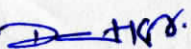
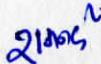


Technical Pre-Qualifying Requirements (PQR)

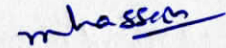
REF: Replacement of CNC control, drives, feed & spindle motors, measuring system, electrical cabinet along with its installation, customization, adaptation & commissioning on CNC Machining Center (Model No. MPA-80A) Plan No. 2-380, TBM, BI-3, BHEL Haridwar.

Sl. No	Description	Accepted (Yes/No)	Deviation	Remarks
1.	<u>QUALIFYING CONDITIONS</u>			
1.1	a) The Bidder must have successfully commissioned two numbers of CNC machines with Siemens 828D-SL (or advanced) or Fanuc 0i-MF (or advanced) CNC system having three or more CNC controlled feed axes during last seven years as on the date of tender opening. b) The above commissioned machines should be running satisfactorily for at least 6 months prior to tender opening date. 6 months period will be calculated on the basis of commissioning certificates/ performance certificates/ e-mail from bidder's customers provided/received. c) Bidder to provide P.O. / W.O copies and commissioning/ performance certificates for satisfactory operation of the above retrofitted machines along with name, address & contact details including e-mail IDs, telephone numbers of their customer*. In case commissioning/performance certificate is not provided, e-mail confirmation from customer of bidder will be considered as commissioning/performance certificate. E-mail IDs should preferably be based on the customer's domain name. *Customer would mean the eventual user who is using the referred machine. d) BHEL reserves the right to verify the information provided through suitable means viz. e-mail, telephonically or visit of BHEL team as per the discretion of BHEL. All the papers must be self-attested by the bidder along with company seal.			Bidder to provide details & comply


(DEWANT KUMAR)
Dy. Manager (TUM-L&D)


(RAMVAROS YADAV)
Dy. Manager (WEX/MCR)


(ISHAN DWIVEDI)
Sr. Engineer (NCT)


(MUDASSAR HASAN)
Dy. Manager (WEX/MAINT-3)

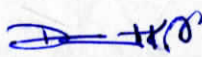

(RISHABH GUPTA)
Manager (WEX/CNC-NBS)

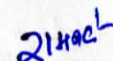
Scope for Replacement of CNC control, drives, feed & spindle motors, measuring system, electrical cabinet alongwith its installation, customization, adaptation & commissioning on CNC Machining Center (Model No. MPA-80A) Plan No. 2-380, TBM, BI-3, BHEL Haridwar

Brief About Machine:

The machine comprises of X, Y, Z & B axes with a Spindle, Pallet changer equipped with two pallets & tool changer. All axes, rotary table, tool changer, workpiece/pallet changer and spindle are CNC controlled. Existing CNC System is Fanuc System 7 and has to be replaced. Existing feed drives & spindle drive have to be replaced along with the feed motors & spindle motor. The existing Automatic pallet changer is equipped with twin pallets (1000 mm X 1000 mm). Most of the operations during pallet change cycle are hydraulic and some are pneumatic. The existing Automatic tool changer is equipped with 40 tools in one magazine & hydraulically operated tool changer arm. The existing logic for both tool changer & pallet changer has to be maintained for automatic operation. Automatic operation should be through Sub-program/ Auxiliary codes without any manual intervention.

Sl. No	Description	Quantity	Accepted (Yes/No)	Deviation	Remarks
1.	<u>MATERIAL SUPPLY INCLUDING SCOPE OF WORK:</u>				
1.1	<u>CNC SYSTEM:</u> The existing Fanuc System 7 has to be replaced with Siemens SINUMERIK 828D SL or advanced/ Fanuc 0i-MF or advanced. All standard features should be listed in technical offer. Also all available/ required optional features of the offered CNC system as mentioned below should be offered and included in the offer.	01 No.			Bidder to provide details & comply
(a)	Milling configuration (with all standard milling cycles)				Bidder to comply
(b)	Oriented Spindle stop				Bidder to comply
(c)	USB ports, RS232 or Ethernet port for data transfer. (Note: USB port is must for data transfer.)				Bidder to comply
(d)	Measuring systems, lead screw, Backlash & Friction compensation, Bi-directional pitch error compensation facility				Bidder to comply
(e)	Graphic simulation- Single sided 2D view, dynamic				Bidder to comply
(f)	PLC in Ladder diagram / STL format should be provided. Ladder program should be viewable on the monitor of CNC. Status of various signal should be indicated in ladder diagram				Bidder to comply
(g)	CNC user memory for program and data should be 2MB or more.				Bidder to comply
(h)	Cylindrical interpolation				Bidder to comply
(i)	Tool management				Bidder to comply
(j)	Background editing				Bidder to comply
(k)	Look ahead of 70 blocks.				Bidder to comply


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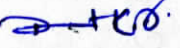

(RAMVAROS YADAV)
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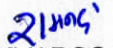

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Sr. Engineer (NCT)

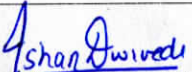

(MUDASSAR HASAN)
Dy. Manager (WEX/MAINT-3)

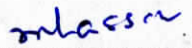

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Manager (WEX/CNC-NBS)

(l)	Solid Tapping				<u>Bidder to comply</u>
(m)	Features Pre-defined or through USER keys: i. Single block. ii. Block search with calculation & without calculations in automatic mode. iii. Optional Stop. iv. Programmable keys. v. Rapid Feed On/OFF. vi. Co-ordinate system transformation. vii. Co-ordinate system rotation. viii. Helical/ Spline interpolation. ix. Scaling. x. Mirroring. xi. Facility to store up to 999 subroutines & 9999 part programs. xii. Facility to store at least 20 zero offsets & at least 2 additive zero-offsets. xiii. It should be possible to store tool offsets at least equal to the number of tools in ATC. xiv. Oriented Spindle stop. xv. Dry run switch (Dry run freely executable during program run in automatic). xvi. Coolant ON/OFF switch/key (Coolant should be switch on/off during Auto/Jog mode irrespective of the definition in the part program). xvii. On screen graphic simulation. (Offline graphic simulation-fast simulation of tool movements without requirement of locking machine axes/independent of machine movements). - xviii. Programming with polar coordinates.				<u>Bidder to comply</u>
1.1.1	Machine Control panel for Mode selection, Feed override, Spindle override, Feed START/STOP, Cycle START/STOP, Spindle START/STOP, Axes Jogging option, Reset, Incremental Keys (1, 10, 100, 1000 & 10000 micron), Chip Conveyor FORWARD/STOP/REVERSE, User definable keys (minimum 6 nos.) and other keys required as per the existing machine functions. Details related to installation of the machine control panel on the electrical cabinet is at clause no. 1.5.1.	01 No.			<u>Bidder to comply</u>
1.1.2	CF card for data transfer (if required for use on machine)	03 Nos.			<u>Bidder to comply</u>
1.1.3	Transcend make CF card reader. Interface cables for connecting CF card with PC/ CNC system with PC through Ethernet & RS232 port on machine as per availability of ports on the CNC System.	03 Sets			<u>Bidder to comply</u>
1.1.4	All Profibus/ interface connectors within all the CNC cabinets as required for successful commissioning shall be in the scope of supply.	01 Set			<u>Bidder to comply</u>
1.1.5	PLC shall be supplied, installed & commissioned. 144 nos. of Inputs, 128 nos. of Outputs are to be programmed in the PLC maintaining the existing logic. In case the vendor perceives that more Inputs/ Outputs are required for completion for the work as per their designed and conceived electrical scheme, the same should be included in the scope of supply. Vendor may note that Hard copy of the PLC program is available.	01 Set			<u>Bidder to comply</u>


