or 125 Hr. (Whichever is earlier)

Crane No …..... Shed…...……..... Rly…..……

Hour Meter Reading…...……. Date:…...

Repeat all Daily check.

S.No	Details of work to be carried out	Condition/action	Sign.	Remarks
	A. CONDITION: DIESEL ENGINE STOPPED			
1.	General check : Check tightness of foundation/ mounting bolts of the following : a) Engine, b) Radiators, c) Compressor d) Radiator fan. e) Inlet & Exhaust manifolds.			
2	**Engine fuel system** Drain sediments from a) Fuel filter b) Fuel tank			
3	Clean the outer body of engine air intake filters.			
4	Check following V – belts for correct tension and serviceability: a) Cooling fan belts b) Water pump drive belt c) Compressor and fuel pump drive belt. d) Alternator drive belt			
	B. CONDITION : DIESEL ENGINE RUNNING			
1.	Mechanical (General examination) General visual checking to be made to detect loose, defective, missing or leaky parts in the following systems: a) Cooling water b) Lube oil c) Fuel oil d) Air intake & exhaust			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Main Engine, NTA 855 L)
6 Monthly or After 250 Hr. (Whichever is earlier)

Crane No .....… Shed.....…..... Rly.....……

Hour Meter Reading.....…… Date:.....

Repeat all checks of Daily & Weekly Schedule

S.No	Details of work to be carried out	Condition/action	Sign.	Remarks
A.	**CONDITION : DIESEL ENGINE STOPPED**			
1.	Change the following filters: a) Engine lube oil system :- i) Full flow filter ii) By-pass filter b) Engine fuel filter c) Water filter Note : Change gasket while changing the filter.			
2.	Engine Oil. Drain engine oil. Clean and check oil drain plug threads and seal surface. Change engine oil Run the engine at idle for some time and shut down. Again check level and add if required to ensure the oil level to “H”.			
3.	Fuel inlet connection screens : Check and clean magnetic filter screens in fuel system.			
4.	Check throttle linkages with hand for freeness.			
5.	Clean and inspect. Replace if damaged. a) Crank case breather, b) Fuel Tank breather			
6.	Coolant : Check SCA(Supplement Coolant Additive) concentration with test kit, CC-2626. Add SCA at the rate of 1.5 units/ gallon. Test procedure given in page V-23 in OEM’s manual.			

	Water used should have the following maximum levels: - Calcium Magnesium : 170 PPM.(as CaCO3+ MgCO3) - Chloride : 40 PPM (as Cl) - Sulphur : 100 PPM as (SO4)			
B. CONDITION : DIESEL ENGINE RUNNING				
1.	Cooling water system Check that vent pipes in the system are open.			
2.	**General check** For any leakages in the systems.			
3. a)	Safety Devices Ensure that oil pressure switch is in proper working order. Setting of OPS (Pick up at 1.0 kg/cm^2, Drop out at 0.8kg/cm^2). To check, stop the engine, LED will glow when pressure drops below 0.8kg/cm^2. Now start the engine, LED should shut off when pressure reaches above 1 kg/cm².			
b)	Ensure proper working of hot water temperature safety device. LED indication should come and buzzer should sound. (Max temp: 95 °C) To check ,remove the temperature safety switch and test with hot water at 95 °C. LED indication should come on panel with buzzer sound.			
c)	Ensure proper working of low cooling water level safety device. On pick up engine should shut down along with LED indication .			
d)	Ensure proper working of engine over speed safety device. Raise engine RPM by pressing governor plunger. Engine should shutdown at 1800 RPM along with LED indication.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Main Engine, NTA 855 L)

One Year or After 1500 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily, Weekly & 6 monthly Schedule

S.No	Details of work to be carried out	Condition/action	Sign.	Remarks
A.	**CONDITION : DIESEL ENGINE STOPPED**			
1.	Use a suitable solvent like kerosene to clean engine Note: Protect electrical components & openings from spray nozzle.			
2.	Engine mounting : Inspect flexible mounting rubber for deterioration & age hardening. Replace the damaged mounting. Replace broken/lost bolts and torque the mounting nuts and bolts.			
3.	Crank shaft end clearance : Measure the crankshaft end clearance with dial indicator. It should meet the following specification New : Min 0.10 mm ; Max 0.45 mm Maximum permissible worn limit : 0.56 mm.			
4.	Turbocharger Mounting : Check the turbocharger mounting nuts. Tighten the nuts with 48 Nm torque.			
5.	V-band clamps (Turbocharger) : Check the clamps & tighten with 8 Nm torque on :- a) Discharge/elbow b) Compressor housing c) Turbine housing			

