

		BHARAT HEAVY ELECTRICAL LIMITED, BHOPAL		
				REV: 01
TECHNICAL SPECIFICATION CUM COMPLIANCE CERTIFICATION FOR "MANUFACTURING LINE OF TRANSFORMER RADIATOR ELEMENTS" SPECIFICATION No. - FBM-2024-09-FTM01				
IMPORTANT NOTE:- 1. Vendor must specify in detail with evidence of complete specification against each clause. Offers with incomplete clause no 17 will be treated as technically disqualified. 2. The "Offered" column and where applicable, the "Deviations" & "Remarks" column of this format shall be filled by the vendor and specified along with the offer. Inadequate/ 3. The offer and all documents enclosed with offer should be in english language only. 4. All dimensions are in mm unless otherwise stated.				
ADDRESS OF THE SUPPLIER :		ADDRESS OF THE OEM :		
TELEPHONE NOS :		TELEPHONE NOS.:		
FAX NOS :		FAX NOS.:		
E-MAIL ADDRESS :		E-MAIL ADDRESS :		
SCOPE: SUPPLY, ERECTION & COMMISSIONING OF MANUFACTURING LINE OF TRANSFORMER RADIATOR ELEMENTS AS SPECIFIED BELOW				
S. No.	DESCRIPTION OF BHEL REQUIREMENT	VENDOR TO CONFIRM/SPECIFY	VENDOR's OFFER	REMARK(if any)
1.0	GENERAL :-			
1.1	Purpose: (Operation/Jobs involved) Transformer radiator elements are formed by welding 2 Nos. of 1.25 mm thick Panels (Sheets) having flutes. The weight of a radiator element is max. 40 Kgs. Initially sheets are pre-assembly then multi-spot welding and longitudinal seam welding operations of the parallel edges are carried out and the elements are discharged on the pallet kept at the discharge end. After It, seam welding of the cross edges of radiator elements is to be carried out, followed by flattening of welded panel and trimming & de-burring of edges. Refer Drawing :- 24-FTM-001 & 1499430001 Rev 14 for details of job. 1. It is proposed to introduce The "Manufacturing Line of Transformer Radiator Panels" will encompass:- a. Retro -fitting of existing flute rolling machine with addition of embossing collar forming and shearing at BHEL. b. Tack welding machine for panels before multi spot welding. c. Multi spot welding machine with provision to weld panels of customized length. d. Duel end seam welding machine. e. End seam welding machine. f. Flattening of welded panels. g. Trimming & Deburring of panels. The overall arrangement shall have additional feature of Ducting and Chimney for fume extraction. This line will be semi automatic after loading the panels for tack welding. In the same, a new resistance seam welding machine along with PLC based control panel, pneumatic circuitries, etc. is to be provided. 2. Pipe Notching press for twin slot punching of header pipes:- During transformer radiators manufacturing, radiator elements are welded to the electric resistance welded (ERW) header pipes and for the same, it is required to create twin slots on these header pipes at uniform pitch along the length of the header.	Indentor Vendor to Note		
1.2	Work Piece Material:	Indentor		

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	Radiator Element:			
1.2.1	Max. Job weight = 40 Kgs.	Vendor to Note		
1.2.2	Max. Length of the job = 3500 mm	Vendor to Note		
1.2.3	Min. Length of the job = 1800 mm	Vendor to Note		
1.2.4	Max. Width of the job = 520 mm	Vendor to Note		
1.2.5	Min. Width of the job = 250 mm	Vendor to Note		
1.2.6	Max. Length of cross weld = 250 mm	Vendor to Note		
1.2.7	Thickness of sheet — 1 to 1.25 mm	Vendor to Note		
1.2.8	Material = M.S. / S.S / CRCA	Vendor to Note		
2.0	CONFIGURATION: The Proposed MANUFACTURING LINE OF TRANSFORMER RADIATOR ELEMENTS broadly comprise of following sub-systems.			
2.1	The "Manufacturing Line of Transformer Radiator Panels" will encompass: 1. De-coiling, 2. Flute rolling, 3. Embossing collar forming and shearing, 4. Automation of assembly fitting of radiator panel elements and spot welding, 5. Dual seam welding, 6. Cross dual seam welding, 7. Flattening, 8. Trimming, 9. Deburring and additional feature of Ducting and Chimney for fume extraction. This line will be Semi-automatic with manual feed option available.	Vendor to Note		
2.2	Radiator Element: Width: 520 mm Length: 3500 mm No. of flutes: 7 X 3 = 21 Sheet thickness: 1 to 1.25 mm	Vendor to Note		
2.3	A PLC based control system for controlling & sequencing various electro-mechanical activities.	Vendor to Note		
3.0	Operation Description :-			
3.1	Each transformer radiator element is made by welding 2 nos. of fluted panels made out of 1.0 to 1.25 mm thick sheets of M.S./S.S. The shape, dimensional details as well as the operations involved in the assembly of each radiator element is given in the 24-FTM-001 & 1499430001 Rev 14. As is evident from the drawing, panel pre-assembly; multi-spot welding; longitudinal seam welding and cross end seam welding operations are required to be done for assembling a radiator element out of a pair of fluted panels. Max. weight of each assembled element is around 40 Kgs.	Vendor to note		
4.0	SPECIFICATIONS:-			
4.1	UNIT-1 (LINE INVOLVE WELDING)			
4.1.1	TACK (SPOT) WELDING MACHINE STATION: Single phase AC 75 KVA Spot welding machines (2 Nos.) {For stitching the Radiator panel before feeding to multi-spot-weld machine}	Vendor to confirm		
	It should be 4 head special purpose tack (spot) welding arrangement, with PLC & HMI control with working Height (in mm (approx.)) : 900-1000 with proper cooling system.	Vendor to confirm		
	Machine should have four spot welding guns mounted on a table, with two 75 KVA transformer with rated input voltage 415 V, Three Phase, 50 Hz placed inside the machine frame.	Vendor to confirm		
	It should be suitable for welding four spots, two spots at the start of the panel and two spots at end of the panel, to join two halves of radiator panels prior to multi spot welding. Input motorized conveyor shall be provided for panel sliding.	Vendor to confirm		
	Operator would manually load the two radiator panel sheets at loading side of the machine.	Vendor to confirm		
	After placing the radiator panel in the front input conveyor, machine should have arrangement to match the both sheets and slide towards the tacking machine for panel tacking.	Vendor to confirm		
	Both the halves of Radiator panel will get tack welded with each other prior to entry of job in multi head spot weld machine.	Vendor to confirm		

