Bharat Heavy Electricals Limited
Ramachandrapuram : : Hyderabad – 502032
M&S – DIVISION
SCOPE OF WORK (ANNEXURE-I)

Tender No.: M&S/P&S/2021/36, Dt.: 06.09.2021
Name of Work: Annual Maintenance Contract for 111 machine tools / Equipment / Lighting (except shop floor roof lighting) in 207-Tool Room & 210-Spares Manufacturing Centre and electrical maintenance of 07-Annexe and Central Gauging Centre buildings, New pipe and plate yard, crèche near J-Gate.

DESCRIPTION OF WORK:

A.	**PREVENTIVE MAINTENANCE :**
A.1	**METAL CUTTING MACHINES :**
1	To externally inspect (without dis-assembly) the whole machine and each of its units, for making the defect list about the condition and the operation of the machine. To regulate, check durability and tightness of fixed / rigid joints i.e. bed foundation, bed sections between themselves, pulleys, flywheels, sprockets, gears, friction discs etc.
2	To open out the covers of the units for inspection and check the condition of mechanisms.
3	To regulate clearances between lead screws and their mating units of the slides, saddles, traverses, carriages etc.
4	To regulate spindle bearings
5	To check proper engagement of speed and feed gears and the level/handle position.
6	To regulate friction and the brake tension
7	To regulate smooth sliding of tables, slides, saddles, traverses, carriages, slide blocks, slotter ram.
8	To tighten wedges and clamping plates.
9	To check the condition of the guides of the bed, carriages traverses and other friction surfaces. To clean scratches and any other damages.
10	To check and regulate springs tension.
11	To tighten / replace loose or worn out fasteners (i.e pins, nuts, screws, bolts etc.)
12	To check proper functioning of limits, reverses, stoppers.
13	To clean, tighten, repair/replace chains, belts, linings (brake).
14	To check the condition of coolant system, and carry out necessary minor repairs.
15	To check the condition of guards, fencings etc. and carry out necessary repairs.
16	To check the condition of lubricating and hydraulic system and carry out necessary minor repairs.
17	To replace lubricating oil in all the reservoirs.
18	To regulate machine and hand over to the maintenance in-charge.
19	To make out the list of parts which need replacement during the next planned repair.
20	To disassemble part wise few units (2 to 3) of the machine which are excessively worn out (or dirty). For the remaining units, open out covers for internal inspection and wash.
21	To wipe out the complete machine and wash the parts of the disassembled units.
22	To disassemble spindle and clean roughness from the spindle shanks, the surfaces for fixing instruments / devices. To clean / scrape bush bearings. To assemble spindle and regulate bearings.

23	To check clearances between bush and shaft shank. To replace worn out bushes.
24	To regulate ball/roller bearings. To replace worn out bearings.
25	To add friction discs, scrape conical friction surfaces. To regulate friction couplings and brakes.
26	To clean burs on gears. To replace gears with torn out metal and tooth surfaces.
27	To replace worn out / broken external fasteners of tool holder, wedge, clamping plate etc.. To clean remaining fasteners.
28	To scrape / clean regulating wedges and clamping plates.
29	To clean lead screws of slides, carriages, traverses etc.. To replace worn out mating nuts.
30	To check for proper working and regulate the levers / handles for reversing motion, blocking device for speed / feed engagement, fixators, safety mechanism and limits etc.
31	To replace worn out parts that will not last till the next planned repair.
32	To clean scratches and damages on friction surfaces of the bed guides, carriages, slides, traverses, columns etc.. To restore oil pockets, if necessary.
33	To repair fencing and guards, covers on belt drives, casing, shields, screen and also arrangements for protecting the machine parts from chips and abrasive dust.
34	To carry out the repair of lubricating and hydraulic systems.
35	To replace oil in all the reservoirs.
36	To regulate smooth sliding of tables, slides, carriages, slide blocks. To tighten wedges and clamping plates.
37	To regulate springs tension of worm disengagement and other similar mechanisms.
38	To check for proper functioning of limits, reverse, stoppers.
39	To check and repair the cooling system. To eliminate leakages through pipe joints and cocks. To carry out minor repairs of pumps and fittings.
40	To make out the list of worn out parts that need replacement during the necessary planned repair.
41	To clean working surfaces of the table.
42	**To check machine accuracy as per accuracy test chart.**
43	To run the machine on no-load and on-load at all speeds and feeds and check accuracy and surface finish on the sample (machined).
A.2	**HYDRAULIC UNIT AND EQUIPMENT :**
1	The hydraulic units (pumps, apparatus, and pipelines) of the machines are repaired along with the mechanical part of the machine.
2	To regulate hydraulic aggregate as per hydraulic scheme given in the machine manual. Pressures are regulated as per pressure gauges installed on the machine. To replace oil after washing and cleaning.
3	To tighten the bolts at the pipe joints so as to prevent leakages.
4	To check and tighten (if necessary) the gland packings.
5	To make out the defect list that needs to be attended during the forthcoming planned repair.
6	Complete servicing of hydraulic units under **B-Schedule.**
A.3	**ELECTRICAL EQUIPMENT OF THE MACHINES :**
	During preventive maintenance, the mechanical and electrical work should simultaneously be carried out.
A.3.1	**AC & DC ELECTRICAL MOTORS AND WELDING GENERATORS :**
1	To check for the fastenings of the motor, proper earthing, degree of heating of the body and the bearings, uniform air gap between the stator and rotor, proper installation, normal sound in running of the motor, correct working of the ventilation and cooling arrangement.
2	To clean and blow out (with compressed air) the electric motor, without disassembling it.
3	To tighten the electric connection to the motor.