6.	<u>Fuel injectors and valves</u> a) Adjust cross head b) Adjust fuel injectors. c) Check and adjust valve clearance at coolant temperature of 60^0 C or below : Inlet : 0.28 mm ; Exhaust : 0.58 mm. Replace Rocker cover gasket & tighten the cover cap screw to 45 Nm.			
7.	<u>Cooling system Hoses</u> : Inspect the cooling system hoses and connections for leak/deterioration. Replace the damaged hose/connecting part/clamps.			
B.	**CONDITION: DIESEL ENGINE RUNNING**			
1.	Check for leakages in all the systems.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Main Engine, NTA 855 L)

Two Year or after 6000 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily ,Weekly , 6 monthly & yearly Schedule

S.No	Details of work to be carried out	Condition/action	Sign.	Remarks
	Air Intake & Exhaust System			
1.	Turbocharger i) Check oil leakages through intake & exhaust seals. ii) Check turbocharger axial and radial clearances : Radial Min. (mm) Max. (mm) Impeller 0.18 0.46 Turbine 0.25 0.53 Axial 0.03 0.10 iii) Repair the turbo with repair kit.			
2.	Check for leakage in air intake system, if any, rectify the same with necessary parts.			
3.	Replace air cleaner inner & outer filter elements.			
4.	Check vacuum indicators for functioning & external damages and replace if necessary.			
5.	Check for leakage from exhaust system, if any, rectify the same with necessary parts.			
6.	Check air intake and exhaust piping supports. Take corrective action accordingly.			
	Fuel System			
1.	Clean water separator assembly.			

2.	Check all fuel line hoses for damage and leakage and replace if required.			
3.	Inspect the spider coupling for damage. Mount the spider coupling and pump. Tighten the mounting screw with 45 Nm torque.			
4.	Check fuel lines & connections for leakage.			
5.	Check fuel pump linkages.			
6.	Check actuator functioning.			
7.	Clean thoroughly fuel tank with steam and detergents and dry the tank with air blast.			
	Lubricating Oil System			
1.	Check & replace the damaged oil line hoses & clamps.			
2.	Check external oil leakage from head gasket/rocker housing gasket, seals, etc. If necessary, replace the same.			
	Cooling System			
1.	Flush cooling water tank. Replenish with SCA and water . Check for concentration.			
2.	Check all hoses, clamps & coupling O-Rings of cooling system pipe lines and radiator assembly and replace if necessary.			
3.	Remove radiator assembly from the mounting & clean the radiator assembly.			
4.	Check all radiator Anti Vibration Mountings and replace if necessary.			
5.	<u>Water Pump Idler pulley</u> : Check for : a) Freedom of rotation b) Cracked, chipped or broken pulley groove.			
6.	<u>Water Pump</u> : Check water pump for water leakage. If any continuous leak indication or drip is			

	indicated, replace the pump with new or rebuilt one.			
7.	Replace following belts:- i) Water pump drive belts. ii) Compressor and fuel pump drive belt. iii) Cooling fan hub belt drive. iv) Alternator drive belt.			
	Others			
1.	**Vibration Damper (Viscous**): Check Vibration damper for : a) Evidence of fluid loss, dents and wobble. b) Any deformation or raising of the damper from cover plate. c) Replace if necessary. **Do not repair or balance damper in field.**			
2.	Check for the leakages in various systems			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Main Engine, NTA 855 L)

3- Yearly or After 6000 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily, Weekly, 6 monthly yearly & 2-yearly Schedules

S.No	Details of work to be carried out	Condition/action	Sign.	Remarks
1	Remove, clean and Calibrate the injectors after replacing the cups and O-rings.			
2	Adjust valve. Check the conditions of push rods, adjusting nut & screws, if necessary replace.			
3	Calibrate the PT pump by replacing the necessary parts (e.g. magnetic filter, gasket set, etc.)			

Part – II

Schedule for Auxiliary Engine (KOEL HA -294)

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Auxiliary Engine, KOEL HA -294)

Daily Schedule

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....…… Date:.....

S.No	Details of work to be carried out	Condition/action	Sign.	Remarks
A.	**CONDITION: DIESEL ENGINE STOPPED**			
1.	Lube oil filling Check the lube oil level and top-up if necessary. Ensure that the oil is up to the upper (max.) mark.			
2.	Engine air intake system a) Remove and clean dust pan.			
3	Run the Engine, warm up & check the leakages in the systems.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Auxiliary Engine, KOEL HA -294)

Monthly or 125 Hr. (Whichever is earlier)

Crane No ….....… Shed…...…….....
Rly…..……

Hour Meter Reading…....……. Date:….....

Repeat Daily check.