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	It should have arrangement for sliding by motor + Gear box and rack & pinion arrangement, with input conveyor length to suit the requirement.	Vendor to confirm		
4.1.2	SYNCHRONIZED HYDRAULIC OPERATED AC MULTI-HEAD SPOT WELDING MACHINE :			
	The process of multi spot welding should be as per following - Initially the panel should be clamped with servo motor drive at first welding spot position, then sheet should be clamped at neck area on both ends. Now all electrode from TOP and corresponding BOTTOM electrodes should move towards the sheets. Once the sheet gets clamped, welding transformers shall be energized and the welding current will be switched ON. Welding cycle should be repeated till end of the first row. After first row spot completed, the Top & Bottom Electrodes are de clamped and sheets should be indexed automatically according to set pitch and the cycle repeats & the similar process should be continued till the completion of last row of the panel as required.	Vendor to confirm		
	Machine Frame: Fabricated very heavy robust and rigid strong welded MS steel frame on which 8 hydraulic cylinders mounted one beside the other; similar arrangement is at the bottom.	Vendor to confirm		
	Welding Transformer:	Vendor to confirm		
	It should be suitable for welding 6 or 8 spots on radiator panel with a minimum pitch of 63mm and maximum pitch of 75mm. Machine should have arrangement for welding either 6 or 8 spots according to the requirement.	Vendor to confirm		
	Vacuum moulded encapsulated water-cooled energy saving welding transformer rating AC 150 KVA @ 50% Duty cycle. Input supply voltage 415V AC, 50 Hz.- mounted on machine. Qty. - 6/ 8 nos	Vendor to confirm		
	It must have Efficient internal cooling system of the transformer, machine must be compact yet efficient with its low impedance properties. It should draw very low energizing current such that system works efficiently.	Vendor to confirm		
	Welding heads (Pressure head assembly):			
	Welding heads @ Top & Bottom in single row with sequential welding: Round RAM with hardened and ground steel, moving accurately bored cast iron housing for quick response and high production.	Vendor to confirm		
	It should have T-slot table mounted on the top side of the frame with adjustable pitch for better quality of spot welding. Qty. 6/8 Nos.	Vendor to confirm		
	Machine should have arrangement such that welding current is passed through all welding head using separate welding transformers and single welding controller.	Vendor to confirm		
	It should have thermostat for transformer & thyristor protection.	Vendor to confirm		
	Hydraulic			
	Machine should have reputed make standard Hydraulic power pack, to operate all hydraulic pressure head alongwith indexing of panel and clamping and also Hydraulic indexing for subsequent row welding.	Vendor to confirm		
	Hydraulic Welding Heads - 12/ 16 nos with hydraulic cylinders (6/8 Welding Head on Top, 6/8 Welding Head on Bottom)	Vendor to confirm		
	It should be suitable for welding of radiator panel with maximum width of 520 mm. Machine working height should be (in mm approx): 900-1000 mm. & welding speed should be minimum 2.5 meters/Min.	Vendor to confirm		
	Welding Controller	Vendor to confirm		
	Machine should have AC welding controller with thyristor contactors to fire the all 6/ 8 welding transformers – 3/4 nos.	Vendor to confirm		
	It should have synchronous CMOS IC based welding controller with thyristor and thyristor panel (2 Nos.).	Vendor to confirm		
	Controller should withstand the fluctuations in the source voltage supply.	Vendor to confirm		
	The machine uses 6/8 SCR units connected to the 3/4 welding controller and it energize eight welding transformers one after another.	Vendor to confirm		
	Electrodes	Vendor to confirm		
	The top and bottom electrodes 12/16 nos. should move with hydraulic cylinders.	Vendor to confirm		
	Electrode Top & Bottom -3/4 nos. (Standard)	Vendor to confirm		
	There shall be provision in the system such that center distance between the welding electrodes should be adjustable from minimum 50mm to maximum 70mm range.	Vendor to confirm		

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	Water cooling	Vendor to confirm		
	Entire system shall have arrangements for water cooling piping and air piping with different colour code: Push in type connector/fitting for easy maintenance.	Vendor to confirm		
	Clamping	Vendor to confirm		
	Machine should have LM guides for travel of sheet panels with clamping arrangement.	Vendor to confirm		
	The machine should be equipped with clamp arrangement to clamp the radiator panel at the neck on both ends and facilitate easy loading of the component.	Vendor to confirm		
	PLC & HMI	Vendor to confirm		
	Machine Control should be reputed make & would have standard cabinet suitable for I/O, PLC & Wiring & HMI for easy fault finding & sequencing of operation. .	Vendor to confirm		
	There should be an motorized indexing mechanism, controlled by servo motor with ball screw and clamping arrangement to clamp two panels at neck from both ends for making spots at required pitch distance.	Vendor to confirm		
	Machine should also have following secondary connections & accessories:	Vendor to confirm		
	Pneumatic solenoid valve,	Vendor to confirm		
	Air valve	Vendor to confirm		
	Air filter,	Vendor to confirm		
	Regulator,	Vendor to confirm		
	Pressure gauge	Vendor to confirm		
	Foot switch	Vendor to confirm		
	FRL unit	Vendor to confirm		
4.1.3	AC (150 KVA + 150 KVA) energy saving Dual head circumferential seam (Set of two machines-LH & RH) welding machine with MFAC controller			
	Welding machine			
	This machine is required for longitudinal seam welding of radiator panels, upon completion of multi-spot welding operation, the sheets are passed into a dual seam welding machine. The machine should be suitably placed face-to-face to carry out seam welding of two long sides of transformer radiator panels simultaneously. Both the machines will be mounted on a common base with an adjustable slide with Lead Screw & Hand wheel to adjust distance between two machines to weld radiator of different width.	Vendor to confirm		
	Welding transformer used in the machine should be encapsulated water cooled 150 KVA single phase 415V AC welding transformer rating @50% duty cycle (2 Nos.).	Vendor to confirm		
	Welding speeds of both machines should be controlled with the help of synchronized drive, to have equal welding speeds. Accessories like pneumatic solenoid valve, air filter, regulator, pressure gauge & foot switch with microprocessor based weld controller model ME 412, with thyristor contactors.	Vendor to confirm		
	Machine should have sensors for component sensing at the time of welding and also at after the welding.	Vendor to confirm		
	Machine should be supplied with following Accessories: 1. Machine would have suitable capacity I/O PLC for sequencing operation. 2. Standalone operator pendant box would be provided with HMI. 3. Reputed make solenoid valve on the machine. 4. Standard FRL limit. 5. Wordsworth make Air valve.	Vendor to confirm		
	Frame	Vendor to confirm		
	Robust and Rigid machine frame.	Vendor to confirm		

