

**SCOPE OF WORK**

The scope included the following:

<b>A.</b>	<b>Explanatory Note for the Work 'M3/M4/M5" check of Greaves -Make Diesel engines for Power Cars.</b>
	The following steps to be followed while executing the work of M3/M4/M5- check as per schedule:
<b>1</b>	After receiving a power car (due for M3/M4/M5check) in the workshop the concerned contact person/service representative deputed by the firm will be informed through mobile phone/Whats App/letter/e-mail etc. regarding the receipt of power car
<b>2</b>	M3/M4/M5-check must be done as per maintenance instruction given in MAINTENANCE MANUAL FOR LHB COACHES (IRCAMTECH/GWL/ELECT./2022-23/LHB Manual/1.1 & IRCAMTECH / M/ GWL/ Power Car/Schedule Dated: 30.07.2024) or latest or latest guideline issued by railway (if any). However, detailed scope has been provided for ease of maintenance of power car, for any contradiction, guidelines of latest CAMTECH manual or latest guideline issued by railway (if any) Will be final.
<b>3</b>	A joint inspection between the railway representative (JE/SSE) & authorized service representative from firm will be done after the power car is placed at a suitable location/shop to find out deficiencies and to decide works to be carried out and PDC of the work involved so that the power car will be turned-out as per coaching depot requirement.
<b>4</b>	As per the requirement the service representative will draw necessary materials from the railway (as per Schedule) department through requisition on a proper format that will be given by railways
<b>5</b>	After issue of the material the service person will carry the material to the respective location where the scheduled M3/M4/M5check is planned to be carried out.
<b>6</b>	The team of the respective service persons will carry out all the activities mentioned in the scope of work for M3/M4/M5 check duly following all the safety protocols under the supervision of the deputed graduate engineer by the firm.
<b>7</b>	The servicing firm will bring all the necessary tools and plants to complete the whole work (e.g. Stripping, fitting, testing, measuring and all other required tools and accessories) on their own.
<b>8</b>	The day-to-day activities done and the material used must be recorded in a register and should be countersigned by railway representative
<b>9</b>	Intermediate stage inspections will be carried out by railway representatives for progress of work.
<b>10</b>	All the scheduled activities under M3/M4/M5check should be completed well before the target date so that the DA sets can be tested on load properly.
<b>11</b>	All the released materials during the M3/M4/M5 check must be handed over to the railway custody.
<b>12</b>	After all the activities in the scope of M3/M4/M5 check are completed properly, a final joint inspection will be carried out by both the parties duly running and load testing on the DA sets
<b>13</b>	During running on load all the electrical and engine running parameters including safety aspects will be checked by both the representatives and it will be included in the joint report.
<b>14</b>	If any deficiency or abnormality is noticed during load testing of DA sets, it should be rectified by the authorized service persons as soon as possible to make it service ready before final traffic outage.
<b>15</b>	Service person from the firm carrying out the work must be available all the time (railway workshop working hours) up to final load testing on traffic out.
<b>16</b>	Contact nos. of the service representative along with alternate authorized contact nos. must be made available all the time throughout tenure of the work.
<b>17</b>	Work on offered coach has to be completed within 15 working days for the M3-check, within 21 working days for the M4-check, and within 30 working days for the M5-check, starting from the date of offering the Coach. If contractor fails to comply it, then penalty will be imposed as per Penalty clause.
<b>18</b>	If the work will not complete with in the schedule time, then necessary penalty may be imposed as per tender schedule.
<b>19</b>	Nominated supervisor from railways: SSE or any other supervisor decided by the administration thereafter.
<b>20</b>	M3/M4/M5-check and other optional work mentioned in schedule will be done at Carriage & Wagon Workshop, Liluah. If any goods are required to be repaired outside C&W/Workshop/LLH, the transportation will have to be borne by contactor and contractor will not have any claim for same.
<b>21</b>	Condition based items given shall be checked jointly by Firm's nominated representative & Railway representative and decision of replacement of parts should be mutually agreed by railway supported by Joint Note with nominated SSE/PC/LLH and counter signed by controlling officer. Firm will be bound to make necessary repair/replacement on

	the price quoted in their offer No extra payment or price variation will be accepted in the price quoted in their offer during complete agreement period.
22	All bolts elongation, torque and tightness should be as per maintenance instruction given in MAINTENANCE MANUAL FOR LHB COACHES (IRCAMTECH/GWL/ELECT./2022-23/LHB Manual/1.1 & IRCAMTECH/ M/ GWL/ Power Car/Schedule) OR latest or latest guideline issued by railway (if any).
23	All the required Tools, Machineries and plant, Portable welding machines, Gas Cutting torch along with Cutting-Nozzle with gas pipe, Hand tools, Power tools, Fork Lifter, Pipe with nozzle for cleaning by compressed air etc. are the scope of Firm Supply.

**B. M3 Check schedules on Greaves Cotton make diesel Engine TBD41V12-CPCB-I & 12V14TAG23- CPCB-2 as per RDSO specification.**

**B.1**

M3 Check schedules on Greaves Cotton make diesel Engine TBD41V12-CPCB-I & 12V14TAG23- CPCB-2

Engine System	Check/ Clean/ Change/ Calibrate	Description
Lube oil System	Check	Oil leaks
		Oil Pressure & Temperature gauges
		Existing Oil Filter for metal particles due to wear & tear of the internal Engine parts
		Lube Oil Level In Sump
	Change	Centrifugal Filter Paper Element
		Lube oil Spin on Filter (As required)
		Lube Oil
Fuel System	Check	Fuel Leaks
		Fuel Level In Tank
		Actuator Linkage (Link Rod Ball Joint)
	Drain	Drain sediments form Water separator
	Clean	Clean Water separator (As Required)
		Injector Nozzles & Spray If Necessary (Only perform if black smoke /Not taking load related problem persists)
		Fuel Tank
	Change	Fuel Filter Cartridge (As required)
		Vertical FTP Carbon Brush
		Mico Bosch Coarse fuel filter (As required)
Cooling system	Check	Coolant Leaks
		Coolant Level in Radiator
		Radiator Motor , Fan , Hub & Bearing Assembly
		Coolant Level & Temperature Gauges
		Check Belt Tension
	Clean	Radiator Fins
	Check & Top Up	Add Coolant Additive
	Change	Radiator Cap & Rubber Ring
		Coolant Water & Additive
		Water Pump Belt (As required)
Air system	Check	Air Leaks
		Air Cleaner Restriction (Vacuum Indicator)
		Turbo Charger - Axial & Radial Play (0.2 mm)
	Check & Change	Air Filter Element (Max Life of Big Filter is 2000 Hrs / 1 Year Whichever is earlier)
Exhaust System	Check	Exhaust Leaks
		Exhaust Bellows & Change If Necessary

Engine Related		Retorqued - Turbo Turbine side Clamp
	Clean	Exhaust Silencer
	Check	Tappet Clearance & Set if necessary
		External Fasteners Torque & do If Necessary
		Alternator Greasing
Electric al System	Check	Tappet Cover gasket
		Battery Condition
		Specific Gravity of the Battery
		Battery Power Cable leads
Wiring & Panel	Check	Check & Correct- Panel Wiring
		Check EPS & Alarms
	Clean	Magnetic Pick Up Unit

## **B.2-Pre load test and final load test on DA Set**

Scope of work for Pre-load test.

1	Pre load test will be carried out on DA set very next day after being informed by the SSE/C&W/LLH. Failing which a penalty will be imposed on the firm as per GCC guidelines.
2	The firm will carry out all necessary preparations and arrangements to carry out pre load test such as engine electrical and mechanical controls.
3	The DA set shall run at full load.
4	All engine and alternators parameters must be recorded as per format available.
5	Joint inspection note will be prepared with SSE/C&W/LLH nominated staff for further works.