S.No	Details of work to be carried out	Condition/action	Sign.	Remarks
1.	Clean the engine externally by blowing compressed air			
2.	Fastening: Check & tight if necessary : a) Check & tighten-up the fasteners for following b) Exhaust manifold c) Exhaust piping d) Lube oil sump e) Front cover f) Hose clip for air cleaner g) Lube oil filter mounting h) Engine mountings i) Fuel connections.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Auxiliary Engine, KOEL HA -294)

Half Yearly or 250 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....…… Date:.....

Repeat all checks of Daily & 125 Hr. Schedules

S.No	Details of work to be carried out	Condition/action	Sign.	Remarks
	A. CONDITION : DIESEL ENGINE STOPPED			
1.	Lube oil filter a) Remove and replace paper element type filter. b) Clean filter housing. c) Check condition of sealing ring & change if necessary.			
2.	Change engine lube oil.			
3.	Fuel filter insert : a) Remove the pre filter element. b) Flush the housing c) Replace the filter insert.			
4.	Lube Oil level in fuel pump and its governor: Loosen oil level control plug through 3-4 turns. Remove the screw plug & fill in fresh oil until it spills at oil level control plug			
5.	Air breather: a) Remove and wash the breather thoroughly in petrol. b) Blow dry with compressed air c) Assemble.			
6.	Exhaust silencer: Remove soot from exhaust silencer and clean the exhaust piping.			
7.	V- Belt for auxiliary generator and Blower fan drive: i) Check V – belts over whole length for damage and cracks. Renew if necessary. ii) Check for correct tension of the belt by pressing midway between the pulley. If it deflects inward by more than 10 to 15 mm then, re-tension the V- belts.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Auxiliary Engine, KOEL HA -294)

Yearly or 1000 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....…… Date:.....

Repeat all checks of Daily ,125 Hr. & 250 Hr. Schedules

S.No	Details of work to be carried out	Condition/action	Sign.	Remarks
B.	**CONDITION : DIESEL ENGINE STOPPED**			
1.	Cooling system a) Remove air cowling b) Clean with wire brush, the fin of cylinder liner, cylinder head & lube oil cooler. c) Blow through engine with compressed air from the exhaust air side. d) Remove dirt from cooling air ducting. Assemble cooling air cowling.			
2.	Micro fuel filter insert a) Remove the micro filter element. b) Flush the housing c) Replace the filter insert. d) Change the sealing range if the required.			
3.	Valve clearance: Check and adjust valve clearance if necessary. For both inlet and exhaust valves the permitted clearance is 0.15 mm.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Auxiliary Engine, KOEL HA -294)

2-Yearly or 2000 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily ,125 Hr., 250 Hr. & 1000Hr. Schedules

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Auxiliary Engine, KOEL HA -294)

3-Yearly or 3000 Hrs. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily ,125 Hr., 250 Hr. ,1000Hr. & 2000Hr. Schedules

S.No	Details of work to be carried out	Condition/action	Sign.	Remarks
C.	**CONDITION : DIESEL ENGINE STOPPED**			
1.	Injector : a) Remove injector, clean and test for the correct opening pressure of 175 to 180 kg/cm^2. b) If necessary, replace the nozzle along with sealing washer.			
2.	Calibrate the fuel pump			
3.	Calibrate the PT pump by replacing the necessary parts.			

Part – III

Schedule for Hydraulic system including all Cylinders, Valves, pumps & motors etc.

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Hydraulic system including all Cylinders, Valves, pumps & motors etc.)

Daily Schedule

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1	i) Check connection for damage and leakage in following pumps connected with main engine: a) Main variable displacement pump 1. b) Main variable displacement Pump 2. c) Slewing gear variable displacement pump. d) Gear pump for oil cooler circuit. e) Gear pump for control circuit. ii) Secondary pumps connected with auxiliary engine: a) Gear pumps for main pressure circuit. b) Gear pumps for control circuit.			
2	Hydraulic tank : a) Check connection for damage and leakage. b) Check the hydraulic oil level through oil level glass on the tank. Top up with same brand of oil if necessary, as per clause 5.4.3 of General Description. (Level to be checked when all the cylinders are in retracted position). c) Check the hydraulic oil temperature on the gauge mounted in the cab in working condition. (Max. 70 ºC)			
3	Slewing gear pump filter: a) Check the oil filters and its connections & mountings for external damage, leakage or firm seating. b) Check the pollution indicator for red indication on filter ; if red indication visible , change the filter.			
4.	Rotary lead-through: a) Check the hoses, their connections and attachments for external damage, firm seating and proper sealing. 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 correct seating and damage.			
5.	Spring suspension blocking cylinders: a) Check the blocking cylinders and their connections for external damage, firm seating and proper sealing. b) Retract & extend the cylinders and check for proper working and carry out inspection of the piston rods for any scoring marks.			
6	Control blocks in the Under carriage: a) Check the valve block and their connections for external damage and leakage. Tighten the fittings; if required. b) Check functions of suspension blocking cylinders and travel gear pinion disengagement / engagement device by means of hand lever.			
7	Outrigger beam cylinders: a) Check the cylinders and their connections for loose, leaky, external damage, firm seating and proper sealing. Tighten the fitting ; if required. b) Check automatic latching of the piston rod of jack cylinder in retracted position.			
8	Check the following hydraulic motors and their connections for firm seating, external damage and proper sealing. a) Main hoist motor b) Auxiliary hoist motor c) Slewing motor d) Travel gear motors (2 Nos.) e) Derricking motor f) Recovery winch motor			
9	Control blocks on Superstructure: a) Check the valve block and their connections for external damage and leakage. Tighten the fittings; if required.			
10	Counter weight cylinders (5 Nos.) & Jib root point cylinder (2 Nos): Check the cylinders and their connections for external damage and leakage. Tighten the fittings; if required.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Hydraulic system including all Cylinders, Valves, pumps & motors etc.)