S. No.	DESCRIPTION OF BHEL REQUIREMENT	VENDOR TO CONFIRM/SPECIFY	VENDOR's OFFER	REMARK(if any)
	Base of the machine is common and heavy fabricated platform type on which both seam welding machines are mounted and adjustable inside to outside to weld 520 mm width radiator fin.	Vendor to confirm		
	Pressure head	Vendor to confirm		
	Both machines should have special designed pressure head with precise machined hardened and ground ram.	Vendor to confirm		
	Pressure head assembly should have low inertia ram for good quality weld with reputed make pneumatic cylinder.	Vendor to confirm		
	Machine should have Ø 300 x 12 mm thickness welding electrode wheel with 4 mm welding track at top and bottom.			
	Welding controller: VFAC 800A, IGBT based welding controller (2 Nos.).	Vendor to confirm		
	Welding cylinders: Suitable capacity stroke adjustable welding cylinders.	Vendor to confirm		
	Top head should be adjustable by Pneumatic cylinder	Vendor to confirm		
	Bottom head should be adjustable by Pneumatic cylinder	Vendor to confirm		
	Throat depth: Both machines would have minimum throat depth to save energy. - 400mm	Vendor to confirm		
	Electrode housing	Vendor to confirm		
	Both machines would have electrode housing of Cu-Cr with silver contact bearings inside the housing to get better weld quality.	Vendor to confirm		
	Electrode wheel	Vendor to confirm		
	Machine should have electrode wheel mounted & should have internal cooling as well as external flood cooling arrangement. External knurl wheel drive is to be given to the welding wheels	Vendor to confirm		
	Machines should have common drive motor and gear box connected with each machine and gear train assembly to give both electrode wheels drive.	Vendor to confirm		
	To maintain equal speed of the both machines would have periphery drive with both wheels by profile drive and a common drive for both of the machines.	Vendor to confirm		
	Bottom electrode should have lifting arrangement with manual slide for wear compensation adjustment.	Vendor to confirm		
	Cooling Arrangements	Vendor to confirm		
	Both machines should have water cooling pipe in different colour code:	Vendor to confirm		
	Machine should have inlet and outlet water manifolds & should have different colour code for water-in and water-out pipe line.	Vendor to confirm		
	Air and water piping should be with PU tubing with push in type connectors/fitting for easy maintenance.	Vendor to confirm		
	Multi-tech make Water flow switch only for transformers.	Vendor to confirm		
4.1.4	AC 150 KVA or 100KVA Longitudinal seam welding machine			
	Welding machine			
	Encapsulated water cooled welding transformer of capacity 150 KVA @ 50 % duty cycle at Rated Input Voltage 440 V, Three Phase, AC @ 50Hz. - 2 Nos having top & bottom Silver Contact weld wheel holders, mounted on anti-friction Y side with Lid screw & AC Motor drive.	Vendor to confirm		
	A seam welding machine with transformer rating 150KVA @ 100% duty cycle . The machine is to be with bottom fabricated bed with suitable for welding the end seam inclined at 12 deg orientation. A programmable microprocessor based welding controller is to be provided for controlling welding cycle. The seam welding machine is to be roller type having internal water based cooling arrangement of the copper welding wheels. Water line for the cooling of wheels and cooling of transformer is to be incorporated into the seam welding machine. External knurl wheel drive is to be given to the welding wheels. Rotational speed is to be controlled by a suitable AC vector drive. Further, both the welding wheels are to be actuated through pneumatic cylinders for applying the required force on radiator element during welding. In flute elements welding shall start from one corner and proceed at 12 deg. followed by welding on subsequent edge. Wheels should be designed such that welding is possible right upto the corner point so that no leakage occurs at the intersecting points between longitudinal and transverse weld seams. A scale is to be provided on the bottom of the machine for adjusting the machine as per job length.	Vendor to confirm		