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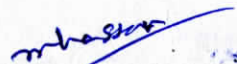

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1.1.6	16 Nos. X 8 Channel Relay boards preferably Phoenix contact make should be provided for driving the PLC outputs to the machine. All PLC outputs to be routed to the machine through these Relay boards.	01 Set		<u>Bidder to comply</u>
1.1.7	Existing Software & electrical logic has to be retained in new PLC program. Existing PLC program in hard copy is available with us and similar logic has to be developed.			<u>Bidder to comply</u>
1.1.8	All Softwares (Licensed copy) for taking back-up along with communication cables for data back-up & restoration to be provided.	01 Set		<u>Bidder to comply</u>
1.2	<u>AC SERVO MOTORS & SPINDLE MOTOR:</u>			
1.2.1	SIEMENS/FANUC AC servo motor without holding brake of suitable rating for X axis with rated Torque (Mn) of 23 Nm or above and RPM more than or equal to 1500 RPM. Size constraints for the motor has to be accounted for considering the available space in the machine Existing motor details are as under: GETTYS Fanuc DC Servo Motor Model 20 Type no: A06B-0602-B Torque constant at Stall: 23 Nm Ampere constant at Stall: 33 A; Voltage: 128 V; RPM: 1500 RPM Insulation class: H	01 No.		<u>Bidder to provide details & comply</u>
1.2.2	SIEMENS/FANUC AC servo motor with holding brake of suitable rating for Y axis with rated Torque (Mn) of 23 Nm or above and RPM more than or equal to 1500 RPM. Size constraints for the motor has to be accounted for considering the available space in the machine Existing motor details are as under: GETTYS Fanuc DC Servo Motor Model 20 Type no: A06B-0602-B221 Torque constant at Stall: 23 Nm Ampere constant at Stall: 33 A; Voltage: 128 V; RPM: 1500 RPM Insulation class: H	01 No.		<u>Bidder to provide details & comply</u>
1.2.3	SIEMENS/FANUC AC servo motor without holding brake of suitable rating for Z axis with rated Torque (Mn) of 38 Nm or above and RPM more than or equal to 1000 RPM. Size constraints for the motor has to be accounted for considering the available space in the machine Existing motor details are as under: GETTYS Fanuc DC Servo Motor Model 30 Type no: A06B-0603-B Torque constant at Stall: 38 Nm Ampere constant at Stall: 35 A; Voltage: 131 V; RPM: 1000 RPM Insulation class: H	01 No.		<u>Bidder to provide details & comply</u>
1.2.4	SIEMENS/FANUC AC servo motor without holding brake of suitable rating for B axis with rated Torque (Mn) of 23 Nm and RPM more than or equal to the existing motor. Size constraints for the motor has to be accounted for considering the available space in the machine Existing motor details are as under:	01 No.		<u>Bidder to provide details & comply</u>


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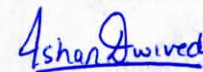

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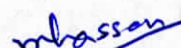

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	GETTYS Fanuc DC Servo Motor Model 20 Type no: 20 1/3 PM , 1.8 KW No: D-032546				
1.2.5	Suitable SIEMENS/FANUC AC Spindle Motor (Forced Air cooled) with 15 KW or more rated Power & RPM more than or equal to existing motor i.e. 3500 RPM. Size constraints for the motor have to be accounted for considering the available space in the machine. Spindle has a gear ratio of 27/60 for spindle to intermediate shaft; ratio of intermediate shaft to spindle for high gear as 98/49 and low gear as 42/105. Final spindle RPM are 40 to 599 (Low gear) & 600 to 3150 RPM (High gear). Existing motor details are as under: Mitsubishi Superline DC Motor Type: SDN-CFZ-F Frame size: 160L Winding SEPA 65V Pole: 4; KW: 11/15; RPM: 1150/ 3500; Voltage: 210 V; Amps: 63/ 92; Field current: 6.6/ 2.0 A Insulation class: F; Ambient temperature: 40 deg C; Temperature rise limit: 90 deg C Vibration class: V-10	01 No.			<u>Bidder to provide details & comply</u>
1.2.6	Supply of intermediate flanges, couplings and any other parts required for mounting of the Axes AC Servo motors (4 Nos.) and Spindle motor (1 No.).	01 Set			
1.3	<u>AC SERVO DRIVES & SPINDLE DRIVE:</u>				
1.3.1	SIEMENS/FANUC make AC Servo drive for Feed motors' control with input voltage of 415VAC (+/- 10%), 3 phase 3 wire system.	01 Set			<u>Bidder to provide details and comply</u>
1.3.2	SIEMENS/FANUC make AC drive for Spindle motor control with input voltage of 415VAC (+/- 10%), 3 phase 3 wire system.	01 Set			<u>Bidder to provide details and comply</u>
1.3.3	AC Line Filter with appropriate rating. Maximum ratings of motors offered to be taken into account for calculating the ratings of the Modules.	01 Set			<u>Bidder to provide details and comply</u>
1.3.4	Encoder cables (including motor encoders, external encoder and linear scales) of suitable length for all AC Servo motors & Spindle motor.	01 Set			<u>Bidder to provide details and comply</u>
1.3.5	Power cables of suitable length for all AC Servo motors & Spindle motor. Please note that X, Z & B axis motor is without holding brake & Y axis motor is having holding brake.	01 Set			<u>Bidder to provide details and comply</u>
1.3.6	Input supply of 415VAC is available on the machine. If the installed system & Drives require any other rated supply then suitable rated supply transformer to be supplied by the vendor.	01 No.			<u>Bidder to comply</u>
1.3.7	Shield terminal plates and earthing schematic for all the modules.	01 Set			<u>Bidder to comply</u>
1.3.8	Pre-assembled cables to connect a laptop with the drives & system for commissioning and diagnosis purposes.	01 Set			<u>Bidder to comply</u>
1.3.9	Drives commissioning software on CD (Licensed copy) along with interface cables.	01 Set			<u>Bidder to comply</u>
1.4	<u>MEASURING SYSTEM:</u>				
	The existing X-axis linear feedback system has to be replaced with a suitable slim line scale &	01 No.			<u>Bidder to provide</u>


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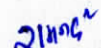

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Manager (WEX/CNC-NBS)