Monthly or 125 Hr. (Whichever is earlier)

Crane No ….....… Shed…...…….....
Rly…..……

Hour Meter Reading…....……. Date:….....
.

Repeat Daily check.

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1	Check the abnormal running noises of the following pumps. i) Pumps connected with main engine a) Main variable displacement pump 1 b) Main variable displacement Pump 2 c) Slewing gear variable displacement pump d) Gear pump for oil cooler circuit e) Gear pump for control circuit ii) Secondary pumps connected with auxiliary engine. a) Gear pumps for main pressure circuit. b) Gear pumps for control circuit.			
2	Hydraulic oil tank: Check the oil filter visual clogging indicator mounted on the tank. With the oil at operating temperature: See the colour indication :- i) If green – Normal. ii) If Yellow - Advisable to change the filter inserts. iii) Red – MUST change the filter inserts.			

4	Check the running noises of the following hydraulic motors :- a) Main hoist motor b) Auxiliary hoist motor c) Slewing motor d) Travel gear motors (2 Nos.) e) Derricking motor f) Recovery winch motor			
5	Clean the mounting bolts and lubricate the following. a) Counter weight cylinders. b) Jib root point cylinders.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Hydraulic system including all Cylinders, Valves, pumps & motors etc.)

6 Monthly or 750 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily & Monthly Schedule

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1	Check operating pressures in pressure gauges mounted behind the cab. Faulty pressure gauges must be changed: The max. operating pressure of following pumps are : a) Main variable displacement pumps 1 & 2 - 400 bar b) Slewing gear pump - 250 bar. c) Gear pump for control Circuit - 30 bar d) secondary Gear pumps for main pressure circuit. - 200bar c) Secondary gear pumps for control circuit. - 30 bar			
2	Hydraulic oil tank: a) Check the breather filter fitted on the top of the tank for clogging / damage, if required, cartridges to be replaced.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Hydraulic system including all Cylinders, Valves, pumps & motors etc.)

Yearly or 1500 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily , Monthly & half yearly Schedules

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Hydraulic system including all Cylinders, Valves, pumps & motors etc.)

2- Yearly or 3000 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily , Monthly , half yearly & Yearly Schedules

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1	Hydraulic oil tank: Change the hydraulic oil through an external mounted filter assembly with two-stage filtration cart. (For detail refer clause 5.4.3 of General Description)			

Part – IV

(Schedule for Slewing ring, Gear boxes and Reduction gear units)

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Schedule for Slewing ring, Gear boxes and Reduction gear units)

Daily Schedule

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1	Pump distribution gear box: a) Check the gear box at flange connections for external damage, leakage and firm seating. b) Check for abnormal running noises. c) Check the oil level in distribution gear box through the dipstick. Top up; if required			
2	Check the following reduction gear units for external damage, leakages and abnormal running noises. i) Slewing gear reduction Unit. ii) Main Hoist reduction gear unit. iii) Auxiliary Hoist reduction gear unit. iv) Derricking gear reduction gear unit v) Recovery winch reduction gear unit.			
3	Travel reduction gear unit a) Check visually reduction gear unit for any leakage ,and crack or damage. b) Check visually the sealing of drain plug.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Schedule for Slewing ring, Gear boxes and Reduction gear units)

Monthly or 125 Hr. (Whichever is earlier)

Crane No …..... Shed…...……..... Rly…..……

Hour Meter Reading…...……. Date:…..... .

Repeat Daily check.