4	To clean the slip rings and current collectors.
5	To regulate and properly fasten the brush holders.
6	To restore the insulation on the winding overhang.
7	To replace the current collecting brushes.
8	To replace or add the grease lubrication.
9	To service / overhaul completely all motors under **B-Schedule.**
A.3.2	**ELECTRO-MAGNETIC FRICTION COUPLINGS :**
1	To check the coupling body and the discs for heating.
2	To check the fastening of the body in relation to the axial shift.
3	To check the fastening of the slip rings.
4	To check for easy movement of the armature and proper engaging and disengaging of the coupling.
5	To check for proper feeding of the lubrication.
6	To change the worn out brushes and to adjust the brush holders.
7	To clean the slip rings and to wipe out the friction surfaces (without disassembly).
8	To measure the resistance of the winding.
9	To complete overhauling**.**
A.3.3	**ELECTRO MAGENTS :**
1	To check for the fastening of the electro magnet and its body
2	To tighten the connections.
3	To check for heating of the no-volt coil, to rectify minor defects, and replace, if necessary.
4	To check the various parts and change, if necessary.
5	To coat the coils with varnish
6	To check the insulation and the proper movement of the core.
7	Complete servicing under **B-Schedule.**
A.3.4	**MAGNETIC STARTERS AND CONTACTORS :**
1	To check and rectify the visible damages.
2	To check for the complete in and out movement of the armature of the magnetic device.
3	To check the heating of the lugs and the melting of solder from them.
4	To check for the provision of spark extinguishing grids and proper earthing.
5	To check for the heating elements of the thermal over load relay, its proper setting and normal functioning.
6	To check for the good condition of the push buttons, fastening of the apparatus and tightness of the connections.
7	To clean or change the contacts.
8	To check and adjust the motion of the moving contacts.
9	To adjust the simultaneous switching off the 3 phases.
10	To check the action and adjustment of the thermal overload relay.
11	To measure insulation resistance of all the current carrying parts.
12	Complete servicing**.**
A.3.5	**END LIMIT SWITCHES :**
1	To check for proper fastening of the end switch to the machine, tightness of the cover and the sealing, marking, fastening of the fixator (operating arrangement) to the machine, cleaning of the body and the lever of the switch, cleaning of the contacts.
2	To carry out minor repairs of the various parts.
3	Complete servicing**.**