1.4.1	transducers (1 Vss output) of Heidenhain make with +/- 5 micron accuracy grade. The existing linear feedback system is Inductosyn (2mm cycle 250 mm long scale pieces) and slider (2mm 96 bar slider). Axes traverse is 1256 mm between software limits. The Laser Calibration & Accuracy checking of the scale (if required) shall be in the scope of work.				<u>details & comply</u>
1.4.2	The existing Y-axis linear feedback system has to be replaced with a suitable slim line scale & transducers (1 Vss output) of Heidenhain make with +/- 5 micron accuracy grade. The existing linear feedback system is Inductosyn (2mm cycle 250 mm long scale pieces) and slider (2mm 96 bar slider). Axes traverse is 1006 mm between software limits. The Laser Calibration & Accuracy checking of the scale (if required) shall be in the scope of work.	01 No.			<u>Bidder to provide details & comply</u>
1.4.3	The existing Z-axis encoder/resolver has to be replaced with a suitable slim line scale & transducers (1 Vss output) of Heidenhain make with +/- 5 micron accuracy grade. Axes traverse is 806 mm between software limits. The Laser Calibration & Accuracy checking of the scale (if required) shall be in the scope of work. The existing Motor in-built Resolver/encoder details are as below: Tamagawa Seiki Brushless resolver, Type: TS530N33E9, 3000 Hz, Input stator: 3.5 V	01 No.			<u>Bidder to provide details & comply</u>
1.4.4	The existing B-axis encoder/resolver has to be replaced with a suitable in-built motor ENCODER. The Accuracy checking of the encoder shall be in the scope of work. The existing Motor in-built Resolver/encoder details are as below: Tamagawa Seiki Brushless resolver, Type: TS530N33E9, 3000 Hz, Input stator: 3.5 V	01 No.			<u>Bidder to provide details & comply</u>
1.4.5	The existing Spindle orientation takes place without position feedback. When M19 command is given the spindle creeps at low RPM and low torque in drive is selected with the Roller IN solenoid actuated and the Roller inserts at pre-determined position in the spindle. In this creeping speed, Spindle at Standstill contact from drive is ON which enable Roller IN output. It is proposed that the same scheme is maintained.	01 No.			<u>Bidder to provide details & comply</u>
1.4.6	Position feedback cables from all motor encoders to CNC system as well as from all second encoder/scale to CNC system (as mentioned at clause no. 1.3.4).	01 Set			<u>Bidder to provide details & comply</u>
1.4.7	Couplings, Mounting brackets, mounting plates etc. for mounting of scales, transducers, external encoders of all axes/ spindle and other items required for ensuring accuracy and repeatability of the feed axes movement & spindle RPM should be included in the offer. In case any modification in the covers is required, the same shall be included in the offer.	01 Set			<u>Bidder to comply</u>
1.5	<u>ELECTRICAL FEATURES:</u>				
1.5.1	It is proposed that the existing electrical cabinet with customized machine control panel -1 No. (Size: Height: 150 cm, Width: 110 cm, Depth: 43 cm) is to be replaced with reputed make cabinet of similar size for mounting the electrical items. The existing electrical cabinet is located on the side of the machine and starts at a height of 44 cm from floor level. The new cabinet should be oil, dust and vermin proof and should be supplied with suitable side mounted air-conditioner of	01 No.			<u>Bidder to comply</u>


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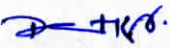

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	reputed make. Size constraints for the electrical cabinet have to be accounted for considering the available space in the machine. The new electrical cabinet should not have rear opening. No elements should be mounted on the back-side of the panel. Electrical Cabinet should be aesthetic & with the following features: a) Integrated Customized Machine Control panel with all the relevant rotary switches, push-buttons, emergency switch and all functional keys to cover all existing machine functions should be provided on the new electrical cabinet door. The manual operations as existing in the present system have to be provided through User Definable keys in the Integrated Machine Operator Panel with LED signals. Extra Push buttons & Lamps to cover all the existing manual operations shall be in the scope of work. In case of need of extra push-buttons & lamp indications, the same shall be provided on the operator panel. b) Front doors should be on hinges to access the electrical items. c) No opening from rear side of the electrical cabinet. d) All the cable entry and exit points should be properly sealed. e) Illumination light with switch for working in the electrical cabinet. f) 220 VAC/ 5 Amp 3-pin service socket and switch.				
1.5.2	Existing CNC system cabinet (Size: Height: 144 cm, Width: 110 cm, Depth: 70 cm) is to be replaced with reputed make cabinet. The cabinet should be oil, dust and vermin proof. Special care should be taken for ensuring that all the cables to and from electrical cabinet and other machine components viz. servo motors, spindle motor, glass scales etc. should pass through a conduit wherever exposed which are otherwise routed through cable pits/trenches and the same needs to be maintained with no loose/ external wiring/ cabling. CNC system cabinet should be aesthetic & with the following features: a) CNC System, MCP, I/O Boards, Drives and Modules are to be mounted in the supplied cabinet. The size of the CNC cabinet is to be decided by the vendor considering this and the available space. b) Height of the CNC System display to be suitable for person of average height (5'5"). c) Fitted with side mounted suitable air conditioner. d) Illumination light with switch for working in the operator panel. e) 220 VAC/ 5 Amp 3-pin service socket and switch.	01 No.			<u>Bidder to comply</u>
1.5.3	The operator hand pendant having handwheel (with light indication) for manual movement of axes, Incremental Selection (1, 10 & 100 micron), axes selection (X, Y, Z & B), Spindle Tool LOCK/EJECT & Air Blow Push Buttons is to be replaced with new one having same functionalities/ features. Vendor has to rewire the above with new lugs, ferrules and conduits as required.	01 Set			<u>Bidder to comply</u>
1.5.4	Electronic Hand wheel interface (if required)	01 No.			<u>Bidder to comply</u>


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1.5.5	All AC three phase motors used in the machine are to be interfaced/ incorporated in the scheme. Existing motor & pumps to be replaced with equivalent ones of reputed makes with same or higher capacity. Details of some important motors are: i) Coolant Motor: 0.37 Kw, 2900 rpm; Pump discharge: 12 litres/min; Tank capacity: 100 litres for 4 coolant types viz. Mist, Mist/ Flood, Through spindle and coolant for oil hole drilling. ii) Slide-way Lubrication pump drive motor: 70 W, 2 Pole, 2760 RPM. Existing pump is Willy Vogel Type: MFE2/ BW3; Tank capacity: 2.7 litres; Frequency: 60 hours/ round; Pump operating time: 10 min	01 Set			<u>Bidder to provide details & comply</u>
1.5.6	Existing chip conveyor motor along with the gear box to be replaced by suitable alternative. Existing chip conveyor motor is of 0.4 KW/ 4 pole/ 1500 rpm.	01 Set			<u>Bidder to provide details & comply</u>
1.5.7	Air filter, Regulator & Lubricator (FLR) of appropriate capacity to arrest moisture, other suspended particle etc. for providing dry and clean air for machine operation. The machine requirement is 5-7 Kg/cm ² , 400 NI/min.	01 Set			<u>Bidder to provide details & comply</u>
1.5.8	All existing Proximity switches and Limit switches are to be replaced. All these shall be replaced with 24 VDC based elements of reputed makes viz. Schneider, IFM, Siemens, Balluff.	01 Set			<u>Bidder to comply</u>
1.5.9	All existing Pressure switches and Flow switches are to be replaced with digital pressure and digital flow switches. All these shall be replaced with 24 VDC based elements of reputed makes viz. IFM, Parker, Rexroth, Yuken, Vickers, Hydac, Hawe.	01 Set			<u>Bidder to comply</u>
1.5.10	All existing Solenoid Valves are to be replaced. All these shall be replaced with 24 VDC based elements of reputed makes viz. Parker, Rexroth, Yuken, Vickers, Hydac, Hawe.	01 Set			<u>Bidder to comply</u>
1.5.11	L&T/Siemens/ABB/ Schneider Electric make MCCB with rotary handle kit of appropriate rating as per the new scheme (25% over-rated to maximum load) for switching on the power supply of panel & machine to be mounted at operator height.	01 No.			<u>Bidder to comply</u>
1.5.12	Suitable Semiconductor, HRC fuses, fuse bases of GE/SIEMENS/BUSSMAN make for overload protection.	02 Sets			<u>Bidder to comply</u>
1.5.13	The complete LV switchgear of the machine including overloads, relays, contactors, MPCBs etc. is to be supplied & interfaced by the vendor as per existing scheme and of reputed makes. All AC induction motors for auxiliary functions should be wired through MPCBs.	01 Set			<u>Bidder to comply</u>
1.5.14	Additional Keys, Push-buttons, Indicator lamps/ lamp holders & Selector switches required on the operator panel for operation of the machine to be provided by the vendor.	01 Set			<u>Bidder to comply</u>
1.5.15	All Harting connectors, Indicators, Cable Lugs, Ferrules, Plug sockets etc. used in the machine shall be replaced with new versions of reputed makes.	01 Set			<u>Bidder to comply</u>
1.5.16	DC Regulated Power Supply 24V DC, 40 Amps of Siemens/Phoenix/M-System/Allen Bradley for all Outputs & relay boards.	04 Nos.			<u>Bidder to provide details & comply</u>
1.5.17	DC Regulated Power Supply 24V DC, 20 Amps of Siemens/Phoenix/M-System/Allen Bradley for all Inputs, PCU and other areas.	02 Nos.			<u>Bidder to provide details & comply</u>