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	Machine should have the facility to weld two inclined (at an angle of 12 deg) short sides of radiator panel.	Vendor to confirm		
	Machine should be complete with accessories like pneumatic solenoid valve, air filter, regulator, pressure gauge & foot switch with microprocessor based weld controller with thyristor contactors.	Vendor to confirm		
	Frame	Vendor to confirm		
	Machine frame: Heavy duty fabricated robust and rigid machine frame. Fabricated structured base made of from channels.	Vendor to confirm		
	Movement of the machine: Machine base should have rail runner block for forward and backward or pneumatic cylinder arrangement for both side degree	Vendor to confirm		
	Welding controller	Vendor to confirm		
	Welding controller should be programmable microprocessor based with latest features VFAC 800A, IGBT based welding controller -2 nos	Vendor to confirm		
	Pressure head	Vendor to confirm		
	The machine should have pressure head assembly with reputed make pneumatic cylinder for good quality weld.	Vendor to confirm		
	Machine should have Ø 300 x 12 mm thickness welding electrode wheel with 4 mm welding track at top and bottom.	Vendor to confirm		
	Top head — adjustable by Pneumatic cylinder	Vendor to confirm		
	Bottom head — adjustable by Pneumatic cylinder	Vendor to confirm		
	Electrode wheel	Vendor to confirm		
	Standard wheel size top wheel- Dia 300 X 10 mm thickness (approx..)	Vendor to confirm		
	Standard wheel size bottom wheel- Dia 300 X 10 mm thickness (approx..)	Vendor to confirm		
	Electrode wheel mounted on the machine	Vendor to confirm		
	Drive to copper wheel - External drive through knurl wheel	Vendor to confirm		
	Copper Wheels —to be water cooled from inside	Vendor to confirm		
	Cooling water - Nominal pressure b/w 3-4 bar.	Vendor to Note		
	Cooling water consumption — To be specified by manufacturer	Vendor to specify		
	Available max. air pressure at BHEL— 4 bars.	Vendor to Note		
	Machine should have inlet and outlet water manifolds & should have different colour code for water-in and water-out pipe line.			
	Air and water piping should be with PU tubing with quick-change connector type as per standards. push in type for easy maintenance.			
	Air valves: Wordsworth make			
	The tapping threads for bolting the copper discs should be having bolt with recoil insert for better strength and to avoid cutting of threads.	Vendor to confirm		
	Electrode lifting arrangement	Vendor to confirm		
	One of the seam welders should be mounted on the base while the other should be on an adjustable platform which will allow the user to move it forward or backward in case of a change in the width of the radiator fin.	Vendor to confirm		
	Bottom electrode lifting arrangement would be manual as per bottom electrode wear.	Vendor to confirm		
	Top electrode height should be adjusted by nuts on pneumatic stroke adjustable cylinder for electrode wear.	Vendor to confirm		
	The drive mechanism should be provided to the entry and exit rollers while the seam welding wheels rotate freely. The lower electrode wheel can be lifted or lowered in case of wear in the electrode diameter.	Vendor to confirm		
4.2	UNIT-2 (LINES BEFORE AND AFTER WELDING)			
4.2.1	LINE BEFORE WELDING	Vendor to confirm		

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	520 mm die without scarp and corner cutting die and Collar forming along with embossing	Vendor to confirm		
	Collar forming of 5-8mm size will be required on both sides of the panel along with facility for embossing and shearing on both ends. Press machine should be suitable for embossing of plate having thickness 1-1.25mm. Height of the machine will be approx 1000mm from the ground level.	Vendor to confirm		
		Vendor to confirm		
4.2.2	LINE AFTER WELDING	Vendor to confirm		
4.2.2.1	Heavy duty straightening and side cutting machine Trimming and coining unit/machine	Vendor to confirm		
	This unit is for straightening the fin and Trimming the edges on precise width and coining the slited edges, it should be done in 2 stage pneumatic cylinder.	Vendor to confirm		
	It should have very heavy duty and robust fabricated frame and table, heavy structural material shall be used for fabrication. A box type frame with thick plate will be recommended at the top on which whole machine assembly will be mounted.	Vendor to confirm		
	Machine should have hardened and ground pinch rollers, mounted at the entry level. There shall be 4 nos. pinch rollers. 2 nos. at top and 2 nos. at bottom fitted with bearings. Top rollers should be adjustable up and down with the help of cylinders to close and open.	Vendor to confirm		
	The machine should have very heavy duty hardened and ground spindles and cutters fitted after pinch rollers.	Vendor to confirm		
	There shall be 2 nos. spindles and cutters arrangement. One will be at top and another will be at bottom side. Both will be engaged with each other for proper and smooth cutting. Guard should be provided for cutting rollers.	Vendor to confirm		
	Straightening arrangement: The machine should have sufficient roller assembly for straightening of welded fin. All rollers should be hardened and ground for long life and for better result. All rollers should have provision for manual adjustment as per requirement. All rollers should be connected with each other and same should be connected with main cutter spindle to drive.	Vendor to confirm		
	The machine should have guide rollers in between every stage and rollers to make sure that panel travel should be straight.	Vendor to confirm		
	The machine should have coining tool (hardened hour glass shape with notch at center) at the exit point to round up the trimmed edge of fin.	Vendor to confirm		
	Trimmed width of panel should be 518mm,	Vendor to confirm		
	Trimming Rollers should be EN -31 Hardened.	Vendor to confirm		
	Drive Motor 5 HP, planetary gear box with Suitable ratio	Vendor to confirm		
	Speed should be minimum 3.5 to 4 meters per min.	Vendor to confirm		
4.2.2.2	End shearing machine	Vendor to confirm		
	The End shear machine should be hydraulically operated with with 5 HP motor.	Vendor to confirm		
	Both top and bottom plates should move during shearing operation for supporting the panel properly during shearing operation	Vendor to confirm		
	The approach end of fresh panel and trailing end of earlier panel should be sheared at a time.	Vendor to confirm		
	Machine shall be designed such that after shearing, old panel should get ejected from exit conveyor where as fresh panel should come forward and should wait for next panel to end shear together.	Vendor to confirm		
	This unit should finish cut the edges and corner of the fin on prefect length and the corner on radius shape (518 mm width fin should accommodate corner on radius)	Vendor to confirm		
	20 mm corner radius is compulsory for 520 mm width panel.	Vendor to Note		
4.3	CONVEYORS :	Vendor to confirm		
	Equipment type Powered Roller Conveyor system 700 mm width is required for smooth movement of elements.	Vendor to confirm		
	Rollers 50mm dia x 720mm long Zn Plated is recommended.	Vendor to confirm		