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1	Check the bolt connection of Pump distribution gear box for firm seating ; tighten, if required.			
2	Slewing gear reduction Unit: a) Check for all connections, lines & connection for firm seating. b) Check the oil level with help of dipstick. The oil level must be between the upper & lowering marking on the dipstick. Top up if required. c) Check the bolt connection firm seating. Tighten ,If required. d) Check the breather filter for cleanliness/ damage and if required, clean or replace.			
3	Roller bearing of slewing ring. a) Check the running noises to ensure that the bearing assembly runs smoothly by rotating superstructure slowly on the undercarriage; b) Lubricate the slew ring via two lubrication nipples located in the left machinery house near the slewing reduction gear unit. c) Check the bolt connection for			

	looseness; if required bolts must be tighten (tightening force 560000N).			
4	Pinion & Gear wheels (Travel gear) a) Check the gear wheel & pinion for external damage like cracks/ broken teeth. b) Clean the gear wheel and pinion to remove waste grease and dirt and then re-grease the same.			
5	Travel reduction gear unit: a) Check the oil level via an overflow gauge, screw out the oil filler plug. If required, add the oil until the oil level remains constant.			
6	Main Hoist reduction gear unit: a) Check all connections, lines for firm seating. b) Check the oil level via oil level inspection plug; if required, Top up oil. c) Check the bolt connection for firm seating . tighten them , if required.			
7	Auxiliary Hoist reduction gear unit: a) Check all connections, lines for firm seating. b) Check the oil level via oil level inspection plug; if required top up oil. c) Check the bolt connection for firm seating. Tighten, if required.			
8	Derricking gear reduction gear unit: a) Check all connections, lines for firm seating. b) Check the oil level via oil level inspection plug; if required; top up oil. c) Check the bolt connection for firm seating. Tighten, if required.			
9	Recovery winch reduction gear unit: a) Check all connections, lines for			

	firm seating. b) Check the oil level via oil level inspection plug; if required; top up oil. c) Check the bolt connection for firm seating. Tighten, if required.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Schedule for Slewing ring, Gear boxes and Reduction gear units)

6 Monthly or 750 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily & Monthly Schedule

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1	Pump distribution gear boxes : a) Check the vent filter on the housing upper side ; if required, clean or replace.			
2	Lubricate the following gear boxes via lubricating nipple : a) Main hoist reduction gear unit b) Auxiliary hoist reduction gear unit b) Derrick reduction gear unit c) Recovery winch reduction gear unit			
3	Travel reduction gear unit : a) Clean the gear unit exterior. b) Check vent on the gear box unit : If it is clogged, screw out vent and wash in a suitable solution and dry with compressed air.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Schedule for Slewing ring, Gear boxes and Reduction gear units)

Yearly or 1500 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....…… Date:.....

Repeat all checks of Daily , Monthly & half yearly Schedules

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1	Change the oil of following gear boxes with prescribed grade of oil: a) Pump distribution gear box b) Slewing reduction gear unit c) Main hoist reduction gear unit d) Auxiliary reduction hoist gear unit. d) Derrick reduction gear unit e) Recovery winch reduction gear unit			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Schedule for Slewing ring, Gear boxes and Reduction gear units)

2- Yearly or 3000 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily , Monthly , half yearly & Yearly Schedules

Part – V

(Schedule for Electrical and control System)

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
Electrical and control System
Daily Schedule

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....…… Date:.....

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1	i) Check the generators and its connections for firm seating, external damage, unusual sound, high temperature and dour : a) Generator on main engine b) Generator on auxiliary engine c) 24 V battery charging alternators d) Starters e) Starter motor.			
2	Check the limit switches and their mounting and connections for external damage and firm seating for following limits of motion: a) Main hoist limit switch. b) Auxiliary hoist limit switch. c) Derrick in/out limit switch.			
3	Safe load indicator: a) Check the limit switches near the rotary lead through for sensing superstructure position, the load cells and angle sensor for damage and firm seating. b) Check proper function / indication of SLI for different mode of display.			
4	Batteries : a) Check the electrolyte level by opening out the filler plug ; Top up with distilled water to the marking , if required.			
5	i) Check following lighting elements of the crane, their mountings and cable connection for damage, firm seating and moisture; damaged or			

	moist lighting fixture must be replaced. a) Control panel lighting. b) Cab lighting c) Machinery house lighting d) Spotlight mounted on each to the left and right of the cab front side. e) A spot light behind the cab for checking of motion drums. f) Out rigger lightings on each corner of superstructure g) Two red travel lights at the front and at rear of the superstructure h) Two adjustable spot light on jib.			
6	i) Check the screen wiper and wash system for proper functioning.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Electrical and control System)

Monthly or 125 Hr. (Whichever is earlier)

Crane No ….....… Shed…...…….....
Rly…..……

Hour Meter Reading…....……. Date:….....
.

Repeat Daily check.