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(RISHABH GUPTA)
Manager (WEX/CNC-NBS)

1.5.18	Sealed machine light of reputed make having halogen lamp (24 V, 70W) in working area of the machine to be installed.	03 Nos.			<u>Bidder to comply</u>
1.5.19	4 colored signal light (Tower light) display of LED type should be interfaced with PLC to show the operational status of the machine and visible from a distance.	01 Set			<u>Bidder to comply</u>
1.5.20	Wires & Conduits preferably of LAPP/IGUS or reputed make for rewiring of the entire machine including Control, Signal & Power cables, switchgears cables and field elements cables etc. Note: The vendor to note that the entire machine has to be rewired. 3-phase 415VAC Input Power Supply to the machine will be provided by BHEL.	01 Set			<u>Bidder to comply</u>
1.5.21	Vendor should provide the proposed electrical schematic along with bill of material to BHEL for approval prior to dispatch.	01 Set			<u>Bidder to comply</u>
1.5.22	Terminal boxes, screwed terminal blocks, bus bars, transformers etc. as required per the new electrical scheme should be provided of reputed makes viz. Wago, Phoenix contact etc.	01 Set			<u>Bidder to comply</u>
1.5.23	Machine should have provision to switch from direct position feedback system to indirect position feedback system (built in motor encoder) through PLC/ Custom screen which is required for service purpose only.				<u>Bidder to comply</u>
1.5.24	Suitable logic for existing Mist Lubrication system for spindle to effectively limit the thermal growth of spindle carrier.				<u>Bidder to comply</u>
1.5.25	Any modification/rectification of the existing mounting brackets, couplings etc. for the linear scales, encoders shall be in the scope of supply.				<u>Bidder to comply</u>
1.5.26	Fittings associated with the Mounting of the Axes & Spindle drives in the suitable air-conditioned electrical cabinet are in the scope of work.				<u>Bidder to comply</u>
1.5.27	Before dispatch of material, vendor shall submit to BHEL the Bill of Material (BOM) and proposed electrical drawing/ schematic for scrutiny and acceptance.				<u>Bidder to comply</u>
1.6	<u>OTHER FEATURES:</u>				
1.6.1	Design and supply of intermediate flanges, couplings and any other parts required for motors mounting are in the scope of supply.	01 Set			<u>Bidder to comply</u>
1.6.2	Set of keys for Electrical cabinet & Operator Panel locks.	02 Sets			<u>Bidder to comply</u>
1.6.3	Lapp make hose pipes, DIN rails, cable ducts, insulated lugs, printed ferrules and other material required for the wiring of machine, Electrical & Operator panels as per requirement.	01 Set			<u>Bidder to comply</u>
1.6.4	Party shall supply all clamps, fixtures and fasteners required to complete the replacement work.	01 Set			<u>Bidder to comply</u>
1.6.5	Trial in automatic mode with part programs to prove all milling, tool changing & pallet changing operations and handling over the machine for production.				<u>Bidder to comply</u>
1.6.6	Any other material not mentioned above but found necessary to complete the job, shall be in party's scope of supply.				<u>Bidder to comply</u>
1.6.7	Party to provide manual mode for rotation of Spindle by push buttons and enabling of				<u>Bidder to comply</u>


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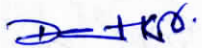

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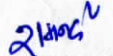

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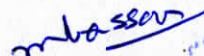

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	continuous cutting feed enabled through push-buttons in the operator panel.				
1.7	AUTOMATIC TOOL CHANGER:				
1.7.1	The existing Automatic Tool Change Magazine is Chain type. The tool magazine is rotated by a hydro-motor and homing of the chain is by proximity switches; Further positioning/ counting takes place by up-counting/ down-counting by the proximity switch sequence. Rotation of tool changer arm is accomplished by a hydro-motor. Rest of the operations is carried out by hydraulic cylinders & solenoid valves. The advance/retract movement of the tool changer arm is powered by a hydraulic cylinder. The operational logic should be maintained. To monitor the various positions of the tool changer mechanism and arm and magazine chain proximity switches & limit switches are used and actuated by some type of actuator piece. No. of Tools in the existing magazine : 40				<u>Information to bidder & Bidder to comply</u>
1.7.2	Tool call should be possible by Tool Id. The existing Automatic Tool Changer's Tool selection method: Random by programmed pocket number or Tool ID; Tool is called by random system (shortest path) of Tool selection; Tool are in fixed location.				<u>Information to bidder & Bidder to comply</u>
1.7.3	The existing Automatic tool changer is equipped with 40 tools in one magazine & hydraulically operated tool changer arm. The existing logic has to be maintained for automatic operation. Automatic operation should be through Sub-program/ Auxiliary codes without any manual intervention.				<u>Information to bidder & Bidder to comply</u>
1.7.4	The hand-pendant located near the tool magazine has to be replaced by a separate & firmly mounted hand-pendant to carry out the manual magazine indexing operations. Sufficient interlocks to be built in into the system so that wrong operation is not permitted with a Pop-up alarm.				<u>Information to bidder & Bidder to comply</u>
1.7.5	M-code based/ Screen based/ Hand pendant based system shall be provided for step by step retrieval of tool changer stuck up / trapped in the automatic tool changing operation with sufficient interlocks to be built in into the system so that wrong operation is not permitted with a Pop-up alarm. Possibility of retrieving the tool changer after power failure should also be provided.				<u>Information to bidder & Bidder to comply</u>
1.7.6	Written instructions on how to extract the tool changer trapped anywhere in the ATC cycle and complete M code list for individual functions involved during ATC cycle shall be provided with the machine.				<u>Information to bidder & Bidder to comply</u>
1.7.7	Automatic management of tool offsets.				<u>Bidder to comply</u>
1.7.8	Machine operation should be possible even in situation when the ATC is out of order due to some Mechanical / Electronic problem.				<u>Bidder to comply</u>
1.7.9	The existing push-buttons with indication light for manual tool clamp/unclamp near the Headstock to be replaced and existing operation to be ensured.				<u>Bidder to comply</u>
1.7.10	Sufficient interlocks to be built in into the system so that wrong operation is not permitted with a Pop-up alarm.				<u>Information to bidder & Bidder to comply</u>


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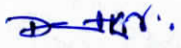

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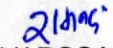

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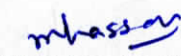