## **B.3- LOAD TESTING OF ENGINE AFTER M3- CHECK SCHEDULE ON POWER CAR.**

1	Engine of power car after POH schedule shall be run at a speed of 1500 rpm continuously at a rated load. Before starting the Engine for load testing, the alignment, foundation, level of coolant, fuel, lubricant oil, condition of battery etc shall be checked by the contractor so that the load testing can be conducted properly. After starting the Engine, the rotation shall be checked and the engine shall run at 1/3rd load only for approximately 10 minutes and then it shall run at 3/4th load for a further 5 minutes, there after the engine shall run continuously at full load. When the engine reaches normal running temperature, operating values shall be checked and recorded. Also during load test the performance of the repaired Engine shall be jointly checked and remarks shall be given. The engine during operation will be checked for below mentioned observations
i.	Unusual Engine noise.
ii.	Excessive smoke.
iii.	Abnormal water or oil temperature.
iv.	Inadequate/ high lubricating oil pressure.
v.	Low Power.
vi.	Abnormal jerk during start and stop of the Engine.
vii.	Excessive use of coolant or lubricating oil.
viii.	Leakage of fuel, coolant or lubricating oil.
ix.	Abnormal vibration.
x.	Engine knocking.
xi.	Engine overheats.
xii.	Engine over speeds.
xiii.	Abnormal colour of exhaust gas.
xiv.	Water in lube oil etc.
xv.	Hard starting or Engine failure to Start.
xvi.	Excessive smoke under load.
xvii.	Excessive fuel consumption.
xviii.	Low lube oil pressure.
ix.	Excess Blow Bye.
xx.	Worn valve and guides.
xxi.	Mechanical knocks
xxii.	Excessive crank case pressure.
2	Contractor shall also arrange for emission test, blow bye test and additional tests which are required to be conducted as desired by the Railway to judge the performance of the Engine without delay.
3	Cleaning of the engine room must be ensured.

NOTE : All LOAD TEST (PRE OR FINAL) WILL BE CARRIED OUT BY CONTRACTOR AS PER RDSO GUIDELINE OR MANUAL (WHICHEVER IS APPLICABLE OR LATEST)

**ANNEXURE**

ENGINE SERIAL NO \_\_\_\_\_ ENGINE MODEL NO \_\_\_\_\_ ENGINE STARTED AT \_\_\_\_\_ HRS

ENGINE STOPPED AT \_\_\_\_\_ HRS TOTAL HRS \_\_\_\_\_ HRS

DATE:-

ENGINE				ALTERNATOR				
Time (HRS)	LOP	LOT	W.T.	Voltage	AMP	Hz	Pf	Kw

SIGNATURE OF

FIRM REPRESENTATIVE

SIGNATURE OF RAILWAY

REPRESENTATIVE

**ANNEXURE**

ENGINE SR NO- \_\_\_\_\_ ENGINE MODEL\_ \_\_\_\_\_

PERFORMANCE OF THE REPAIRED ENGINE OBSERVED DURING LOAD TESTING.

SN	ITEMS	REMARKS
1	CLEANLINESS OF ENGINE	
2	ENGINE NOISE	
3	WATER / COOLING TEMP	
4	LUBE OIL TEMPRETURE	
5	LUBE OIL PRESSURE	
6	POWER OF ENGINE	
7	JERK DURING STARTING OF ENGINE	
8	JERK DURING STOPPING OF ENGINE	
9	VIBRATION DURING RUNNING OF ENGINE	
10	CONSUMPTION OF LUBEOIL	
11	CONSUMPTION OF COOLANT	
12	LEAKAGE OF FUEL	
13	LEAKAGE OF LUBE OIL	
14	LEAKAGE OF COOLANT	
15	KNOCKING OF ENGINES	
16	COLOUR OF EXHAUST GAS	
17	HEATING OF ENGINE	
18	SPEED OF ENGINE	
19	MIXING OF WATER IN LUBE OIL.	

Signature of Railway Representative

Signature of Firm Representative

Note: -

1. *After every B/C check schedule, DA sets must be run on rake load for minimum 01 Hrs.*
  2. *After D/M4 & E/M5 check schedule, DA Sets must be run for full load condition for minimum 04 Hrs on load bank.*
  3. *DA Sets must be run on full load for minimum 02 Hrs after every SS1/SS2/SS3 schedule.*
- { Authority:- Railway Board letter no 2024/Elect(G)/114/1/PC dated 24.09.2024 }**

**C. The following works to be carried out during M4 Check of Greaves Make Diesel Engine Model TBD41V12, CPCB-I & 12V14TAG23, CPCB-2**

(M4-check will include the following in addition to (B2 & B3) mentioned above for M3- check schedule

Engine System	Check/ Clean/ Change/ Calibrate	Description
Lube oil System	Check	Oil leaks
		Oil Pressure & Temperature gauges
		Existing Oil Filter for metal particles due to wear & tear of the internal Engine parts
		Lube Oil Level In Sump
	Change	Centrifugal Filter Paper Element
		Lube oil Spin on Filter (As required)
		Lube Oil
Fuel System	Check	Fuel Leaks
		Fuel Level In Tank
		Actuator Linkage (Link Rod Ball Joint)
	Drain	Drain sediments form Water separator
	Clean	Clean Water separator (As Required)
		Injector Nozzles & Spray If Necessary (Only perform if black smoke /Not taking load related problem persists)
		Fuel Tank
	Change	Fuel Filter Cartridge (As required)
		Vertical FTP Carbon Brush
		High Pressure fuel Pipes
		Mico Bosch Coarse fuel filter (As required)
Cooling system	Check	Coolant Leaks
		Coolant Level in Radiator
		Radiator Motor , Fan , Hub & Bearing Assembly
		Coolant Level & Temperature Gauges
		Check Belt Tension
	Clean	Radiator Fins
	Check & Top Up	Add Coolant Additive
	Check & Change	Main Water Pump if required
		Secondary Water Pump If Required
	Change	Radiator Cap & Rubber Ring
		Coolant Water & Additive
		COOLANT CIRCUIT HOSES
		FLEX MASTER COUPLINGS - O RINGS
		Water Pump Belt (As required)
Air system	Check	Air Leaks
		Air Cleaner Restriction (Vacuum Indicator)
		Turbo Charger - Axial & Radial Play (0.2 mm)
	Check & Change	Air Filter Element (Max Life of Big Filter is 2000 Hrs / 1 Year

		Whichever is earlier)
	Change	Vacuum Indicator
		HOSES IN AIR INTAKE SYSTEM
Exhaust System	Check	Exhaust Leaks
		Exhaust Bellows & Change If Necessary
		Retorqued - Turbo Turbine side Clamp
	Clean	Exhaust Silencer
Engine Related	Check	Tappet Clearance & Set if necessary
		External Fasteners Torque & do If Necessary
		Check Vibration Damper
		Alternator Greasing
	Change	Tappet Cover gasket
	Check & Record	Crank Shaft End Play (0.12 mm to 0.2 mm)
	Check & Change	Check Valve & Insert Condition, Change if necessary.(Check if any abnormalities found on valves)
		MAIN COUPLING RUBBER ELEMENT
Electric al System	Check	Battery Condition
		Specific Gravity of the Battery
		Battery Power Cable leads
Wiring & Panel	Check	Check & Correct- Panel Wiring
		Check EPS & Alarms
	Clean	Magnetic Pick Up Unit
	Check & Change	Sensors & Safety switch, Change if necessary

D. The following works to be carried out during M5 Check of Greaves Make Diesel Engine Model TBD41V12, CPCB-I & 12V14TAG23, CPCB-2

D.1- (M5-check will include the following in addition to (B2 & B3) mentioned above for M3- check schedule