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	Maximum weight of job will be 75 Kg.	Vendor to confirm		
	Rollers pitch should be minimum 100mm.	Vendor to confirm		
	Frame fabricated from MS powder coated section and should have geared motor.	Vendor to confirm		
	Adjustable side guides 25mm high (400-700mm),	Vendor to confirm		
	Height should be approx 970+/- 50mm, speed 2-4m/min fixed speed,	Vendor to confirm		
	Sensor provided at the start and end of the conveyor.	Vendor to confirm		
4.3.1	Out conveyor from embossing machine	Vendor to confirm		
	There should be motorized conveyor with the roller assembled with the help of bearing for both side for smooth movement of the material.	Vendor to confirm		
	This conveyor would control the position for trailing end of panel from embossing machine and shall keep the panel smoothly.	Vendor to confirm		
4.3.2	Motorized drive roller conveyor with pneumatic cylinder aligned two panels for input to tack welding machine	Vendor to confirm		
	Manual conveyor fabricated robust structure made from square MS tube.	Vendor to confirm		
	Length of the manual roller conveyor should be suitable to have one radiator panel size 3.5 meter.	Vendor to confirm		
	Pneumatic cylinder should be provided for alignment of two panels with header locator.	Vendor to confirm		
	Conveyor should have both side rollers to support radiator panel to maintain the center distance.	Vendor to confirm		
	Conveyor length should be approx 4 Meter.	Vendor to confirm		
4.3.3	Motorized drive roller input feeding Conveyor for multi-spot-welding machine	Vendor to confirm		
	These feeding conveyor should be fabricated with robust structure made from square MS tube.	Vendor to confirm		
	Length of the feeding conveyor should be suitable to have one radiator panel size 3.5 meter.	Vendor to confirm		
	The conveyor should have rollers for transportation of radiator panel fitted at suitable pitch.	Vendor to confirm		
	Feeding conveyor should have both side rollers to support radiator panel to maintain the center distance.	Vendor to confirm		
	Sensor should be provided at the start and end of the conveyor.			
	Conveyor length should be approx 7 Meter.	Vendor to confirm		
4.3.4	Motorized drive conveyor for carrying spot welded panel from multispot welding machine to dual head circumferencial seam welding machine.	Vendor to confirm		
	There should be motorized conveyor with the Roller assembled with the help of bearing on both side for smooth movement of the material.	Vendor to confirm		
	This conveyor should be controlling the position of the panel at circumferencial seam operation.	Vendor to confirm		
	Sensor should be provided at the start and end of the conveyor.			
	Conveyor length should be approx 7 Meter.	Vendor to confirm		
4.3.5	Motorized drive conveyor for carrying seam welded panel from dual head Circumferencial seam welding machines to longitudinal/end seam welding machine.	Vendor to confirm		
	The seam welded panel should pass through motorized conveyor to the end seam welding machine.	Vendor to confirm		
	There should be pneumatic clamping provided to panel to get positioned correctly for end seam welding.	Vendor to confirm		
	The pneumatic clamping should operate with the help of sensor to clamp the panel during end seam welding so that there would be no movement during welding.	Vendor to confirm		
	There should be pneumatic clamps are provided as soon as panel gets positioned correctly for other End seam welding.	Vendor to confirm		
	Conveyor length should be approx 4 Meter.	Vendor to confirm		
4.3.6	Out conveyor from end seam welding machine	Vendor to confirm		
	Out conveyor from End seam and it shall act as a feeding conveyor for straightening and trimming operation.	Vendor to confirm		

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	There should be motorized conveyor with the roller assembled with the help of bearing for both side for smooth movement of the material.	Vendor to confirm		
	Conveyor length should be approx 4 Meter.	Vendor to confirm		
4.3.7	Out conveyor after straightening and trimming operation	Vendor to confirm		
	Out conveyor after straightening and trimming operation and it shall act as a feeding conveyor for straightening and trimming operation.	Vendor to confirm		
	There should be motorized conveyor with the roller assembled with the help of bearing for both side for smooth movement of the material.	Vendor to confirm		
	This conveyor is called entry conveyor from end shearing machine and it should be controlling the position of the panel at end shearing operation.	Vendor to confirm		
	Conveyor length should be approx 4 Meter.	Vendor to confirm		
4.3.8	Out conveyor from end shearing machine	Vendor to confirm		
	There should be motorized conveyor with the roller assembled with the help of bearing for both side for smooth movement of the material.	Vendor to confirm		
	This conveyor should control the position for trailing end of panel to end shear.	Vendor to confirm		
	Conveyor length should be approx 4 Meter.			
4.3.9	Synchronizing controllers	Vendor to confirm		
	There should be control panel for synchronizing motions of all conveyors and individual controls of the machines.	Vendor to confirm		
	The control panel should have the PLC and HMI for controlling motions and feeding basic panel dimensions.	Vendor to confirm		
4.4	Pipe Notching press for twin slot punching of header pipes :-			
	CONFIGURATION OF PRESS (Refer drg. no. 3-MTD-21-2472, Rev-I) :- The hydraulic press would be having a station for making twin slots. The hydraulic cylinders of the station would be pressurised by a hydraulic power pack near the header punching station & connected through rigid seamless tubing. A control panel to be provided for housing the drives, PLC, contactor etc. for the station. Control desk is to be provided separately for the station which should have cylinder expansion, contraction, emergency buttons etc.	Vendor to Note		
4.4.1	Design			
	Design of hydraulic notching press should be according to the latest standards keeping latest trends and developments in mind. Manufacturer may examine the ERW header pipes and should design the press accordingly. Before taking up manufacturing, the Manufacturer should get the detailed drawings of their proposed press duly concurred by us. However the responsibility of proving would lie with manufacturer.			
4.4.2	Twin slot punching station :-			