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1.7.11	Hand pendant Selector switch positions should have etching for defining the operation to be performed in case a hand pendant is provided.				<u>Information to bidder & Bidder to comply</u>
1.8	<u>AUTOMATIC WORKPIECE CHANGER:</u>				
1.8.1	The existing Automatic pallet changer is equipped with twin pallets (1000 mm X 1000 mm). The existing logic has to be maintained for automatic operation. Automatic operation should be through Sub-program/ Auxiliary codes without any manual intervention. The pallet change for both the Pallet 1 & 2 takes place at same position of X axis and the same has to be managed in the automatic pallet change operation.				<u>Information to bidder & Bidder to comply</u>
1.8.2	The dual pallet AWC is a separate assembly that works in conjunction with the X axis table slide. The pallet is positioned from the AWC rotor onto the X axis receiver, via the cylinder located on the side of the rotor which slides the pallet into position over the receiver. The pallet is clamped into position on the X axis receiver. Most of the operations during pallet change cycle are hydraulic and some are pneumatic. Turning mechanism consists of hydraulic cylinder, chain and sprocket. Once the pallet is positioned, two registration pins accurately locate the 1000 mm square pallet. Hydraulic power positively locks the pallet and receiver together. Once the pallet is clamped. The B axis will rotate and the X axis will move linearly to position the work pallet to the programmed position.				<u>Information to bidder</u>
1.8.3	The hand-pendant located near the Work-piece changer set-up pallet has to be replaced by a separate & firmly mounted hand-pendant to inform the control that the Work has finished which will enable pallet change.				<u>Bidder to provide details & comply</u>
1.8.4	M-code based/ Screen based/ Hand pendant based system shall also be provided for step by step retrieval of pallet stuck up / trapped in the pallet changing operation with sufficient interlocks to be built in into the system so that wrong operation is not permitted with a Pop-up alarm. Possibility of retrieving the tool changer after power failure should also be provided.				<u>Bidder to provide details & comply</u>
1.8.5	Written instructions on how to extract a Pallet trapped anywhere in the AWC cycle and complete M code list for individual functions involved during AWC cycle shall be provided with the machine.				<u>Bidder to comply</u>
1.8.6	Automatic management of pallet offsets.				<u>Bidder to comply</u>
1.8.7	Hand pendant Selector switch positions should have etching for defining the operation to be performed similar to the existing ones on the machine.				<u>Bidder to comply</u>
1.9	<u>MINOR MECHANICAL WORK:</u>				


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1.9.1	<u>Hydraulic power pack:</u> A new hydraulic pressure pump along with electric motor has to be provided with following components mounted on its tank - - Tank with Capacity 100 litres - Main Hydraulic Pump - Pressure Compensated variable delivery pump model - PVQ-20-LSAY-CN or equivalent having following parameters: - Pressure: Main circuit-70 kg/cm² Balance circuit- 65 kg/cm² - Discharge – 63 litre/minute - Motor - SF-E132M, 7.5Kw, 4-pole, 1440 rpm - Oil level indicator (sight glass). - Suitable relief valve. - Pressure switch. - Pressure gauge along with pressure checker. - Air breather. 20-micron filter at the outlet of pumps with clog indicator. - Air bleed valve. - Suction strainer (80 micron). - The main hydraulic pump delivery should have connection for two outlets of ½” BSP and 1/4” BSP connectors. The existing hydraulic power pack is the single source of fluid power to head counter balance, table clamp, spindle orientation, tool lock, spindle gear shift, pallet loader rotate, pallet clamp/changing, AWC lever and rod movement etc. All flexible hoses and any other modification required to connect the new power pack with the machine has to be supplied/done by the vendor. All the supplied hydraulic component should be of Rexroth/Parker/Yuken/Vickers/Hydac/Hawe make. The hydraulic related diagrams are attached as Annexure-1, 2 & 3 for reference.	01 Set		<u>Bidder to provide details and comply</u>
1.9.2	<u>Hydraulic system:</u> All existing Pressure switches are to be replaced with digital elements as per clause no. 1.5.10. All existing solenoid valves are having 110V AC supply. All these valves shall be replaced with 24 VDC coil based elements as per clause no. 1.5.11 The hydraulic logic is to be retained. Any base plates, hydraulic pipes etc. for incorporating the new solenoid valve schemes to be included in the scope of supply. All existing hydraulic hose pipes are to be replaced with new hose pipes of suitable dia. All the oil seals, O-rings, wiper seals of all piston cylinders must be replaced with new oil seals, O-rings, wiper seals of suitable dimensions. The hydraulic related diagrams are attached as Annexure- 1, 2 & 3 for reference.	01 Set		<u>Bidder to provide details and comply</u>


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1.9.3	<u>Lubrication system:</u> The existing gear pump of Willyvogel make (Model-MFE 5) for lubrication is to be replaced with a new one or equivalent of reputed make like Rexroth/Parker/Yuken/Vickers/Hydac/Hawe/Vogel. Lubrication Pump delivery should have one out let connection of ½" BSP connector for connecting hoses to the machine. Proper functioning of the lubrication system has to be checked and restored. The lubrication of X, Y and Z-axes slide ways is performed by Willyvogel make MFE2/BW3 pump. All the piston distributors/metering units installed on the machine is to be replaced with new ones of reputed make. Copper tubes of dia 2 mm, 4mm, 5 mm, 6mm & 8 mm of length 10 m each to be provided.	01 Set			<u>Bidder to provide details and comply</u>
1.9.4	<u>Counter Balance system:</u> Existing counter balance cylinder is to be used ensuring its correct functionality. However, all the oil seals (Piston seal and rod seal), O-rings, wiper seals of the piston cylinder must be replaced with new oil seals (Piston seal and rod seal), O-rings, wiper seals of suitable dimensions.	02 Sets			<u>Bidder to provide details and comply</u>
1.9.5	<u>Headstock Gear lubrication (Oil Mist Lubrication):</u> An air-oil mist unit is to be provided for lubrication of gears of the headstock with 1-liter tank capacity, inlet and outlet pressure gauges, filter regulator. A port of compressed air with pressure of 6 kg/cm² will be provided by BHEL.	01 Set			<u>Bidder to provide details and comply</u>
1.9.6	<u>Table:</u> a) The existing table is to be completely overhauled, to restore it as per original condition/test chart b) All the Seals, O-rings have to be replaced with new ones. c) All the Bearings in the table assembly have to be replaced with the equivalent one of TIMKEN /FAG /SKF/FAFNIR/NTN make only. The exact designation/dimension of the bearing/seal/table parts should be ascertained by the party when the machine will be provided to the party as per clause 3.1 (ii). Apart from the above mentioned work if any other work/modification is required, it will be in party's scope to restore the rotary table.	01 Set			<u>Bidder to provide details and comply</u>
1.9.7	<u>Telescopic Cover:</u> A new telescopic cover is to be provided for X-axis and Z-axis slideways replacing the old one. The exact dimensions of the telescopic covers should be ascertained by the party when the machine will be provided to the party as per clause 3.1 (ii).	01 Set each			<u>Bidder to provide details and comply</u>