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1	Switch cabinets: a) Check the switch cabinets for any external damage b) Check the door connection whether they are close properly. Any faulty seals must be replaced immediately. c) Check cable connections for firm seating and damage.			
2	Junction boxes and cableways: a) Check the junction boxes for external damage and ensure their cover for proper seating and tightness. b) Check the cables for external damage, bent and for proper seating.			
3	Batteries: a) Check the batteries and the cable connecting terminals for external damage. b) Clean the batteries, battery boxes, tighten the terminal lugs and apply petroleum jelly on all terminals. c) Ensure the plugs are clean d) Check the specific gravity and should be (1200-1240) e) Check if any battery is having reverse polarity			

	f) Check and record battery voltage. Should be min-1.8 V , max-2.2 V.			
4	Check the functioning of following limit switches without load for all switching points slowly. a) Main hoist limit switch b) Auxiliary hoist limit switch c) Derrick in/out limit switch			
5	Lighting, control panels, fan and sockets: a) Clean the lighting fixture and control panel with suitable aid. b) Clean fan vent grates with suitable aid. c) Check the lighting elements and fan for proper function ; any faulty broken lamps or lighting elements must be replaced immediately. d) Check other cab equipments for their proper functioning and any external damage.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Electrical and control System)

6 Monthly or 750 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily & Monthly Schedule

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1	Clean the Switch cabinet interior with suitable cleaning aid.			
2	Clean the limit switches with dry compressed air at 3 Kg/ cm^2 and their mountings and check connections for firm seating.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Electrical and control System)

Yearly or 1500 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily , Monthly & half yearly Schedules

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1	Clean the junction box interior with the suitable aid (preferably with vacuum cleaner)			
2	Starters for Main & Auxiliary engine. Remove and overhaul: a) Check the brushes. If worn to approximately 10 mm, then renew the brushes. (Must always be replaced in sets & with correct grade). b) Check the brush spring pressure. It must be 0.965 to 1.080 kg. c) Check the commutator surface. Clean with fine emery if surface is dirty or badly discoloured. d) Check the drive assembly for free movement over the shaft spline. Smear grease over shaft spline. e) Ensure that the mounting bolts are securely fastened. f) Ensure that all electrical connections are clean and tight.			
3	Alternator on Main & Auxiliary engine: a) Check the brushes. Renew the brush and spring assembly; if overall length of the brushes is worn to less than 10 mm. Otherwise, clean the brushes with petrol moistened cloth. b) Ensure that the slip ring			

	surfaces are clean and smooth. If required, refinishing, clean the surfaces with fine emery paper. c) Check bearing for play and wear, renew if required. d) Externally clean the alternator and ensure that the ventilation slot / air spaces are clear. e) Ensure proper belt tension.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Electrical and control System)

2-Yearly or 3000 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily , Monthly , half yearly &f yearly Schedules

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1	Batteries: a) Remove and recharge the batteries. b) Clean the battery box and paint it.			

Part – VI

(Schedule for Pneumatic & Brake system)

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Pneumatic & Brake system)
Daily Schedule

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....…… Date:.....

Sl. No.	Description of defects	Action taken	Signature	Remarks
1.	Air pressure Reservoir Check visually any external damage of air pressure reservoirs & its connections. a) 50 ltrs(3 Nos.) b) 25 ltrs (2 Nos). c) 14 ltrs (3 Nos). d) 9 ltrs (2 Nos). e) 5 ltrs (1 No).			
2.	Disengaging device for travel gear unit a) Check visually connection & mounting for external damage & firm seating b) Check air pressure cylinder for connection, mounting & firm seating. c) Check visually spline shaft teeth, for dirt, if required clean & grease. d) Check disengaging device for its proper functioning.			
3.	Wheel set a) Check wheel set mounting and its firm seating visually. b) Check visually any crack, skidding, or damage on wheel hub or tread.			
4.	Wheel set bearing a) Check wheel set bearing visually for any external crack or damage			
5.	Bogie Spring suspension a) Check visually the component of spring assembly for crack or damage . b) Check visually spring assembly for its firm seating .			
6	Brake system a) Check visually all component of brake			

	system for external damage , any air leakage and if required rectify . b) Check visually changeover device (Self or train brake) & its mountings for any damage, firm seating. c) Check Bowden cable for any damage and proper fitment visually. d) Check visually brake cylinders for any air leakage ,firm seating and mountings. e) Check the brake disc for any crack or damage visually. f) Check visually the brake cylinder adjuster unit for any external damage and its firm seating			
7.	<u>Functional tests:</u> a) Check the function of emergency release device from the cab. b) Carry out the function of brake system. c) Check the working of parking brakes. d) Check the brake cylinder pressure from the gauge in the cab: Max. admissible cylinder pressure : 6 bars Spring cylinder release Pressure : 5 bars			
8	<u>Brake pipe & couplings</u> a) Check visually brake pipe ,feed pipe, vacuum hose pipe, couplings &their pertaining stop cock for any external damage b) Observe air leakage from these and rectify, if required.			
9	<u>Axle mounted compressor</u> a) Check visually the compressor & its coupling for mounting firm seating . b) Check visually leakage of oil.			
10	Test the signal horns.			
11	Check the brake paddle in cab for its firm seating.			
12	Match Truck			
	a) Check visually all brake equipment, air ,pipes, their safety clamps for any damage and firm seating .			