Engine System	Check/ Clean/ Change/ Calibrate	Description
Lube oil System	Check	Oil leaks
		Oil Pressure & Temperature gauges
		Existing Oil Filter for metal particles due to wear & tear of the internal Engine parts
		Lube Oil Level In Sump
	Change	Centrifugal Filter Paper Element
		Lube oil Spin on Filter (As required)
		Front & Rear Oil seals
		Lube Oil
Fuel System	Check	Fuel Leaks
		Fuel Level In Tank
		Actuator Linkage (Link Rod Ball Joint)
	Drain	Drain sediments form Water separator
	Clean	Clean Water separator (As Required)
		Injector Nozzles & Spray If Necessary (Only perform if black smoke /Not taking load related problem persists)
		Fuel Tank

	Change	Fuel Filter Cartridge (As required)
		Vertical FTP Carbon Brush
		High Pressure fuel Pipes
		Mico Bosch Coarse fuel filter (As required)
	Calibrate	Calibrating the Fuel Pump
Cooling system	Check	Coolant Leaks
		Coolant Level in Radiator
		Radiator Motor , Fan , Hub & Bearing Assembly
		Coolant Level & Temperature Gauges
		Check Belt Tension
	Clean	Radiator Fins
	Check & Top Up	Add Coolant Additive
	Check & Change	Main Water Pump if required
		Secondary Water Pump If Required
	Change	Radiator Cap & Rubber Ring
		Coolant Water & Additive
		COOLANT CIRCUIT HOSES
		FLEX MASTER COUPLINGS - O RINGS
		Water Pump Belt (As required)
Air system	Check	Air Leaks
		Air Cleaner Restriction (Vacuum Indicator)
		Turbo Charger - Axial & Radial Play (0.2 mm)
	Check & Change	Air Filter Element (Max Life of Big Filter is 2000 Hrs / 1 Year Whichever is earlier)
	Clean	After cooler
	Change	Vacuum Indicator
		HOSES IN AIR INTAKE SYSTEM
Exhaust System	Check	Exhaust Leaks
		Exhaust Bellows & Change If Necessary
		Retorqued - Turbo Turbine side Clamp
	Clean	Exhaust Silencer
Engine Related	Check	Tappet Clearance & Set if necessary
		External Fasteners Torque & do If Necessary
		Check Vibration Damper
		Alternator Greasing
	Change	Exhaust Silencer
		Tappet Cover gasket
	Check & Record	Crank Shaft End Play (0.12 mm to 0.2 mm)
	Check & Change	Check Valve & Insert Condition, Change if necessary.(Check if any abnormalities found on valves)
		Check AVM & Change if necessary
		Change Liners If Required
		Change Piston Assembly If Required
		Checking all critical fasteners change if Necessary
		Check Push Rod Change if necessary
		Check Tappets & Change if necessary
		Check Rocker Lever & Change if necessary
		Check Cam Shaft & Change if necessary

		Check Connecting rod Big & Small end bearing change if required
		MAIN COUPLING RUBBER ELEMENT
Electric al System	Check	Battery Condition
		Specific Gravity of the Battery
		Battery Power Cable leads
	Check & Change	Over haul the Self Starter Motor.
Wiring & Panel	Check	Check & Correct- Panel Wiring
		Check EPS & Alarms
	Clean	Magnetic Pick Up Unit
	Check & Change	Sensors & Safety switch, Change if necessary

**D.2- Details of work to be carried out during M5- Check of Greaves Make Diesel Engine Model TBD41V12, CPCB-I & 12V14TAG23, CPCB-2**

1	<b>M5- Check Schedule:</b> M5- Check maintenance schedule of Greaves Make engines of power car at Railway's premises/ Outside of C&W/LLH (if required) shall include the following works in addition to disassembly and assembly works for the Engines and its other associated works during M5- check. The spares/ engines which require factory attention shall have to be carried out at Contractor's premises of factory by firm on his own cost.
2	Engine dismantling into components, cleaning of components, Servicing of Sub assemblies, Replacement of Liners, Pistons, Piston rings, and connecting rod bearings, Crank Shaft Main Bearings, Cam bush bearings, Lube oil pump replacement, Gear Train cleaning, inspection and assembling, replacement of front and rear oil seals, Replacement of Engine Safety control, sensors, Switches, gauges replacement, Replacement of kit spares. Assembling of engine and testing at Service centre/ at plat.
3	Crank Shaft Bend Checking, Grinding and Crack Detection.
4	Conrod small end bush replacement and bend checking
5	Turbo charger turbine, compressor case Cleaning, Replacement of Kit as required at Service Centre
6	Radiator coolant flushing, internal cleaning with cleaning agent, minor repairs
7	Cleaning of After cooler/Intercooler, Oil cooler,
8	Starter Motor Servicing
9	Replacement of Vulcan Coupling element, and Engine alternator alignment.
10	Exhaust Pipe line Insulation Cladding work, Cleaning of Silencer
11	Transportation of Sub assemblies, Radiator to work shop/Service centre and returning back, Loading, unloading, lifting, and handling charges
12	<b>Tappet Cover-</b> Check crack & physical damage. Replace, if damaged. If found ok the same & re-use. Replace breather.
13	<b>Rocker Housing Assembly-</b> Inspection/ replacement of rocker lever, bushing, shaft plug and physical damage, then replace, if damaged. If found ok, clean the same & re-use. Replace rocker lever, bushes, shaft, cap etc. as per requirement after inspection. Clean lube oil passages.
14	<b>Cylinder head of Greaves Make engine</b> – Check for crack & physical damage, Pressure Testing (with air & water Leakage testing, Crack testing, cleaning of heads with alkali or solvent. Replace, if damaged. If found ok, de-carbonize and de-scale the cylinder head. Replace all intake valves, exhaust valves, valve guides, valve seat inserts, valve collets, valve spring & retainers etc. Inspection of Cylinder Head-as per standards.
15	<b>Piston &amp; ring Sets-</b> Check for crack & physical damage. Replace pistons assembly along with piston rings, if damaged/defective.
16	<b>Cylinder Liners-</b> Check for crack & physical damage. Replace cylinder liners with liner rings, if damaged/ defective.
17	<b>Connecting rods-</b> Inspect all connecting rods for bend, Bend test should be less than 4thou with bush, twist test should be less than 10thou with bush, Piston pin bush limit 2400 thou to 2401 thou, Crank pin bore -4.2518 to 4.2522 thou, burning marks etc. Replace if bend/twist is out of limit or if connecting rod is having burning marks/dents. If found ok, clean the same and re-use. Clean lube oil passages. Replace all bushes.
18	<b>Connecting rod bearing-</b> Check for crack & physical damage. Replace connecting rod bearings with suitable size bearing depending on crank pin size, if damaged/defective.
19	<b>Main bearings-</b> Check for crack & physical damage. Replace main rod bearing with suitable size bearings depending on crank main journal size, if damaged/defective.
20	<b>Cam shaft-</b> Inspection of cam shaft for bend/damage/pitting on cam shaft, and inspect the cam shaft for bend, pitting marks and scratches. Replace, if bend out of limit of pitting marks/heavy scratches are observed. If found ok, clean the same & re-use. Polish the cam lobes, if damaged/defective.
21	<b>Cam follower-</b> Inspect cam follower assemblies. Check cm follower assembly. If found ok, re- condition the cam follower assemblies by replacing all rollers, pins, shaft, socket & locks, if damaged/defective.
22	<b>Push rod-</b> Check the push rod, if found defective, worn out, damaged then replace push rods.