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1.9.8	Coolant/Cutting Oil Device: The pump is to be replaced with an equivalent new pump and the adjoining hoses, solenoid valves, relief valve, suction filter, and nozzles are to be replaced with those of Rexroth/Parker/Yuken/Vickers/Hydac/Hawe make. Any base plates, hydraulic hose pipes, connectors etc. for incorporating the new solenoid valves to be included in the scope of supply. All existing hyd hose pipes to be replaced with new hose pipes of suitable dia. The pump used at present is a Torchoid pump 2MM-400-208HAM-VDS of KANSAI make (connected with 400 W, 4 pole motor) mounted over a 100-liter tank. The pressure and discharge of the pump is 5 kg/cm ² and 12 litre/min.	01 Set each		<u>Bidder to provide details and comply</u>
1.9.9	Vendor shall ensure that machine functionality with the new mechanical systems is maintained. Coolant motor & pump shall be replaced with reputed make viz. Grundfos, Brinkmann, Lowara etc. Other coolant items/components shall be of Rexroth/Parker/Yuken/Vickers/Hydac/Hawe make only as mentioned in clause no. 1.9.8.			<u>Bidder to comply</u>
2.	FINAL ACCEPTANCE:			
2.1.	Party shall undertake commissioning of all the supplied components at HEEP, BHEL, Hardwar. All material required for commissioning of the system with the machine shall be arranged by the party free of cost and obligation. All commissioning materials shall be arranged by party for successful running of the machine.			<u>Bidder to comply</u>
2.2	Existing machine logic, PLC, Electrical logic and technological processes have to be retained.			<u>Bidder to comply</u>
2.3	Final Acceptance shall be at HEEP, BHEL, Haridwar after: a) Upon completion of the scope of supply and scope of work at BHEL. b) Final acceptance shall include clearance of all pending issues related to the contract. c) Successful commissioning & Demonstration of various cycles and control functions as envisaged in the technical scope. Party shall demonstrate operation of all parts of the system supplied along with all the features as specified above. After settlement of all pending issues related to the purchase order, a certificate for Completion of works in all respect shall be released within 15 days by Production and Maintenance personnel of BHEL which will be the referred document for Final Acceptance and final payment to the Bidder.			<u>Bidder to comply</u>
3.	<u>DELIVERY: (IF DELIVERY PERIOD IS NOT OFFERED/ ACCEPTABLE, OFFER WILL BE REJECTED):</u>			
3.1	i) Execution of Project: 75 days from date of release of machine for work. The delivery period of work for the purpose of LD as per clause 4 shall be considered from the date of handing over of the machine to vendor for start of work to the date of final acceptance. ii) The party shall be provided the machine within one month for 2 weeks after placement of order to ascertain exact details of material required for mechanical/hydraulic work. Vendor			<u>Bidder to comply</u>


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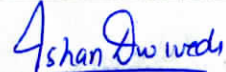

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	shall have to re-assemble the machine and hand-over the machine for production after getting the necessary details.				
4.	<u>LATE DELIVERY PENALTY (LD) CLAUSE:</u>				
4.1	As per clause no. 9 of standard "General Instructions and Standard Terms & Conditions for bidding against Tender Enquiry (GISTC)". LD will be applicable for delay in work (as per clause no. 3 above). Any delay due to reasons attributed to BHEL will not be accounted in delivery period. This period will be excluded for the purpose of calculating LD. For more details check the following link: https://www.bhelhwr.co.in/bhelweb/uploads/GISTC_IND_TE_Ver_Sept18.pdf				<u>Bidder to comply</u>
5.	<u>DOCUMENTATION:</u>				
	Following documents shall be supplied by the Party:				
5.1	CNC system manuals in hard copy comprising of Installation & Start-up guide, Connecting conditions, Configuration guide, Diagnostics guide, Commissioning guide.	01 Set			<u>Bidder to comply</u>
5.2	Commissioning and service manuals of the AC servo drives & Spindle drive in hard copy.	01 Set			<u>Bidder to comply</u>
5.3	New electrical schematic of the complete machine interfacing new CNC System and drives (including wiring diagrams) in hard copy as well as in soft copy.	03 Sets			<u>Bidder to comply</u>
5.4	Programming Manuals.	01 Set			<u>Bidder to comply</u>
5.5	Instructions for data back-up & restoration for CNC, PLC, Feed drives & Spindle drive.	03 Sets			<u>Bidder to comply</u>
5.6	Complete list of bill of materials including make/manufacturer.	01 Set			<u>Bidder to comply</u>
5.7	All documentation (soft copies) mentioned at clauses no. 5.1 to 5.6 above, ghost backup / Image of CNC system, CNC, Spindle & Feed Drive parameters, NC & HMI Data back-up should be provided on Portable hard disk (min. 2 TB).	01 Set			<u>Bidder to comply</u>
5.8	Additional required Softwares for machine maintenance on CD/DVD in installable format.	01 No			<u>Bidder to comply</u>
5.9	Latest Siemens documentation on CD/DVD/USB device viz. DOCON CD/DOCON DVD etc.	02 Nos.			<u>Bidder to comply</u>
6.	<u>WARRANTY:</u>				
6.1	Party shall stand warranty for all the supplied material and work executed for a period of one year from the date of successful hand-over after final acceptance (Ref. Clause no. 2) at BHEL, Haridwar.				<u>Bidder to comply</u>
7.	<u>TRAINING:</u>				
7.1	Party shall impart training to BHEL staff, for operation & maintenance of the system supplied by them during installation & commissioning.				<u>Bidder to comply</u>
7.2	Vendor to arrange one week training for one person for Maintenance & commissioning of CNC				<u>Bidder to comply</u>


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	system, two persons for operating & one person for programming at CNC System manufacturer's works. Expenses for Boarding & Lodging of BHEL personnel during training shall be borne by BHEL.				
8.	<u>VENDOR'S OBLIGATION:</u>				
8.1	The vendor shall bring all tools, tackles and testing equipment with them for successful installation & commissioning of supplied system.				<u>Bidder to comply</u>
9.	<u>PRE-DISPATCH INSPECTION:</u>				
9.1	Pre-dispatch inspection of all the items covered under Scope of Supply at Para (1) shall be carried out by BHEL personnel at party's works.				<u>Bidder to comply</u>
9.2	Supplier shall invite BHEL for carrying out pre- inspection.				<u>Bidder to comply</u>
9.3	Deputed BHEL persons shall do pre acceptance of material under scope of supply at vendor works and give dispatch clearance.				<u>Bidder to comply</u>
9.4	Expenses of Boarding and lodging of BHEL personnel during PDI shall be borne by BHEL.				<u>Bidder to comply</u>
10.	<u>GENERAL CONDITIONS:</u>				
10.1	A point wise compliance statement shall be submitted by the party with reference to the above scope of supply against each clause/ sub-clause with relevant details & comments. Non-compliance to any of the clauses & quoting inadequate quantity can lead to dis-qualification of the offer.				<u>Bidder to comply</u>
10.2	The Vendor is advised to inspect the machine to ascertain all the relevant details required for successful completion of the work.				<u>Bidder to comply</u>
10.3	The proposed electrical schematic & Bill of Material for the machine shall be provided by the vendor prior to pre dispatch inspection.				<u>Bidder to comply</u>
10.4	Complete specifications such as part no./Model/Type of NCU, PCU, Drives & HMI of CNC System shall be stated in the offer by the party. Ordering brochure/catalogue should be attached wherever necessary.				<u>Bidder to comply</u>
10.5	Vendor must compulsorily quote the quantity exactly as per the Scope of supply. No reduction in quantity as per the above Scope of supply is permissible.				<u>Bidder to comply</u>
10.6	Vendor must note that all the replacement work as envisaged in technical scope has to be carried out at BHEL works only. In any case, vendor will not be allowed to transport any major assembly outside BHEL works. Therefore, vendor is advised to inspect the machine before bidding to collect & ascertain all the relevant details required for successful completion of work.				<u>Bidder to comply</u>


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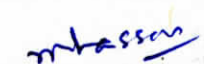