A.3.6	**KNIFE SWITCHES OF ALL TYPES :**
1	To check for proper earthing and condition of cover.
2	To check and replace overheated contacts.
3	To check for proper positioning of the handle of the knife switch.
4	To check for reliable fastening of the knife switch and clean dust and scales.
5	To adjust the simultaneous switching in and switching out of the knives of three phases.
6	To tighten the contact connections.
7	To rectify the distortion of the knives and the pincers of the switch.
8	To file and clean the contact surfaces of the knives and the pincers.
9	To change the defective parts.
10	To paint the cover and the panel.
11	Complete servicing**.**
A.3.7	**ELECTRIC PANEL BOXES :**
1	To check the condition of the panel box and repair the locking and blocking devices of the door.
2	To tighten the fastenings of the apparatus.
3	To examine the complete scheme and the apparatus.
4	To clean and wipe out the apparatus and the panel box.
5	To check for good condition of earthing.
6	To repair the visible damages to the electrical apparatus and electric cables (wiring).
7	To clean the workings contacts and if necessary, replace them.
8	To replace the distorted working contacts.
9	To remove any obstruction to the complete drawing in and falling out of the magnetic core (armature).
10	To check for overheating of the lugs and melting of solder from them.
11	To check the condition of the spark extinguishing chamber and the condition of the signaling apparatus.
12	Complete servicing**.**
A.3.8	**ELECTRICAL APPARATUS & ELECTRIC WIRING ON THE MACHINES :**
1	To check and repair the overheating, carbonizing and mechanical damages to the insulation of the conductors.
2	To check for good condition of earthing, fastening of electric wires and apparatus, tightening of connections.
3	To wipe, blow and clean all the apparatus installed on the machine.
4	To clean the working contacts.
5	To carry out necessary repairs to the electrical apparatus and replace the defective parts.
6	To repair the damaged insulation of the conductors (cables).
7	To rectify or to replace the damaged pipe fitting, metallic and rubber handles.
8	To change the fused bulbs (replace holders, switch etc, if necessary).
9	Complete servicing**.**
A.3.9	**ELECTRICAL FURNACES :**
1	To check resistance elements and change if necessary
2	To tighten fasteners.
3	To check refractory brick lining and change if necessary
4	To change refractory bricks if necessary
5	To tighten all electrical terminals, change if necessary.
6	To check for proper earthing

7	To change cabling and lugs, if necessary.
8	To check for proper functioning of instruments and change, if necessary.
9	To check temperature controls and change, if necessary.
10	Complete servicing**.**
A.3.10	**LIGHTING LOAD AND ELECTRICAL APPLIANCES :**
1	To clean dust.
2	To check fuses and replace with correct capacity fuses, if necessary.
3	To tighten all terminals including those in ML & RM boards.
4	To change blown out bulbs.
5	To check and change control gear, if necessary (like starters, fuses, chokes, holders, spares for electrical appliances, etc.)
6	To check for proper earthing and rectify the same, if necessary.
7	**To maintain voltage between neutral and earth at max. 4 Volts.**
8	To change switches, sockets etc. if necessary, for electrical appliances.
9	Complete servicing**.**
B.	**SCOPE OF WORK FOR BREAK-DOWN MAINTENANCE**
	The following activities shall be performed during breakdown maintenance based on the nature of breakdown.
B.1	**MECHANICAL :**
1	To check for accuracy before disassembly.
2	To measure the wear and friction surfaces before repairing the base parts (beds etc.)
3	To disassemble the machine partly
4	To wash and wipe out parts of the disassembled units. To wash and clean of the dirt from the remaining units.
5	To inspect parts of the disassembled units.
6	To make out the defect list.
7	To grind spindle shanks and replace / scrape bushes.
8	To replace / restore shafts
9	To replace all worn out bushes and damaged bearings.
10	To replace / add friction discs, machine conical friction couplings, re-rivet ferodo lining on friction discs and brakes.
11	To replace worn out gears and worm / worm wheels.
12	To restore / replace worn out lead screws and nuts of longitudinal and transverse feeds.
13	To replace worn out fasteners and clean the remaining ones.
14	**To replace / restore and scrape regulating wedges and clamping plates.**
15	To restore accuracy of lead screws by machining threads (machining by BHEL).
16	To check and clean unworn-out parts left out in the mechanism of the machine.
17	To repair coolant pumps and pipe fittings
18	To repair oil pumps and lubricating / hydraulic systems. To replace oil.
19	To check and replace piston rings and piston. To replace the oil seals / packings etc. partly or completely.
20	To dismantle and wash out the slide valves (solenoid valves etc.), pressure control valves and other hydraulic apparatus. If necessary, pressure valves are lapped.
21	To replace damaged pipes and fittings.
22	To scrape / grind guide surfaces of slides, carriages, traverses, slide blocks etc. **(if the wear exceeds the permissible limits).**
23	To repair / replace guards and fencing (provided for proper safety) and also the arrangements