23	<b>Water pump</b> – Clean & de-scale the water pump housing, Check housing for damage, shaft, bearing checking, impeller checking oil seal checking. Replace, if required. If found ok, recondition water pump by replacing shaft, impeller, bearing, seal & seat assembly, seal oil etc. If the water pump is beyond economical repair, replace it.
24	<b>Accessory Drive</b> -Re-condition the accessory drive assembly by replacing bussing, and seal. Replace the shaft, if found damaged/defective.
25	<b>Fuel pump</b> - Dismantle the fuel pump. Clean all internal fuel passages. Inspect all fuel pump components for wear/damage. Replace as per requirement. Replace all gaskets, bushes & O-rings, barrel plungers, bearings, screen filter, weight & carrier etc. Check gear pump and actuators for wearing/damage/seizure and delivery flow. Replace, if excessive wearing/damage/seizure is observed or fuel delivery flow is low. Checking RPM setting (as per fuel code), Pressure checking/setting (As per fuel code) Low idle checking/setting (As per fuel pump code), Actuator checking/setting, if required (As per fuel pump code), if found ok, re-use the gear pump after cleaning. Calibrate the fuel pump as per code. If it's beyond economical repair, replace it.
26	<b>Injectors of Greaves Make engine</b> - Dismantle all the injectors. Clean the injectors. Inspect injector body for physical damage. Replace, if required. Check barrel and plunger assembly for wiring & clearance, checking through testing. Replace, if excessive clearness is observed. Also replace barrel plunger assembly, if excessive wear on plunger tip is observed. Since barrel & plunger are matched, they must be replaced together in pair. Replace all injector cups, Screen filters, check ball, injectors O rings & Orifice, STC Tapper kit etc. Calibrate the injectors as per injector Part No. If any injector is observed beyond economical repair, replace the same.
27	<b>Lube oil Pump</b> - Clean the lube oil pump. Check housing for wearing/damage, idler, drive gear and shaft, pressure regulator. Recondition lube oil pump housing by replacing gears, Shaft, pressure regulator & all gaskets, if Lube oil pump beyond economical repair replace the same.
28	<b>Lube oil cooler</b> - Dismantle lube oil cooler assembly, Check cooler housing for damage. Replace lube oil cooler housing if required. If found ok, clean/de-scale the housing and element. Replace elements if required & gaskets.
29	<b>Turbo charger</b> – Dismantle the turbo charger. Check bearing housing, exhaust housing, intake housing face checking, & wheel & shaft checking/worn out checking, fuel checking, impeller for excessive wear/damage war page, Centre housing groove checking, Diffuser plate groove checking. Replace if required. Recondition the turbo charger by replacing turbo repair kit, Slinger, Thrust washer. Replace turbo charger, if found beyond economical repair.
30	<b>Air intake manifold</b> - Clean the manifold. Inspect the physical damage. Replace, if damage. Replace the same.
31	<b>Exhaust manifold</b> - De-carbonize the exhaust manifold. Replace, if excessive wearing/warping observed.
32	<b>Gaskets, o-rings, rubber components, Inspection of worn out components&amp; hoses</b> - Replace all gaskets o-rings, rubber parts & hoses with new one.
33	<b>Hydraulic/Electronics Governor</b> - Cleaning of components, Inspection of worn out components and replacement if required, Checking of Hydraulic/Electronics Governor and its reconditioning replacing governor kit. Testing of governor manually by oil feeding and testing the pressure, replace it with new, if the same is found defective, or beyond economical repair than replace it.
34	<b>Thermo stat</b> –Replace the same during Schedule.
35	<b>After cooler</b> -Dismantle after cooler assembly, check after cooler cover & housing for damage. Replace the same if require. Checked after cooler element if found ok, clean/de-scale the element and replace elements if required & gaskets with new one.
36	<b>Fuel Manifold</b> - If found damaged then replace the same.
37	<b>Fly wheel rings</b> - If found damaged then replace the same.
38	<b>Lube oil Sump</b> – Clean the same & replace if required.
39	<b>Main body of Lube Oil Filter</b> - Replace all related gaskets o rings and filters with new one.
40	<b>Tubes of Lube oil and Fuel</b> –Clean the same & replace if found damage.
41	<b>Lube Oil sump of Governor</b> - Clean the same & replace, if required.
42	Check main bearing caps for distortions, replace caps, if found beyond repairs. Carry out line boring.
43	Any other components/assemblies not mentioned above may also be required to be replaced on condition basis.
44	<b>Crank shaft</b> - Inspection of crank shaft bend/crack and strength, machining of crank shaft if required, Main journal out limit 3.9975, Crank pin width 2.751-2.748, than Inspect the crank shaft for seizure, cranks, bend, hardness etc. Replace the crank shaft, if it is beyond salvageable condition due to seizure of bearing, hardness is low even after grinding, cracks, bend is beyond limit etc. If found ok, clean the crank pin shaft & lube oil passage inside the cranks shafts. Check main journal size and crank pin size. Grind it to next under size depending on hardness and wearing on main journal and crank pin. Check & correct dynamic balancing
45	<b>Vibration damper</b> - Inspection /replacement of vibration damper if required than replacement.
46	<b>Rear train</b> - Check all gears & drive for wearing/damage. Replace, if found worn out excessively/damaged. Gear case cover & housing- clean gear case cover, housing. Replace, if found damaged
47	<b>Cylinder block</b> - Checking of cylinder block and caps- Main bearing bore dia 5.8460-5.8450, worn out limit 5.8465, and clean & check for physically damage. Replace, if found damaged beyond salvageable condition. If cylinder block is ok, de-carbonize & de-scale it. Clean all lube oil & coolant passage inside the block. Replace all cam shaft bushes.
48	<b>Fuel tank</b> - check and ensure proper condition of all mounting nuts/bolts and mounting brackets/clamps etc. Drain the