S. No.	DESCRIPTION OF BHEL REQUIREMENT	VENDOR TO CONFIRM/SPECIFY	VENDOR's OFFER	REMARK(if any)
	<p>This station would have a four column down-stroking press configuration comprising of rigid fabricated structure, hydraulic cylinder, guide rods, guide bushes, pipe feeding mechanism, support, tool holder with notching tool for creating desired twin slots on the header pipes, suitable internal as well as external die set, hydraulic power pack, control panel etc. generally in line with our drawing no.: FTM-24-002. The pipe feeding mechanism would consist of a suitable hydraulic collet type arrangement for holding the pipe which would have motorised traverse on LM guides by ballscrew and nut arrangement. Suitable telescopic covered bellows are to be provided for the LM guideways. The notching operation is to be powered by a double acting hydraulic which would be suitably guided by two guide rods of diameter around 75 mm. Suitable guide bushes are to be provided conforming to IS 8127. Suitable internal as well as external die set are to be provided for punching the header pipe and pipe should have sliding fit tolerance to slide over the internal die.</p> <p>Internal die is to be provided with pneumatically actuated/ suitable expansion mechanism to arrest the deflection of pipe during punching. Sequencing of this mechanism to be controlled through PLC. Tool material should be powered high speed tool steel/ suitable should have excellent toughness, wear resistance and fatigue strength. Cylinder stroke is to be limited by limit switch. A support table having V-block with PU liner is to be provided after the punching station to support the overhanging portion of the header pipe. A lubrication arrangement is to be provided for tool & die set to minimize the tool wear. Pressing force of the press should be adjustable upto 40 tons. Electric DC valve for actuation of cylinder is to be provided. All hydraulic tubing should be rigid tubing wherever possible. Maximum 40 pairs of slots are to be created on each header pipe. Automatic feeding of pipe is to be achieved by a PLC based control system. An EM clutch, braking arrangement and encoder based feedback mechanism/ suitable drive arrangement is to be provided to achieve the desired results. A vector drive of rating 1 HP/ suitable is provided. A TD200/ suitable HMI is to be incorporated on the control desk for providing data interface for operation & fault enunciation. Power pack and feeding arrangement should be suitable to achieve cycle time of 6 seconds to punch and advance to next punch position. Further, an internal and external die set & punch for circular slot of Dia25mm is to be provided.</p>	Vendor to Confirm.		
4.4.3	Header positioning & Punching :-			
	Initially circular slot of Dia 25mm would be created and then twin slots would be created at the punching station. Since twin slots are to be created 180° opposite to circular slot, two nos. of spring loaded locating pins are to be provided for eliminating the indexing error during manual indexing. For the same, one pin is to be provided at the table of punching station and other pin at common supporting table. Pin would be inserted inside the circular slot created on the pipe to achieve indexing accuracy before clamping the header pipe at the punching station. Position of hydraulic collet should be such that the first twin slot is created at 125 mm from zero line reference of header pipe as shown in our drg. no. 24-FTM-002 . Further, suitable mechanical stopper is to be provided such that circular slots are created at a distance of 84 mm from the header end face.	Vendor to Confirm.		
4.4.4	Specification :			
4.4.4.1	Job Specification (Refer drg. no. 24-FTM-002):-			
	1. Header pipe nominal bore: 80 mm 2. Header pipe diameter (outer): 89.5 mm 3. Header pipe wall thickness: 4.05 mm {Tolerance applicable as per IS 1239 (part-I): 2004} 4. No. of slots in header pipe for each panel: 2 (1 pair) 5. Centre distance b/w slots for panels: 42 mm to 55 mm (variable) 6. Max. Length of header pipe for Slotting/ Punching: 2000 mm 7. Min. Length of pipe: 760 mm 8. Max. no. Of slot pairs per header pipe: Upto 40.	Vendor to Note.		
4.4.4.2	Twin slot punching station :-			

S. No.	DESCRIPTION OF BHEL REQUIREMENT	VENDOR TO CONFIRM/SPECIFY	VENDOR's OFFER	REMARK(if any)
4.4.4.3	1. Ram force adjustable upto: 40 tons. 2. Daylight (maximum open distance): 300 mm 3. Hydraulic Cylinder type: Double acting 4. Hydraulic Cylinder mounting: Flange mounting 5. Stroke of the cylinder: 200 mm 6. Cylinder Bore: 180 mm 7. Piston Rod: 125mm 8. Guide rods Diameter: 75 mm 9. Maximum Working Pressure: 150 bar 10. Power-pack tank capacity: 50 Ltrs/ suitable 11. Feeding Motor power: 0.5 HP/ suitable 12. Drive Rating: 1 HP/ suitable 13. Cycle time to punch and move to next punch station: 6 seconds	Vendor to Confirm.		
4.4.4.4	PLC Based Control system :-			
4.4.4.5	A PLC based control system is to be used for sequencing of all the electro-mechanical activities. The PLC should be either S7 series of siemens make/ SLC500 of Allen Bradley/Premier range of Schneider make & should have at least 20% of its inputs and outputs free for future use.	Vendor to confirm		
4.4.4.6	Incomer switch fuse unit (SFU).	Vendor to confirm		
4.4.4.7	Cubicle ventilation fan, Louvers with dust cover for ventilation.	Vendor to confirm		
4.4.4.8	Emergency stop contactor & scheme to isolate all machine outgoing supplies during emergency conditions.	Vendor to confirm		
4.4.4.9	220V AC control supply.	Vendor to confirm		
4.4.4.10	24V DC Power Supply for PLC inputs/Outputs of Siemens / Allen Bradley /Schneider Make.	Vendor to confirm		
4.4.4.11	24V DC interposing relays having contact rating of 220V AC, 5 Amps for all PLC outputs.	Vendor to confirm		
4.4.4.12	The AC Vector Drive scheme shall have all elements like Semiconductor Line Fuses, AC Contactor. Line Choke, Output Choke, MCB's for auxiliaries etc	Vendor to confirm		
4.4.4.13	Indicator lamps for mains on PLC healthy,faults,alarms,trips etc.	Vendor to confirm		
4.4.4.14	Analog meters for displaying mains line voltage etc.	Vendor to confirm		
4.4.4.15	Push buttons for control on, fault accept, reset etc.	Vendor to confirm		
4.4.4.16	20" tube light for panel illumination & 5 amps socket for 220V AC supply.	Vendor to confirm		
4.4.4.17	AC motors feeders comprising of MPCB's/ contactors for feeding various motors.	Vendor to confirm		
4.4.4.18	Complete power & control wiring of the drives & PLC along with line semiconductor fuses, AC contactors, MCCB's etc.	Vendor to confirm		
4.4.4.19	Sufficient extra space must be kept in panel for mounting atleast 10% extra elements. Also the base of the panel should be atleast 300 mm from the ground floor for ease of maintenance. All AC Vector drives to be Siemens/ ABB/ Allen Bradley make only. Atleast 6 to 8 Nos. of spare wires be provided from the control desk to the pendant.	Vendor to confirm		
4.4.4.20	KIT:- All accessories like cables, limit switches, conduits, glands, lugs, fuses, ferrules, gourmets, mounting clamp, bracketories etc. required for the complete installation and successful proveout of the system are to be part of scope of supply. Only shielded cables are to be used for referencing potentiometer, encoder connections etc. wherever electrical noise immunity is necessary. All the cabling/ wiring in the panel/ control desk is to be properly dressed and is to be suitably routed through cable trays. All external cablings/wiring is to be properly routed through steel reinforced polyamide grooved conduit of reputed make like LAPP/ Finolex/ Equivalent. Also all cables/ wires should be of reputed make like LAPP/Finolex only.	Vendor to confirm		
4.5	Other Essential equipment			
	Exhaust duct and chimney	Vendor to confirm		
5.0	MAKE OF B.O. ITEMS :-			