	for protecting the machine parts from metal chips and abrasive dust (covers on belt drive, casings, shields, screens).
24	To assemble the repaired units, check proper inter-operation of the units and all the mechanisms of the machine.
25	To run the machine on no-load at all speeds and feeds. To check for noise and heating.
26	To check for accuracy of repaired unit as per test chart.
B.2	**ELECTRICAL :**
B.2.1	**A.C. & D.C. ELECTRIC MOTORS :**
1	To disassemble the motor completely and to rectify the winding damages **without changing it**.
2	To clean units and parts of the electric motor and to change the defective insulating bushes.
3	To wash, impregnate and dry out the winding of the electric motor.
4	To coat the winding with the varnish.
5	To check fastening of the ventilator and to carry out necessary repairs.
6	To wash and grease the ball / roller bearings and change the damaged ones.
7	To wash the bush bearings and if necessary, metalise the same.
8	To weld and machine the end covers, if necessary.
9	To change the ventilation fan and the flanges.
10	To partially solder the risers.
11	To turn and grind the slip rings.
12	To repair brush mechanisms and commutator. To machine the commutator and under cut the mica in the slots.
13	To assemble and check the motor on no-load and also on load after repair.
B.2.2	**ELECTRO MAGNETIC FRICTION COUPLINGS :**
1	To disassemble the coupling, to clean and wipe out the parts, to change the ferodo lining, to check for the discs wear and if necessary, replace the same.
2	To check the gap between the guiding bush of the armature and the shaft and, if necessary, change the bushes.
3	To grind the slip rings.
4	To change the seals.
5	To check for normal functioning of the coupling
B.2.3	**ELECTRO MAGNETS :**
1	To completely disassemble the electro magnet.
2	To check the various parts and change, if necessary.
3	To coat the coils with varnish.
4	To check the insulation and the proper movement of the core.
B.2.4	**MAGNETIC STARTER AND CONTACTORS:**
1	To check and adjust the motion of the moving contacts.
2	To adjust the simultaneous switching off of the 3-phases.
3	To check the action and adjustment of thermal overload relay.
4	To adjust the gap between fixed and the moving contacts and to check the withdrawal of the armature while switching off the magnetic coil
5	To change the defective parts.
B.2.5	**END LIMIT SWITCHES :**
1	To completely disassemble the switch.
2	To clean and check all the parts and to change the worn out ones.
3	To adjust the lever with respect to the fixator.
B.2.6	**KNIFE SWITCHES OF ALL TYPES :**

1	To rectify the distortion of the knives and the pincers of the switch.
2	To file and clean the contact surfaces of the knives and the pincers.
3	To change the defective parts.
B.2.7	**ELECTRIC PANEL BOXES :**
1	To check and adjust the movement and the pressure of the moving contacts.
2	To check the working of the thermal overload protection relay and test the same.
3	To change the electrical conductors (cables) wherever necessary.
4	To replace the defective apparatus.
B.2.8	**ELECTRICAL APPARATUS AND ELECTRIC WIRING ON THE MACHINES :**
1	To replace the defective section of the wiring.
2	To rectify or to replace the damaged pipe fitting, metallic and rubber handles.
3	To replace the defective apparatus.
B.2.9	**ELECTRICAL FURNACES :**
1	To replace damaged resistance elements.
2	To replace refractory brick lining.
3	To tighten all electrical terminals.
4	To replace cabling and lugs.
5	To replace instruments and temperature controls.
B.3	**LIGHTING LOAD AND ELECTRICAL APPLIANCES (other than roof lighting in shop floor) :**
1	To replace fuses with correct capacity fuses.
2	To change fused out bulbs.
3	To change control gear (like starters, fuses, chokes, holders, spares for electrical appliances, fans, exhaust fans / man-coolers, etc.)
4	To rectify earthing.
5	**To maintain voltage between neutral and earth at max. 4 Volts for Personal Computers load.**
6	To change switches, sockets etc. for electrical appliances and lighting load.
7	To change / provide tube light fittings, switch boards wherever necessary.
8	To dismount and bring-down man-coolers/blowers located on girders in shop floor for repair and mounting the repaired ones on the girders in the original location.
C.	**SPECIAL CONDITIONS :**
1	Preventive maintenance schedule two times in a year for two shift running machines (approximately 19) and once in a year for single shift machines (approximately 92 machines), 111 nos.of machine tools/equipment of various categories, lighting load and electrical appliances are to be maintained. This number may vary during execution of the contract.
2	One Operation in Breakdown Maintenance Consists of attending breakdowns of 15 Critical Machines,96 Light/Medium Machines, Electrical Breakdowns of 07&210SMC,07 Annexe,Creche near J-Gate, K-gate, New Pipe & Plate Yard, CGC in a month as and when breakdowns received and maintaining BD% less than 2% per month (uptime of machines should be 98% or higher). Breakdown of critical machines (identified by BHEL) shall be given priority to bring back the same into operation.
3	**Payment Terms:-** Progressive monthly payment and on actual operations executed and submission of tax invoice/bill, duly certified by executing agency.
4	Labour, Tools, minor components/spares proposed for outsourcing are under contractor scope**.**
5	Major Spares and consumables, material handling facilities and utilities will be supplied by BHEL.
6	Drawings / sketches for manufacturing parts to be given by contractor.