	fuel and clean the tank internally as well as externally including the pipe line and Sediment Junction Box etc. Check condition of Diesel filling cap and fuel guage/diesel leakage and attend, if required. Replace wheel valves of fuel pipe line and check NRV valve, replace if damaged with new one. Ensure Opening and servicing of fuel gauges and replacement of rubber items. Ensure replacement of Fuel gauges.
49	Assemble the complete engine using re-conditioned sub-assemblies, new gasket, O-rings etc. All spare parts and fitment of repaired accessories and components shall be as per Greaves procedure.
50	Joint inspection carried out will be only for conditioned based items. Mandatory items will be supplied compulsorily.
51	All released material shall be returned to the consignee duly accounted.
52	Testing of the engine as per Greaves recommended testing parameters.
53	The engines shall be properly painted after carrying out M5- CHECK OR Overhauling as per OEM standard colour scheme of new engines.
54	Transportation charges of carrying the Greaves diesel engines and spares required from C&W/LLH to firm's premises and back after component of M5 -Check schedule will have to bear by the firm.
<p><b>**Replacement of Liners, Pistons, rings, and connecting rod bearings- incase it is decided under conditional base requirement</b></p> <p><b>Note:- During M5- check schedule where engine is required to be taken to</b> firm's premises, a joint note will be prepared for assessment of work involved between firm's representative and railway representative after dismantling the engine. Assessment note will be the basis for payment. The loading/ unloading of engines at the premises of the contractor or at Carriage &amp; Wagon Workshop, Liluah shall be arranged by firm.</p>	
<b>E. Servicing, Repair &amp; Rewinding of 500kVA, 750V Brushless alternators of High capacity Power cars, Make: Crompton Greaves, CGL.</b>	
<b>Detailed Scope of work for item no 1 of Schedule G (Ensure proper servicing and overhauling by disassembly of coupling, end covers, rotor, stator and excitation system etc. and through cleaning of all parts including various windings by blower and thinner and application of anti-track varnish on exposed portion of windings. Ensure proper cleaning and greasing of bearing and their replacement, if required. Replace rubber bushes of alternator and diesel engine coupling. Ensure alignment of alternator and diesel engine coupling with dial gauge during fitment after servicing and overhauling) ( it is must during SS 3)</b>	
1	<p>Servicing of 500KVA, 750Volt, 50 Hz, 3-Phase brushless alternators of high capacity power cars as per scope of work.</p> <p>i. Servicing of 500KVA, 750Volt, 50 Hz,3-Phase brushless alternators of high capacity power cars as per scope of work.</p> <p>ii. Replacement charge of bearings of both (DE &amp; NDE) end.</p>
2	<p>Rewinding and minor repairs of the following items as per their condition of 500KVA, 750Volt, 50 Hz, 3-phase Alternators of high capacity power cars, as per scope of work. (Including supply of material and retention of released materials).</p> <p>i. Rewinding of main rotor winding of 500KVA, 750 Volt, 50 Hz.3Ph. brushless alternators.</p> <p>ii. Rewinding of main stator winding of 500KVA, 750 Volt, 50 Hz.3Ph, brushless alternators.</p> <p>iii. Rewinding of exciter rotor of 500KVA, 750 Volt, 50 Hz.3Ph, brushless alternators.</p> <p>iv. Rewinding of exciter stator of 500KVA, 750 Volt, 50 Hz.3Ph, brushless alternators.</p> <p>v. Rewinding of excitation transformer of 500KVA, 750 Volt, 50 Hz.3Ph, brushless alternators.</p> <p>vi. Core re-staggering of main stator of 500KVA, 750 Volt, 50 Hz.3Ph, brushless alternators.</p>
3	<p>Miscellaneous work including manufacturing, supply, installation and commissioning (including supply of material).</p> <p>i. Casted bearing hub (End shield plate) of both (DE &amp; NDE) ends, as per requirement in respective make alternators.</p> <p>ii. Fabricated mild steel side cover (20 SWG) NDE side in 03 Nos. as per requirement in respective make alternators.</p> <p>iii. Fabricated air exhaust (Air Duct) mild steel net side cover (20 SWG) of Alternator in both (Front &amp; Back) direction in 02 Nos. as per requirement in respective make alternators.</p> <p>iv. Supply &amp; fixing of stainless steel Key of shaft end, as per requirement in respective make alternators.</p>
3.1	<p>Detailed Scope of work for servicing of alternators.</p> <p>Servicing, repair &amp; rewinding of 500KVA, 750 Volt, 50 Hz.3Ph brushless alternators of high capacity power cars, would involve the following activities:</p>
3.2	<p>Pre Testing</p> <p>a. The alternator should be visually inspected for assessment of overall condition and defects of the alternator.</p> <p>b. Checking of condition of Bearings to see the production of abnormal noises etc and the bearings shall be replaced if some defects / abnormality are noticed during observation. The bearings shall be supplied by the firm with OEM's authorized dealers and RDSO approved make-SKF/FAG only with warranty certificate, of the respective OEM of bearings.</p> <p>c. Measurement of IR value with 1000V DC megger. While checking the insulation resistance, it must be ensured that all connections to the windings including AVR and rotating rectifier assembly are removed.</p> <p>d. High voltage test - AC potential of 1500V rms at 50 Hz shall be applied between all external terminals of the alternator shorted together and the frame, for period of one minute. The test shall be commenced at a voltage of less than one third of the test voltages and shall be increased gradually to the full test voltage. The leakage current shall not exceed 30 mA for the above test.</p> <p>e. Surge Voltage test at 3KV shall be carried out to check the condition of the different windings.</p>

	<p>f. If any of the winding is found burnt/ defective it shall be rewound as per clause 3.2 of scope of work. All other works shall be done as per clause 3.1 of scope of work for servicing of alternator.</p>
<b>3.3</b>	<p>Dismantling:</p> <ol style="list-style-type: none"> <li>Dismantling of coupling with hydraulic puller and its fitment after the completion of servicing. No gas heating shall be used.</li> <li>Dismantling/disassembly of alternator end covers rotor, stator and exciter etc. and their fitment/assembly after servicing with suitable tools to avoid any damage during handling.</li> </ol>
<b>3.4</b>	<p>Cleaning:</p> <ol style="list-style-type: none"> <li>Thorough external cleaning of the alternator for removal of mud/dust/ dirt/ grease/ oil etc. before disassembly.</li> <li>Thorough cleaning of rotor / stator/ exciter, etc after disassembly with compressed air.</li> <li>Thorough cleaning of rotor/stator/excitation system etc with the help of non-reactive/corrosive chemical like white spirit/ thinner 205 of Dr. Beck so that there are no traces of dust, carbon, loose fibers, grease, oil, metal particles etc.</li> <li>Degreasing and cleaning of bearings and cleaning of end shields.</li> </ol>
<b>3.5</b>	<p>Moisture removal and application of varnish coat:</p> <ol style="list-style-type: none"> <li>After thorough cleaning of various parts Heat treatment should be done in an air circulating oven at 120 deg centigrade for 4 hrs. to dry out moisture</li> <li>Ensure that there are no traces of Carbon dust on any parts of the alternator and clean it again suitably, if required</li> <li>Apply H Class red Beck tol protective varnish (anti tracking) by spray on exposed portion of various windings and cure them suitably as per recommendation of varnish manufacturer.</li> </ol> <p>Suitable measures shall be taken to protect the parts where the application of varnish is not desired.</p>
<b>3.6</b>	<p>Repairs and Assembly</p> <ol style="list-style-type: none"> <li>The condition of all the parts including the windings, excitation system, bearings etc to be checked and necessary attention for its servicing/checking/testing/ repair etc to be done as per requirement and scope of work to ensure their proper working</li> <li>The couplings, key ways, the keys and the screw threads shall be checked for their good condition</li> <li>Dynamic balancing of the rotor and alignment of grease passages to be done before assembly. The dynamic balancing of rotor shall be checked individually on a balancing machine. The residual unbalance shall not exceed 5.0 gm.cm/kg in any case</li> <li>Proper attention for servicing and repair of alternator parts is ensured and the assembly of alternator be done for its final testing. The alternator shall be thoroughly vacuum cleaned just before assembly</li> <li>Painting of alternators after assembly with smoke grey synthetic enamel paint of Asian/ Berger/ Tractor make</li> <li>Minor repairs including of top &amp; side covers, providing nut bolts &amp; coupling Bolt etc., as per requirement shall be in the scope of work of the tenderer without any extra payment.</li> </ol>
<b>3.7</b>	<p>Servicing of bearings:</p> <ol style="list-style-type: none"> <li>The condition of the bearing be checked and replaced, if required, as per manufacturer standard guidelines. The bearings shall be supplied for replacement by the contractor (with RDSO approved bearings make-SKF/FAG/ their authorized dealer only) along with warranty certificate of the respective OEMs</li> <li>If the condition of the bearing is found satisfactory, it should be properly cleaned and lubricated with lithium based grease confirming to grade 3/ AP 3 (Castrol)/ Mobilube No. 3 ( Indian Oil) in right quantity as per manufacturer's guidelines for the same</li> <li>Grease of different makes and grades should not be mixed</li> <li>The released defective bearings shall be returned to the consignee (Railway)</li> </ol>
<b>3.8</b>	<p>Final Testing of Alternator:</p> <p>After completion of servicing, assembly and rewinding, if required, the following routine test shall be conducted as per guidelines stipulated in RDSO spec. no. RDSO/ PE/ SPEC-D/ AC/ 0084-2008 (Rev -1)</p> <ol style="list-style-type: none"> <li>Measurement of winding resistance</li> <li>Phase sequence test</li> <li>Voltage regulation test</li> <li>Measurement of short circuit characteristics (In case of rewinding)</li> <li>Insulation resistance test with 1000V megger. It should not be less than 10 Mega Ohm</li> <li>High voltage (Dielectric Test) test –</li> </ol> <p>During high voltage test AC potential of 1500V rms at 50 Hz shall be applied between all external terminals of the alternator shorted together and the frame for period of one minute. The test shall be commenced at a voltage of less than one third the test voltages and shall be increased gradually to the full test voltage. The leakage current shall not exceed 30 mA for the above test and Surge Voltage test shall be carried out to check the condition of the different windings. While checking the insulation resistance it must be ensured that all connections to the windings including AVR and rotating rectifier assembly are removed.</p>
<b>3.9</b>	<p>The detailed scope of work and technical specification/requirements to be met for rewinding of various items as per</p>