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11.	<u>BHEL'S OBLIGATION:</u>				
11.1	Existing electrical schematic of the machine shall be provided by BHEL to the vendor.				<u>Information to bidder & Bidder to comply</u>
11.2	Crane facility along with lifting tackles, trolleys etc. will be made available free of charge while working in BHEL premises only.				<u>Information to bidder & Bidder to comply</u>
11.3	Facilities of minor welding, brazing, minor machining limited to fitting work /rework etc. will be made available free of cost inside BHEL premises subject to availability.				<u>Information to bidder & Bidder to comply</u>
11.4	Any civil work required for the erection of panel shall be done by BHEL.				<u>Information to bidder & Bidder to comply</u>
11.5	Consumables like lubricants, kerosene oil, cotton waste etc. will be supplied free of cost by BHEL during execution of works inside BHEL premises. Vendor should make his own arrangements for all types of hand tools including pneumatic/electrical drill machines, grinders, scraping tools along with the general purpose measuring instruments, straight edges etc.				<u>Information to bidder & Bidder to comply</u>
12.	<u>INTELLECTUAL PROPERTY RIGHTS:</u>				
12.1	Each Party shall retain its unrestricted rights, title, ownership and interest in its Intellectual Property. Nothing in this work shall be construed to grant to the other Party any right or license in the Intellectual Property rights of the other Party.				<u>Bidder to comply</u>
13.	<u>NON-DISCLOSURE AGREEMENT:</u>				
13.1	All Drawing and Technical Documents relating to the product or it's manufacture submitted by one party to the other, prior or subsequent to the formation of contract, shall remain property of the submitting party. Drawing, technical documents or other technical information received by one party, shall not without the consent of the other party, be used for any other purpose than that, for which they were provided. Such technical information shall not without the consent of the submitting party, otherwise be used or copied, reproduced, transmitted or communicated to a third party. Patterns supplied by BHEL will remain BHEL's property which shall be returned by the bidder on demand to BHEL. Bidder shall in no way share or use such intellectual property of BHEL to promote his own business with others. BHEL reserves the right to claim damages from the bidder, or take appropriate penal action as deemed fit against the bidder, for any infringement of the provisions contained herein.				<u>Bidder to comply</u>

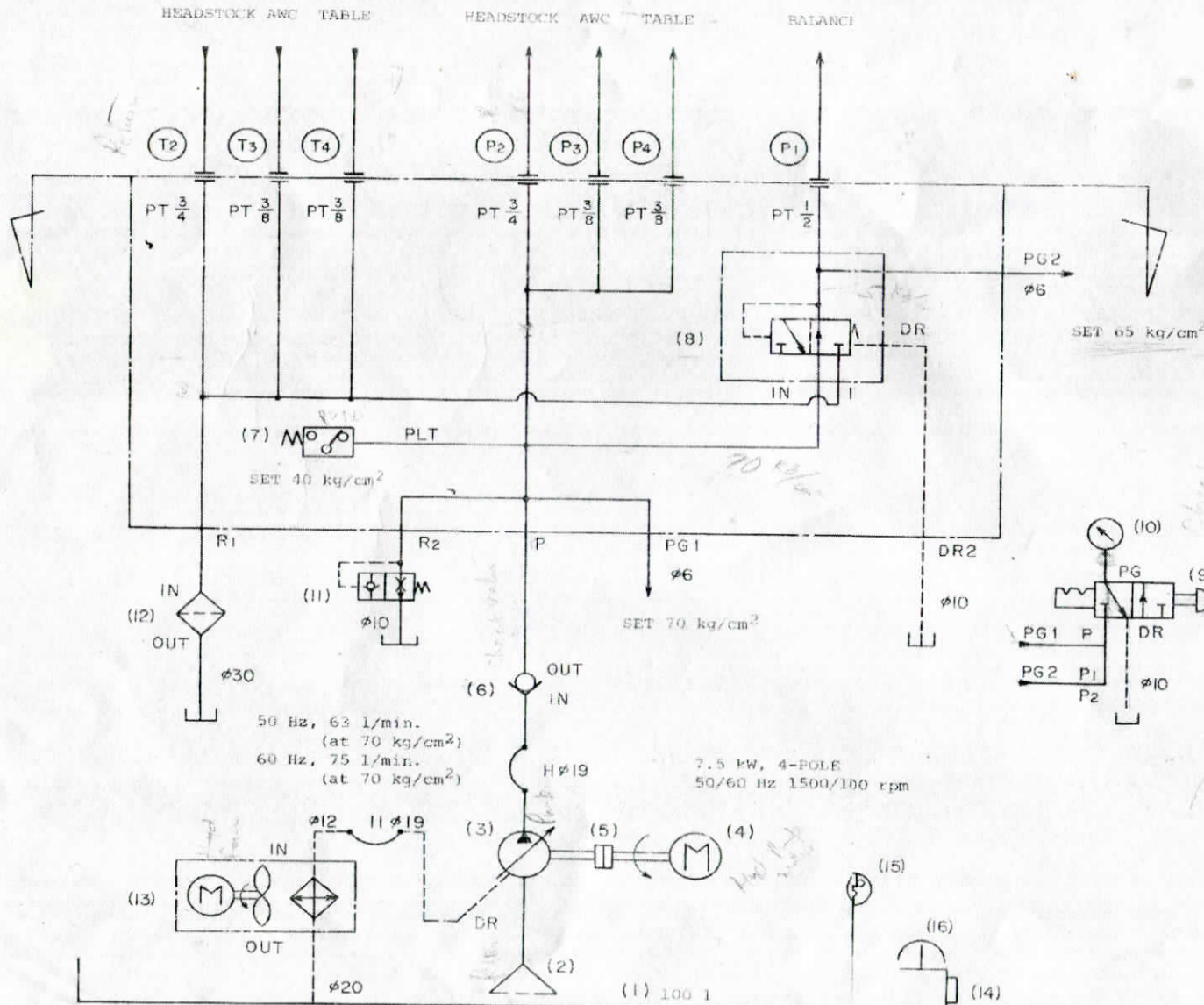

(DEWANT KUMAR)
Dy. Manager (TUM-L&D)


(RAMVAROS YADAV)
Dy. Manager (WEX/MCR)


(ISHAN DWIVEDI)
Sr. Engineer (NCT)


(MUDASSAR HASAN)
Dy. Manager (WEX/MAINT-3)


(RISHABH GUPTA)
Manager (WEX/CNC-NBS)



ITEM	QTY	NOMENCLATURE
1	1	OIL RESERVOIR CAPACITY 100 liters (TOYOOKI)
2	1	STRAINER SPW-08-150 (TAISEI)
3	1	OIL PUMP PVO-20-LSAY-CN (NIHON OIL GEAR)
4	1	ELECTRIC MOTOR SP-EL32M 7.5 kW 4P (MITSUBISHI)
5	1	COUPLING CR-5015U (TSUBASIMOTO)
6	1	CHECK VALVE HK3-ETI-05A (TOYOOKI)
7	1	PRESSURE SWITCH HW3-02023 (TOYOOKI)
8	1	RELIEF REDUCING COMPOSITION VALVE HG-03012A (TOYOOKI)
9	1	PRESSURE CHECKER H-02095 (TOYOOKI)
10	1	PRESSURE GAUGE DPU 1/4 x 60 x 150 (NAGANO)
11	1	AIR-BLEED VALVE H-02096 (TOYOOKI)
12	1	LINE FILTER SP-08-10 (YAMASHIN)
13	1	AIR COOLER AOC-T040A-SE (KAMUI)
14	1	OIL LEVEL GAUGE NEW O-1TYPE (KCHO)
15	1	THERMOSTAT 23810 (NIHONPENALL)
16	1	OIL SUPPLY PORT AND AIR BREATHER SAB-50P (TOKYOROKA)

D. K. K.

(DEWANT KUMAR)
Dy. Manager (TUM-L&D)

21mgy

(RAMVAROS YADAV)
Dy. Manager (WEX/MCR)

Ishan Dwivedi

(ISHAN DWIVEDI)
Sr. Engineer (NCT)

mhasan

(MUDASSAR HASAN)
Dy. Manager (WEX/MAINT-3)

Rishabh Gupta

(RISHABH GUPTA)
Manager (WEX/CNC-NBS)