	b) Check application and releasing of brakes c) Check emergency release. d) Check air leakage.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Pneumatic & Brake system)
Monthly or 125 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily Schedule

1	Axle mounted compressor a) Check axle mounted compressor connection for any damage ,firm seating and sealing. b) Lubricate the lubricating nipples on compressor shaft. a) Check visually filter element for dirt ,if required, replace. b) Check the oil level by dip stick and top up if required .			
2	Pressure regulator a) Check the pressure regulator visually for external damage			
3	Brake paddle to clean			
4	Lubricate the bogie hinge			
5	Check side bearer clearance .			
6	Bogie a) Check the bogie frame visually for any crack & damage.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Pneumatic & Brake system)
6 Monthly or 750 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily & Monthly Schedule

1.	Axle mounted compressor a) Remove the fine filter element, clean the filer elements by compressed air at pressure of 2kg/cm^2 and clean the housing, check corrosion visually, inspect the gasket, if required to change.			
2.	Clean the bogie suspension by compressed air.			
3.	Check visually the erased painting areas &to be painted.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Pneumatic & Brake system)
Yearly or 1500 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....…… Date:.....

Repeat all checks of Daily , Monthly & half yearly Schedules

1	Wheel set a) check the difference in wheel dia i) Dia of wheel in same axle - Permissible 0.5mm. - Service limit 2.0 mm ii) one axle to another axle - Permissible limit 2.0 mm - Service limit 8.0 mm iii) one bogie to another bogie - Permissible limit 15 mm - Service limit 25 mm b) Check the wheel profile by profile gauge			
2	Wheel set bearing a) Remove the cover &check the bearings visually from out side. b) Change the grease of bearing but the inner bearing should not be opened.			
3	Brake disc a) Check for hollow wear of disc i,e area adjacent to center when wear is not uniform - Hollow wear : max. 2.5 mm b) Check for wear of disc : max imum limit :7.0mm. c) Check for any groove or scoring of disc maximum permissible size : 1.0 mm i) In case the above values are reached, the friction surface of disc to be faced (Permissible surface roughness after machining should be < Rz 20, i.e. 20 microns). ii)Check the brake pads and if required replace them. REF: Manual for wheel mounting brake disc by SAB Wabco.			

4	<u>Brake Pad Check</u> a)Check for wear : (i) Thickness of new brake pad :24mm (ii) Permissible thickness of wear :6mm (iii) Minimum thickness of worn pad : 18mm. b)Checking of Longitudinal clearance between Brake Pad and Pad Holder. i) When the brake is released, the pads may move by a maximum of 2 mm in dovetail direction inside the pad holder. If the freedom of movement exceeds this value, remove the pads and check the dovetail guide on the pad and inside the pad holder. ii) The pads must be replaced if there is any damage on the backs of the pads. iii) The holder must be replaced if there is any damage to the pad holder and/or locking piece. iv) Checking Brake Pad/Brake Disc Clearance. The two brake pads of the brake calliper must have a clearance of 2 mm each from the brake disc or 4 mm clearance for one brake pad when the other is in contact. REF: Manual BSI Brake Caliper by SAB Wabco.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
(Pneumatic & Brake system)

2-Yearly or 3000 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....…… Date:.....

Repeat all checks of Daily , Monthly , half yearly & Yearly Schedules

1	Brake Disc a) Check the tightness of brake disk by torque wrench up to 200Nm. b) Check visually for crack in cooling fins. Maximum 2 nos. cracked cooling fins are permissible.			
2	Air Compressor (Engine mounted): i) Measure total carbon deposit thickness inside the air discharge line pipe. If it exceeds 2 mm, clean and inspect the cylinder head, the valve assembly and discharge line. Replace any pipes or connections if it exceed the specified limit and does not get clean. ii) Replace worn out parts. iii) Replace all 'O' rings, gaskets, oil seals. iv) Assemble and run the compressor to evaluate its performance.			