scope of works of the alternators shall be as under:		
S. No.	Item	Description
1	Class of insulation	H
2	Insulation	All insulations like slot liner, slot wedge, inner slot insulation etc., should be of calendared Nomex of H thermal class
3	Winding wire	Hard drawn high conductivity copper wire with dual coated super enameled and insulation material to be used shall be of Class 'H' The size of winding wire used shall be the same as that of the respective released winding wires for stator, rotor, exciter etc.
4	Winding overhang	To be taped with 50% overlap using adhesive Kapton polyamide film
5	Impregnation	All wound components shall be impregnated by Vacuum Pressure Process using Dr Beck FT 2005 varnish as per scope of work
6	Overcoat	Impregnated winding shall be over coated with Dr. Beck FT 93 or better to avoid tracking & moisture absorption.
7	Winding leads	Winding leads shall be covered Silicon Elastomer extruded FG Sleeving.
8	Type winding of stat or	Double layer, short chorded winding with suitable chording to limit all individual harmonics including 11th harmonic, between any line and neutral measured on no load and full load at 0.8 pf and total harmonic distortion less than 5%.
9	Connection	Series parallel
10	Parallel path	There shall be two parallel path for each phase and one parallel path shall be taken to neutral point through primary winding of the compounding transformer.
11	Auxiliary Winding	3 phases Auxiliary Winding, electrically isolated from the main winding shall be provided in the main stator, to provide excitation current sufficient enough to regulate the line voltage between 750 +/-2.5% at all loads. Power supply to AVR shall also be taken from auxiliary winding to avoid harmonic interference
12	Type of excitation	Compound-using 3-phase compounding Transformer and AVR
<b>3.9.1</b>	Rewinding of main rotor windings shall include the following: - <ol style="list-style-type: none"> <li>Stripping of main rotor windings taking due care so that rotor laminations are not damaged</li> <li>Cleaning of complete rotor assembly so that no traces of old insulation and windings etc. are left behind</li> <li>Complete new rewinding of the rotor assembly with strip conductor of the same size as that of removed conductor having enameled glass covered insulation confirming to IS: 13730 part 13 or better with class 200 of insulation "H". Coil insulation, head insulation, aeration wedge etc. used in main rotor shall be of Class H and 4KV (min) breakdown voltage</li> <li>The dynamic balancing of rotor shall be checked individually on a balancing machine after its rewinding. The residual unbalance shall not exceed 5.0 gm.cm/kg in</li> </ol>	
<b>3.9.2</b>	Rewinding of the exciter rotor shall include the following <ol style="list-style-type: none"> <li>Stripping of exciter rotor windings taking due care so that exciter rotor laminations are not damaged</li> <li>Cleaning of complete exciter rotor so that no traces of old insulation and windings are left over</li> <li>Complete new rewinding of the exciter rotor with 'H' class insulated winding wires of suitable rating as per the specifications given above and having same size as that of released winding wire</li> <li>The slot liners and slot wedges shall be of Class H and 4 kV (min) breakdown voltage.</li> </ol>	
<b>3.9.3</b>	Rewinding of the exciter stator shall include the following: <ol style="list-style-type: none"> <li>Stripping of exciter stator windings taking due care so that exciter stator laminations are not damaged</li> <li>Cleaning of complete exciter stator so that no traces of old insulation and windings are left over</li> <li>Complete new rewinding of the stator with 'H' class insulated winding wires of suitable rating as per the specifications given above and having same size as that of released winding wire</li> <li>The slot liners and slot wedges shall be of Class H and 4 KV (min) breakdown voltage</li> </ol>	
<b>3.9.4</b>	Rewinding of excitation transformer shall include the following <ol style="list-style-type: none"> <li>Stripping of windings taking due care so that the laminations are not damaged.</li> <li>Cleaning of complete core etc. so that no traces of old insulation and windings are left behind</li> <li>Complete new rewinding of excitation transformer with 'H' class insulated winding wires of suitable rating as per the specifications given above and having same size as that of released winding wire.</li> </ol>	
<b>3.9.5</b>	Vacuum Pressure Impregnation Process (VPI): All the windings used in the alternator during rewinding shall be impregnated through vacuum pressure impregnation process (VPI). The winding shall be subjected to pressure impregnation as per recommended procedure of varnish manufacturer. Varnish used shall be of M/s Dr. Beck make specified above. Firm shall use calibrated pressure and temperature gauges fitted with VPI plant	
<b>3.9.6</b>	The tenderer should clearly state availability of infrastructure facilities including VPI for the subject work with full testing facilities for all the specified tests and submit the details of the same for further verification of the availability of the requisite facilities	