S. No.	DESCRIPTION OF BHEL REQUIREMENT	VENDOR TO CONFIRM/SPECIFY	VENDOR's OFFER	REMARK(if any)
5.1.1	Pneumatic cylinder and elements — Festo/ Origa / Dutta/ Enerpac/ Rornheld/ Powerteam/ Rexroth/ Veljan/Electropneumatics/ Wipro/ Parker with bronze impregnated seals of Parker/Shanbom make	Vendor to confirm.		
5.1.2	Hydraulic cylinder and system- Rexroth/Yuken/ Vickers/ Bosch/ Dutta make	Vendor to confirm.		
5.1.3	Pump — Dowty/ Rexroth/ Towler make.	Vendor to confirm.		
5.1.4	Valves elements of hydraulic power packs - YUKEN/POLYHADRON make	Vendor to confirm.		
5.1.5	Motor of Hydraulic system — Bharat Bijlee/ABB/Siemens make	Vendor to confirm.		
5.1.6	Servo Motor- Mitsubishi/Fanuc/Siemens make	Vendor to confirm.		
5.1.7	Drives — ABB/Allen Bradley/Siemens/Modicon/ Schneider make	Vendor to confirm.		
5.1.8	PLC + HMI - Allen Bradley/Siemens/Schneider/ Mitsubishi/Modicon/ ABB make	Vendor to confirm.		
5.1.9	Gearbox — Radicon / Elecon / Bonfiglioli/Premium/Shanti/ Geared motor make	Vendor to confirm.		
5.1.10	Bearings — SKF/FAG make	Vendor to confirm.		
5.1.11	Coupling - Fenner/ Rotex/ Equit make.	Vendor to confirm.		
5.1.12	Brake & EM clutch — BCH/ EMCO/ Electromag only	Vendor to confirm.		
5.1.13	CM rails — Hiwin/ THK/ Equivalent	Vendor to confirm.		
5.1.14	Welding controller (Microprocessor based) - Eurotherm ottly	Vendor to confirm.		
5.1.15	Electrical control elements - Siemens/L & T /Schneider/Teknic make	Vendor to confirm.		
5.1.16	LM guide – AMT/ Equivalent make	Vendor to confirm.		
5.1.17	Limit Switches-Teknic/Siemens/ BCH Equivalent make	Vendor to confirm.		
5.1.18	Cables /Wires- RR cable/LAPP/Finolex/ Equivalent make	Vendor to confirm.		
6.0	SCOPE OF SUPPLY			

S. No.	DESCRIPTION OF BHEL REQUIREMENT	VENDOR TO CONFIRM/SPECIFY	VENDOR's OFFER	REMARK(if any)
6.1.1	<p><u>1. "Manufacturing line of transformer radiator panels". This will encompass following as per the specification in detailed specified. The overall arrangement shall have additional feature of Ducting and Chimney for fume extraction. This line will be semi automatic :-</u></p> <p>a. Retro -fitting of existing flute rolling machine with addition of embossing collar forming and shearing at BHEL - 1 LOT b. Tack welding machine for panels before multi spot welding - 1 LOT c. Multi spot welding machine with provision to weld panels of customized length- - 1 LOT. d. Dual end seam welding machine - 1 LOT. e. End seam welding machine - 1 LOT. f. Flattening of welded panels - 1 LOT. g. Trimming & Deburring of panels- - 1 LOT.</p> <p><u>2. Header punching machine for doing profile cutting on header pipes as per drawing.</u></p> <p>a. Hydraulically operated notching press having twin slot punching station as per specification to meet out requirements and comprising broadly of hydraulic cylinder, guide rods, guide bushes, tool holder with notching tool,internal as well as external die set alongwith pipe feeding mechanism, supporting table, tubings, power pack with first fill of oil, locating pins, job damping arrangement etc : 1 LOT b. Internal and External die set & Punch for circular slot of Ø25 mm: 1 LOT c. Control Panel: 1 LOT d. Control Desk: 1 LOT e. Pipes, hoses, manifolds, connectors, valves, brackets, solenoid valves, pressure switches, pressure Relief & non-return valves, seals etc. for both stations: 1 LOT. f. Kit comprising of items like cable, steel reinforced PVC conduits, lugs, ferrules, bracketories, fasteners, limit switches, anchoring & levelling bolts etc.: 1 LOT g. Operating & Maintenance manuals: 4 SET h. Test & Guarantee certificates: 4 SET i. Erection, commissioning and proving on 20 nos. actual Jobs. j. Spare internal and external die set & punch for twin slot punching station (To be quoted separately) : 1 LOT</p>			
6.1.2	A PLC based self standing control panel, control pendant & foot switch 1 No. each	Vendor to confirm.		
6.1.3	Grouting & leveling bolts 1 Lot	Vendor to confirm.		
6.1.4	Kit comprising of cables,lugs,conduits,ferrules,tubings,FRL,bracketories,sensors cylinders etc. - 1 Lot.	Vendor to confirm.		
6.1.5	Operation and Maintenance manuals 4 Nos	Vendor to confirm.		
6.1.6	Test & Guarantee cetificate 4 Nos.	Vendor to confirm.		
6.1.7	Proving of the complete system on actual jobs.	Vendor to confirm.		