Part – VII

Schedule for Basic Construction (Super structure, Undercarriage, Bogie, Cab Ropes, Sheaves, Drums)

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
Basic Construction (Super structure, Undercarriage, Bogie, Cab Ropes, Sheaves, Drums)
Daily Schedule

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1	Check visually for any crack / damage of the following. a) Counter weight (22 t, 8 t, 6t) and its mountings. b) Out rigger beams assembly (4 Nos.). c) Out rigger pads(8Nos.). d) Superstructure locking device e) Bogies. f) Buffer and draw gear Arrangement			
2.	Rope Check rope condition as per inspection criteria.			
3	Check visually the entire crane steel construction for external damage such as cracks or deformation.			
4	Jib and Jib route point a) Check the jib for external damage & cracks b) Check the jib rope pulleys for external damage, firm seating & excessive wear. Any damage or worn pulleys must be replaced immediately. c) Check the jib support for external damage and firm seating. d) Check the moving latching unit and see whether it moves easily.			
5	Check both the main hoist and auxiliary hoist hook blocks for external damage			

	& cracks. Any damage parts must be replaced immediately.			
6	Cab: a) Check the entire cab for external damage and deformation b) Check the glass for damage; any damaged panes must be replaced.			
7	Match truck: a) Check the for external crack / damage in match truck under frame and bogie frame. b) Check for the loose/ broken mounting of counter weight holding brackets and trestle assembly; strengthen the same if required. c) Check the draw gear and buffer assembly for any defect/ damage. d) Check the Cwts and its supporting arrangement for any crack/ damages.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
Basic Construction (Super structure, Undercarriage, Bogie, Cab Ropes, Sheaves, Drums)
Monthly or 125 Hr. (Whichever is earlier)

Crane No .....… Shed.....…..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily Schedule

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1.	Clean the following. a) Protective housing & panelling. b) Stairways, boards & holding straps.			
2.	Check and lubricate the following. a) Out rigger beams: Remove the waste grease and lubricate until the bearing points are protected by means of a surrounding bead of grease. b) Out rigger pads: Clean the knuckle joints and grease. c) Superstructure locking device: Clean the knuckle joints and then grease. d) Bogies: The side bearers between the under carriage and the bogie must be lubricated regularly. e) Jib support: Clean and grease the knuckle joints and sliding surfaces. f) Lubricate bogie pivots, Screw coupling and buffers			
3.	Check the functional tests of the following. a) Out rigger beams: Check whether they extend & retract properly & whether they lock properly. b) Jib Rope pulleys. c) Jib Rope guides. d) Jib supports.			

4.	Ropes a) Clean & Grease b) Functional Test for smooth running.			
5.	Signs & labeling a) Check visually & re write any thing that has got erased.			
6.	Check the following rope drums and rope clamp for external damage and firm seating; a) Main Hoist rope drum. b) Auxiliary Hoist rope drum. c) Derricking gear rope drum. d) Recovery winch rope drum.			
7	Derrick rope pulley and rope guides: a) Check for external damage, wear & tear; any damaged item must be replaced. b) Check the functionally rope pulley and guides for smooth running.			
8	Deflection rolls on recovery winch: a) Check for external damage, wear & tear; any damaged item must be replaced. b) Check the functionally deflection rolls pulley for smooth running			
9	Cab: a) Clean, grease and the door hinges and their lock for proper functioning.			
10	Seat : a) Check the entire seat and its controls and mountings for external damage and firm seating. b) Clean the slide tracks, on which the movable seat is fixed and grease slightly			
11	Match truck: a) Check the trestle assembly for crack / damage and lubricate the liners b) Cleans lubricate: Bogie Pivot and bolster.			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
Basic Construction (Super structure, Undercarriage, Bogie, Cab Ropes, Sheaves, Drums)
6 Monthly or 750 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....…… Date:.....

Repeat all checks of Daily & Monthly Schedule

S. No.	Detail of work to be carried out	Condition / Action	Sign.	Remarks
1.	Damaged paintwork on following item must be thoroughly de-rusted and painted the following. a) Protective housing b) Stairways, footboards and holding straps. c) Counter weight d) Outrigger beams e) Superstructure locking device f) Bogies g) Jib and jib root point h) Jib support i) Cab j) Match truck			
2	Lubricate the following rope drums with suitable grade of oil: a) Main Hoist rope drum. b) Auxiliary Hoist rope drum. c) Derricking gear rope drum. d) Recovery winch rope drum.			
3	Match truck: a) Clean and lubricate screw coupling and buffers			

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
Basic Construction (Super structure, Undercarriage, Bogie, Cab Ropes, Sheaves, Drums)
Yearly or 1500 Hr. (Whichever is earlier)

Crane No .....… Shed.....……..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily , Monthly & half yearly Schedules

Schedule for Maintenance of 140 t Gottwald Upgrade Crane
Basic Construction (Super structure, Undercarriage, Bogie, Cab Ropes, Sheaves, Drums)
2-Yearly or 3000 Hr. (Whichever is earlier)

Crane No .....… Shed.....…..... Rly.....……

Hour Meter Reading.....……. Date:.....

Repeat all checks of Daily , Monthly , half yearly &f yearly Schedules