<b>3.9.7</b>	Alternators of 500 KVA Crompton Greaves, CGL.make will be handed over to contractor at Carriage & Wagon Workshop, Liluah. Contractor has to service, repair and make them fit for working in all respect. Transportation of the alternators from railway premises to firm and back will be the responsibility of contractor. The prices quoted shall be inclusive of all taxes, levies, octroi etc and no separate payment for transport and handling charges is to be made to contractor.
<b>3.9.8</b>	The alternator shall have stator insulation of class "H", rotor insulation of Class "H" and exciter insulation of class H , slot liners and slot wedges used in the main stator, exciter rotor and exciter field shall be of class 'H' and 4 KVA(min) breakdown voltage. Coil insulation, head insulation, aeration wedge etc. used in main rotor shall be of class 'H' and 4 KVA (min) breakdown voltage. All sleeves shall be of Class 'H' insulation. All winding wires used in the main stator, exciter and main rotor shall be insulated with 'H' class insulation and all the wood components shall be impregnated with 'H' class varnish by vacuum pressure impregnation process. Temperature rise limit for Class 'H' insulation shall not be more than 115deg C above the ambient of 55deg C
<b>3.9.9</b>	The size of the rewinding wire shall be same as that of released winding wires of main stator, main rotor and exciter etc
<b>3.9.10</b>	All the cable termination work should be done by the contractor with proper terminating sockets of crimping type
<b>3.9.11</b>	Contractor shall retain the copper scrap released from alternator during its rewinding and cost of this shall be taken into account while quoting the rates
<b>3.9.12</b>	All spare parts, wire and insulation to be used should be only from OEMs. The firm should be able to produce the performa invoice of components used whenever demanded by the Railways
<b>3.9.13</b>	Technical details of alternator shall be as per ICF spec. No. ICF/Elec/880 and RDSO specifications RDSO/PE/SPEC-D/AC/0084-2008 (Rev-0). Contractor will follow the scheme of winding and insulation and other repairs/overhauling as indicated in above specification and as per schemes OEM's followed by Crompton Greaves, CGL.
<b>3.9.14</b>	Alternator will have to be tested in presence of Railway representative/s before issuing inspection certificate. Firm will test the alternator and hand over alternator to Railway in working order, suitably packed for transportation. Loading /handling of alternator at workplace of the contractor will be at the cost of contractor; however, Railways shall provide fork lifter etc to load/unload the alternators in the contractor's truck at Railway premises
<b>3.9.15</b>	The tests shall conform to relevant IS/ Railway standards wherever applicable. These tests shall be conducted jointly in presence of Railways representative at contractor's premises. A certificate shall be submitted to that effect by the contractor on prescribed Performa jointly finalized before starting of work
<b>3.9.16</b>	Contractor shall use genuine material for repairs and shall use the specialized skilled staff/tools so that the repaired alternators give good life thereafter as per industrial norms
<b>3.9.17</b>	Casted bearing hub (End shield plate) of both (DE & NDE) end shall be provided as per requirement in respective make alternators
<b>3.9.18</b>	Fabricated mild steel side Cover (20 SWG) NDE side in 03 Nos, shall be provided as per requirement in respective make alternators
<b>3.9.19</b>	Side cover shall be painted with primer and authentic paint
<b>3.9.20</b>	Fabricated air exhaust (Air Duct) mild steel net side cover (20 SWG) of Alternator in both (Front & Back) direction in 02 Nos. shall be provided as per requirement in respective make alternators
<b>3.9.21</b>	Fabricated air exhaust shall be painted with primer and authentic paint
<b>3.9.22</b>	Supply & fixing of stainless steel Key of shaft end, as per requirement in respective make alternators
<b>3.9.23</b>	Except rewinding material such as released copper, released insulations, released tapes ( Cotton, PVC, insulation ) etc. released during rewinding, other released material such as bearings, spare parts of control units (diodes, fuses, over voltage unit kit, contactors, control harness wiring, terminals, resistance, M.S. items, rubber items, PVC items, control voltage transformers, CT, cables, thimbles, and diode plates, fabricated work, casted work, defective released items and spare parts etc. supplied by Railway shall be returned to the consignee(Railways) duly accounted
<b>3.9.24</b>	Required material for rewinding material as copper, insulations, tapes (Cotton, PVC, insulation), Paint, grease, bearings, M.S. sheet for fabricating work, Air exhaust, casted iron for casting work miscellaneous work such as Nut & Bolt, washer, groomet cable gland, PVC sleeve, flexible PVC pipe, c, welding work, cutting work, Grinding work, Fitting work shall be supplied by firm and included in the quoted costs
<b>3.9.25</b>	Spare parts of control units ( diodes, fuses, over voltage unit kit, contactors, control harness wiring, terminals, resistance, control voltage transformers, CT, cables, thimbles, and diode plates, RRA unit, AVR, Control unit, Over voltage control unit, Potential transformer, end plate etc shall be supplied by consignee (Railways) as per requirement
<b>3.9.26</b>	During handling, repairing, carrying, dispatching or maintaining if any materials have been damaged then firm will be responsible of the loss
<b>3.9.27</b>	Transportation facilities for servicing of Alternators shall be provided by contractor from Railway premises to repairing place and back for delivery and collection of unattended and attended equipment respectively. The loading/ unloading of alternators at the premises of the contractor or at Carriage & Wagon Workshop, Liluah shall be arranged by firm.
<b>3.9.28</b>	Inspection: The following stage inspections shall carried out by Dy. CEE(W)/LLH or his authorized representative. a. At the time of pre testing of alternators to check the state of windings etc. for joint assessment of the condition of

	<p>the alternator and deciding the requirements of rewinding</p> <p>b. In case of rewinding of any alternators, second stage inspection shall be done after complete removal of the burnt winding and insulation etc. The requirement of core re- staggering shall also be assessed and decided during this stage inspection as per requirement</p> <p>c. After completion of periodic servicing, repair &amp; rewinding of alternators a joint inspection shall be carried out at the time of final testing</p>
<b>3.10</b>	In the event of non-provision of stipulated work, coaches, site or any other item(s) shown in the scope of work/ schedule of rates and quantities to the contractor, Railways shall not be held responsible in any way for any losses incurred by the contractor, for any of the above reasons, on account of non-engagement of his men, material or machinery
<b>3.11</b>	<p>Special Conditions</p> <ol style="list-style-type: none"> <li>Servicing, repair &amp; rewinding of 500KVA, 750 Volt, 50 Hz.3Ph brushless alternators of high capacity power cars.</li> <li>The details of the works mentioned in Scope of Work are indicative and the overall responsibility to carry out the works as per manufacturer's technical specification and site requirement shall lie with the contractor</li> <li>The transportation facility for delivery and collection of unattended and attended equipment's respectively shall be provided by the firm</li> <li>Pre inspection of the alternators shall be conducted within 03 days of collection of alternators from C&amp;W/Workshop/LLH.</li> <li>The alternators with major work shall be completed within 20 days. Otherwise penalty will be imposed as per penalty clause.</li> <li>All the work shall be carried out at firm premises and in good workmanship manner.</li> <li>After completion of the work a joint inspection shall be carried with the firm's representative &amp; representative of Dy. CEE(W)/LLH.</li> <li>All the released materials if any shall have to be delivered with SSE/PC/LLH duly accounted.</li> <li>In case of any dispute the decision of Dy. CEE (W)/LLH will be final, The Railway &amp; the contractor have to follow the decision.</li> <li>Warranty period of this repair work shall be One year after fitment of the alternators on the power car.</li> <li>The contractor shall attend the defect on alternators as and when intimated without any delay The contractor shall intimate the day-to-day progress to Dy. CEE (W)/LLH or to his authorized representative</li> <li>During the work, if there is any damage and lost persist in the item, the affected items/portion shall be repaired/ replaced by the firm free of cost.</li> <li>Any other petty work not mentioned specifically but essential for completeness of the work shall be done by the contractor as per requirement without any extra charges</li> <li>The contractor's representative visiting the C&amp;W/Workshop/LLH shall wear their uniforms and proper safety gears</li> </ol>
<b>4.</b>	<p>Scope of work for Alternator</p> <ol style="list-style-type: none"> <li>Check and ensure proper condition and tightness of mounting bolts. Take corrective action if required</li> <li>Check and ensure proper tightness of all connections of alternator outgoing &amp; control cable. Take Corrective action if required</li> <li>Check and ensure proper earthing connection. Take corrective action if required.</li> <li>Check and ensure proper condition of coupling nut bolts and their tightness. Attend them if required.</li> <li>Check alternator for any unusual sound and attend same.</li> <li>Check &amp; ensure generation of proper voltage (750V , 50 HZ)</li> <li>Ensure proper cleaning and tightness of connection of excitation system. Attend them if required. Use thermal imager equipment to check temperature of cable nuts, connecting nut bolts etc. on load</li> <li>Ensure proper greasing of bearing as per recommendation of OEMs.</li> <li>Check IR value of Alternator winding as per Table/ Annexure 15.1 of chapter 15 of LHB Maintenance Manual Volume II – System Documentation – July- 2022</li> </ol>
<b>F. DG set panel along with accessories</b>	
<b>1</b>	Check and ensure proper condition of mounting bolts /anti vibration pads etc.
<b>2</b>	Check and ensure proper condition of electrical wires/cables /connections and attend/ tighten/ replace them, if required.
<b>3</b>	Check and ensure proper cleaning of Power Panel, Control Panel by Vacuum Pump and dry compressed air at a pressure 1.75 kg/cm2 (25psi) with help of portable compressor
<b>4</b>	Check and ensure proper working of indication lamps, Push Buttons, Switches and Fuses and replace them, if required.
<b>5</b>	Check and ensure proper operation of ACB and its associated contractors. Attend/Replace, if required
<b>6</b>	Check and ensure proper working of instruments provided on instrument panel
<b>7</b>	Check and ensure proper working of DC control & Panel Wiring System and attend, if required
<b>8</b>	Check and ensure proper working of all measuring meters- Ammeter, Volt meter, kW meter, frequency meter, R.P.M. meter, multifunction and replace, if required
<b>9</b>	Checking of the working of all Contactors, such as contactors (K4, K5, K6 & K7), Feeder Contactors, bus coupler