SIGNATURE AND SEAL OF CONTRACTOR

7	MAN POWER REQUIREMENT : Will be Decided by Engineer Incharge before commencement of contract
8	**GEOMETRICAL ACCURACIES OF CRITICAL MACHINES :** Geometrical accuracies of critical machines (identified by BHEL during the contract period) shall be recorded in the test charts concerned. Minor deviations are to be rectified to bring the same to permissible limits. Necessary special tools & gauges for measurement will be provided by BHEL.
9	**Penalty:-** (i) Time period given for minor/Medium breakdown will be 48 hours/2 working days, beyond 48 hours/ 2 working days penalty at the rate of Rs.0.5% of total contract value per day will be recovered from bill upto 10% of total contract value. (ii)Time period given for Major breakdown will be 144 hours/6 working days, beyond 144 hours penalty at the rate of Rs.0.5% of total contract value per day will be recovered from bill upto 10% of total contract value. Note:- Monthly Breakdown percentage should be less than 2% and increase of monthly BD% will lead to non-refundable penalties up to 10% of Total Contract value. (iii) Preventive Maintenance shall be done two times in a year (once in six months) for two shifts working machines and once in a year for single shift machines, no Preventive maintenance no pay, additionally penalty of Rs.2000/- will be applicable per machine.
10	Daily maintenance activities carried out should be reported to maintenance in-charge at the end of the shift.
11	Records of monthly, quarterly and yearly maintenance reports to be submitted to the maintenance in-charge.
12	Record of replacement of spares & consumables machine-wise to be maintained and reported to the maintenance in-charge monthly.
13	Breakdown history of each machine tool / equipment shall be maintained by filling individual history card.
14	Break-down analysis should be performed quarterly.
15	Satisfactory working of each repaired machine / equipment shall be certified by the user and to be checked by maintenance in-charge in the break-down report.
16	In case of critical machine tools, satisfactory working of each repaired unit shall be inspected and approved by maintenance in-charge in the break-down report.
17	Break-down calls directly received from users/ in-charge or his representatives during 2nd shift on emergencies shall be attended.
18	The contractor shall hand over all the machine tools / equipments in working condition to the satisfaction of the in-charge at the end of the contract period. Otherwise, maintenance charges for the total idle period or repair cost of the machine tool(s) / equipment (s) whichever is greater shall be recovered from the contractor.
19	Necessary tools and measuring instruments to upkeep all the machine tools / equipment is under the contractor's scope.
20	ISO 14001 & OHSAS 18001 shall be complied with as BHEL is certified for these.
21	All breakdowns shall be attended at BHEL works only.
22	Random workshop inspection will be done by BHEL representatives.
23	All scrap material like electrical & mechanical consumables & spares, waste lub. Oil, waste coolant, fused bulbs & tubes etc. should be separately stored and handed over to scrap yard after inspection by maintenance in-charge.
24	Lub. Oils consumption records shall be maintained. % Wastage should be decreased year by year as per BHEL prescribed norms. Lub. Oil will be issued after return of waste oil as per norms prescribed by BHEL (Presently, one barrel fresh oil will be issued on return of half

	barrel waste oil).
25	Oiling / greasing points markings to be renewed / maintained on machines with colour codes.
26	All machines / equipments and their surroundings should be maintained neat and clean. General house-keeping and chips removal is under BHEL scope.
27	Oils / coolants should be properly stored and its surroundings should be maintained clean.
28	**The general conditions of contract of BHEL (enclosed) shall also apply to this tender to the extent they are not inconsistent with any of the conditions stipulated herein.**
29	Any point not covered in the agreement, if comes up, will be mutually, solved in the best interest of the work.
30	**The contractor may visit BHEL works to see the machines / equipment proposed for AMC.**
31	Lodging & Boarding facilities for the contractor personnel are at Contractor's scope. BHEL is not responsible for this.
32	Material handling facilities such as crane, battery truck, slings, lifting tackles etc. along with operator, consumables like cleaning solvents, cotton waste etc. and utilities like electric power, compressed air etc. shall be provided by BHEL for the works performed at BHEL works

SIGNATURE AND SEAL OF CONTRACTOR