Indent No: S/6180/2019/1463/U

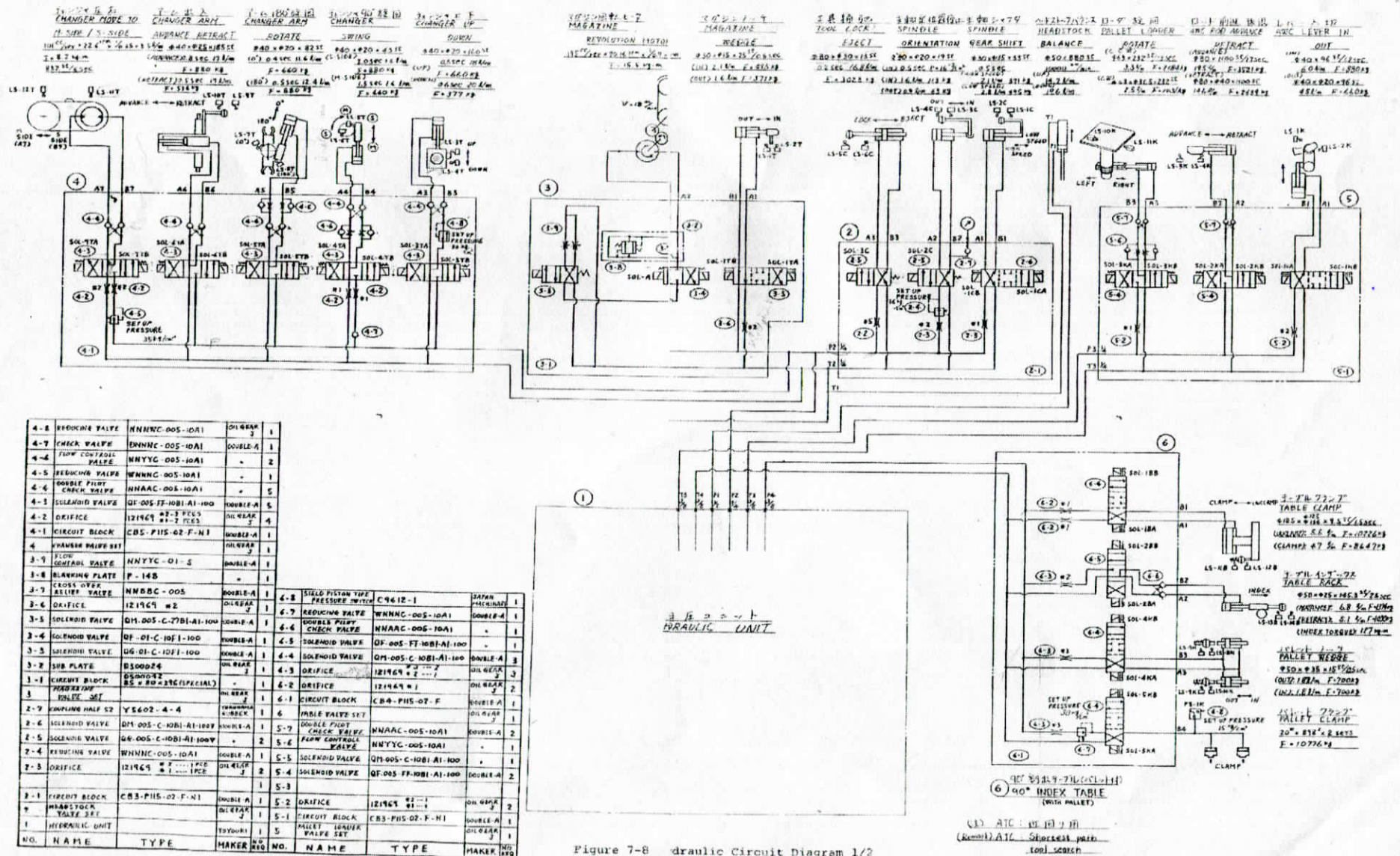


Figure 7-8 Hydraulic Circuit Diagram 1/2

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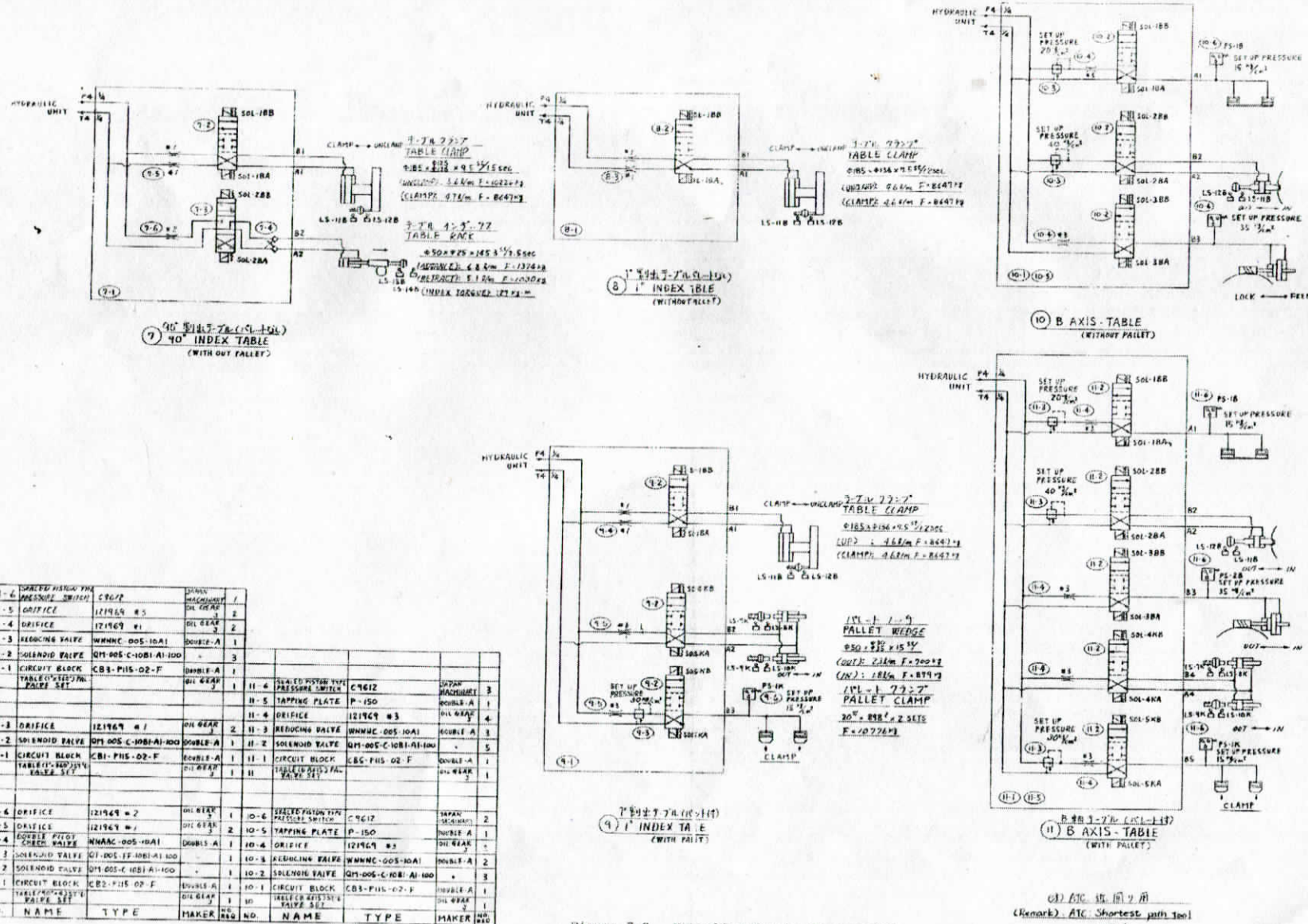


Figure 7-8 Hydraulic Circuit Diagram 2/2

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