	contactors, HOG contactors.
10	Ensure Cleaning and tightness of connections of Power Panel/Control Panel/ other motor terminals (starters of radiator motors, starters of roof exhaust motors). Use thermal imager equipment to check temperature of cable lugs, connecting nut bolt, contactors etc. on load
11	Ensure tightness of bus bars
12	Check contactors bus bars, MCBs, Air Circuit Breakers and all types of rotary switches etc. and replace if defective. Cleaning of panel and its equipment by blower. Replace contacts of contactors, if required. Ensure thermo imaging of power panel on load.
13	Check milli volt drop across ACB terminals
14	Check the operation of RA Mode in working power car/ non working power car mode
15	Check the availability of proper fuses ( no wired fuse to be allowed)
<b>G. Self starter Motor</b>	
1	Check and ensure proper condition of mounting of starter motor, isolation switch bracket/enclosure
2	Ensure its proper working, replace starter motor, relay, switch gears, cables, terminals etc. if found defective
3	Check & ensure proper cleaning by blower/vacuum pump and replace the carbon brush, if required.
4	Check & ensure proper condition of electrical wires and attend them as and when required on condition basis.
5	Check IR value of motor as per table/Annexure 15.1 of chapter 15 of <b>LHB Maintenance Manual Volume II – System Documentation – July- 2022</b>
6	Ensure proper Servicing and Overhauling by disassembly of Coupling, End covers, Rotor, Stator etc. and thorough cleaning of all parts including various windings by blower and thinner and application of anti- track varnish on exposed portion of windings. Ensuring proper cleaning of bearings/ bush and their greasing and replacement, if required. Ensure Replacement of Carbon Brushes. (Replacement of bearing/ bush is must during SS3)
<b>H. Radiator, Radiator pipeline and Radiator Chamber :</b>	
1	Check and ensure proper condition of mounting bolts and anti-vibration pads etc.
2	Check and ensure proper cleaning of radiators. If found clogging, clean by water jet machine 4.9-5.6 kg/cm2 (70-80 psi) with OGR and ID-27 or any other suitable cleaning agent.
3	Check Radiator water & coolant level and top up with mixture of coolant & distilled water, if required
4	Check filing cap, clamps, and coolant leakage in radiator pipelines, attend if required.
5	Check the condition of radiator chamber, doors, hinges, latches, ceiling and intactness of baffles etc. and attend the same to ensure proper condition.
6	Strip and ensure thorough cleaning by water jet machine 4.9-5.6 kg/cm2 (70-80 psi) with OGR and ID- 27 or any other suitable cleaning agent. Remove internal scaling with the help of suitable descaling agent.
7	Replacement of „O“ Ring of radiator pipe line
8	Fill up the radiator with distilled water & coolant ( or pre mixed coolant) as per OEM recommendations
<b>I. Radiator Motor and its Starter</b>	
1	Check and ensure proper condition of mounting bolts
2	Ensure cleaning and checking of connection tightness of starter of radiator motor. Check the condition of gasket of the panel covers. Replace defective contactor/overload relay/MPCB, gasket in the starter panel if required.
3	Check & ensure proper protection setting of relays and MPCB of starter panel
4.	Check the condition of radiator motor, radiator fan blades, fan bots and its tightness, attend defect if any, replace motor if found defective.
5	Ensure greasing of radiator motor as per requirement
6	Check IR value of radiator motor and its cable as per table/Annexure 15.1 of chapter 15 of <b>LHB Maintenance Manual Volume II – System Documentation – July- 2022</b>
7	Use thermal imager equipment to check temperature of motor terminals and starter panel
8	Strip and overhaul radiator motor ensuring proper condition/working of its bearings, replace if required(replacement of bearing is must during SS3)
9.	Strip overhaul starter panel of radiator motor
10	Check and ensure proper condition of electrical cables/wires and attend them as and when required on condition basis
<b>J. Roof Exhaust Fan, Exhaust pipeline &amp; motor</b>	
1	Check and ensure proper condition of mounting bolts
2	Check and ensure proper condition of electrical cables/wires and attend them as and when required on condition basis
3	Ensure working Cleaning and checking of connection tightness of starters of Roof Exhaust motors. Check the condition of gasket of the panel covers. Replace defective contactor/overload relay/MPCB, gasket in starter panel if required
4	Ensure Checking of condition of Roof Exhaust Motor, connection and its tightness. Replace motor if found defective.
5.	Check IR value of Roof exhaust Motor as per table/Annexure 15.1 of chapter 15 of <b>LHB Maintenance Manual Volume II – System Documentation – July- 2022</b>

6	Use thermal imager equipment to check temperature of cable lugs, connecting nut bolts etc. on load to find out loose connection.
7	Strip and overhaul Roof Exhaust motor including ensuring proper condition/ working of its bearings. Replace bearings of motors and self-starters if required.( replacement of bearing is must during SS 3)
8	Strip and overhaul starters panel of Roof Exhaust motors.
<b>K. Fuel Tank</b>	
1	Check and ensure proper condition of all mounting nuts/bolts and mounting brackets/clamps etc.
2	Ensure proper cleaning of fuel tank externally
3	Drain the fuel and clean the tank internally as well as externally including the pipe line and Sediment junction Box etc.
4	Check Condition of diesel filling cap and fuel Gauge/diesel leakage and attend, if required.
5	Replace wheel/ ball valve of fuel pipe line if required.
6	Ensure Opening and servicing of fuel gauges and replacement of rubber items
7	Ensure replacement of Fuel gauges and replacement of rubber items.
8	Calibration and working of fuel flow meter
9	NRV cleaning
10	NRV replacement if required
11	Connecting Pipe line between two tanks must be replaced.
<b>L. Battery Charger</b>	
1	Check and ensure proper condition of mounting bolts and cover.
2	Check and ensure proper tightness of connections.
3	Ensure proper cleaning by dry compressed air at a pressure 1.75 kg/cm <sup>2</sup> (25psi) with help of portable compressor
4	Check and ensure proper condition of electrical wires and attend them as and when required.
5	Check operation of battery change over switch and replace with new one if required.(applicable for power car with single starter battery charger)
6	Check and ensure proper operation of battery charger.
7	Ensure proper Servicing and Overhauling by opening the covers and thorough cleaning of all parts by blower and thinner. Replace the Voltmeter and Ampere meter with new calibrated meters, if required.
<b>M. Cables and Trenches/Tray</b>	
1	Check and ensure proper condition/securing of fixing bolts and covers of all trenches/Trays.
2	Check and ensure proper cleaning of all trenches/trays by Brush, jute/cotton waste etc.
3	Check and ensure proper condition of cables and attend/replace them, if required
4	Ensure proper securing of cables against any rubbing, sharp edges
5	Ensure proper double earthing with proper cable size for Alternator, Radiator Motor & Ventilation Fan Motor.
<b>N. Side body filter</b>	
1	Check and ensure proper condition of mounting and fitment of side body filters.
2	Check and attend packing provided along the mounting frame of side body filters to avoid inrush of unfiltered air in power car. If frame is damaged or corroded, fabrication work should be done by the firm.
3	Remove and ensure proper cleaning of side body filters by dry compressed air at a pressure 1.75 Kg/Sq. Cm (25 psi) with help of portable compressor
4	Ensure proper cleaning of side walls and ceiling of engine room.
5	Replace old side body filter (must change item) with new during D/E check & (on condition basis during C- check).
<b>Load test of DA Set: After M3/M4/M5 check DA set must be tested on load as prescribed by OEMs.</b>	
<b>Note: A joint note is required to be prepared between firm's representative and railway representative and approval of competent authority will be taken before attending any work mentioned in various schedule other than M3/M4/M5 check. All the items mentioned as condition based for various schedule should be utilized only after preparing joint note between railway representative and contractor representative stating that following condition based items required to be changed with approval of concerned officer and same will be the basis for payment for condition based items for various schedule</b>	