S. No.	DESCRIPTION OF BHEL REQUIREMENT	VENDOR TO CONFIRM/SPECIFY	VENDOR's OFFER	REMARK(if any)
6.1.8	Control system:- All controls should be available on a control desk suitably located to the convenience of the operator & to be separate from main control panel so that there is a flexibility to operate it from a convenient place by the Operator. It should have suitable name plate so that the operator understands the functions of each switch. The control panel should have controls for all the parameters of the process. The control panel should be of IP52 protection grade and housing drives. PLC & incorporating all the control for the press. This should consist of main input Fuses, MCB, Contactor fuses, indicating lamps, push buttons, meters etc. All these equipment are to be housed in a robust cabinet with cubicle ventilation, fan & louvers with dust cover (for ventilation). The cabinet should be of minimum 2.4 mm sheet thickness powder coated in ivory colour. All the power wiring should be carried out using reputed make cables of appropriate cross-sectional area. Sufficient extra space must be kept in panel for mounting atleast 30% extra elements. Also the base panel should be at least 300 mm from the ground floor for ease of maintenance or the same suitable fabricated frame is to be provided at the panel base. The internal layout of the control panel should be as per IS Standards, ensuring long & trouble free life of the control elements and ease of maintenance during breakdown. The PLC should be either from Siemens/ Allen Bradley/ Modicon make and should be easily programmable with the following softwares easily available with us: a) Siemens Step 7, Version 5.3 b) Allen-Bradley RS logix 500, Version 6.10.10 c) Modicon, PI-7, Version 4.3 d) ABB, Version 2.3.9.11 e) Schneider, PI-7 Pro V4.4	Vendor to Confirm.		
7.0	LUBRICATION			
	Suitable arrangement for lubrication is necessary.Provision is to be made for the above by providing nipples. etc. For grease lubrication at strategic places wherever required, periodicity of lubrication should be brought out by color code system	Vendor to confirm.		
8.0	GUARANTEE			
	System should be guaranteed for successful performance and for free replacement of faulty material or components/defective workmanship for a period of 24 months from the date of acceptance of the equipment. Free services, after sales is to be provided during the guarantee period including free replacement of defective parts, if any.	Vendor to confirm.		
9.0	PAINTING			
	Painting of System/ Machine/ Electrical Panels: RAL 6011 Apple Green (Polyurethane Paint): To be painted after red oxide primer with heat resistant paint. The system is to be painted with finished coat of Opalean green colour, as per IS standards. The safety guards/barricades etc are to be properly painted using appropriate colours.	Vendor to confirm.		
10.0	PRE DESPATCH INSPECTION & SYSTEM CHECKS			

S. No.	DESCRIPTION OF BHEL REQUIREMENT	VENDOR TO CONFIRM/SPECIFY	VENDOR's OFFER	REMARK(if any)
10.1	<p>Pre-dispatch Inspection of the system will be carried at the supplier's works before dispatch of the system for satisfactory performance of the system and for the accuracies mentioned in this specification. Broadly following items shall be checked before dispatch.</p> <p>(a) Scope of supply (b) Workmanship (c) Ergonomics (d) Structural stability (e) Joint strength (f) Maintainability (g) Dimensional checks (h) No load trials/ logic testing (i) Load trials on dummy load/ actual jobs.</p> <p>An inspection call shall be given by the supplier at least 20 days before the date of inspection. Four copies of inspection & test certificate and guarantee certificate shall be submitted and got approved before dispatch.</p>	Vendor to confirm.		
10.2	Demonstration / physical inspection of all features, assemblies, subassemblies, control panel, bought out items and all accessories shall be done to the full satisfaction of BHEL representative.	Vendor to confirm		
11.0	DESIGN APPROVAL			
	The system is to be generally laid out in line with our specification. Supplier will have to take a prior approval in writing before hand. However, it will be the responsibility of supplier for proving system on actual jobs. Heat treatment & material of critical components is to be strictly adhered to and mentioned in quotation itself.	Vendor to confirm.		
12.0	ELECTRICALS			
12.1	415V(fluctuation + 10% / -10%), 50HZ(fluctuation +/-3 HZ), 3 Phase AC (3 wire system with out neutral) Power Supply Voltage will be provided by BHEL at a single point near the machine, as per layout recommended by Vendor. All types of cables, connections, circuit breakers etc. required for connecting BHEL's power supply point to different parts of the machine/control cabinets, shall be the responsibility of vendor. Requirement of grounding/earthing with required material details is to be informed by vendor well in advance so that same could be incorporated during construction of foundation. All electricals should have suitable safety devices such as thermal overload trip devices,current limiting devices, electronic shear pin. fuses etc.	Vendor to confirm.		
12.2	Tropicalisation: All electrical / electronic equipment shall be tropicalized	Vendor to confirm.		
12.3	All electrical & electronic control cabinets & panels should be dust and rodent proof	Vendor to confirm.		
12.4	All electrical components should be mounted on DIN Rail	Vendor to confirm.		
12.5	All electrical and electronic panels including operator's panel should be provided with fluorescent lamps for sufficient illumination and power receptacles of 220Volts, 5/15 Amp AC. All adapters/receptacles should have compatibility with Indian equivalents.	Vendor to confirm.		
12.6	Motors shall conform to IEC or Indian Standards	Vendor to confirm.		
12.7	All cables moving with traversing axes should be installed in caterpillar / Drag chain. All wiring to be suitably numbered / ferruled for easy maintenance. Additionally, all the cable trays required for laying of cables should be included in the offer.	Vendor to confirm.		
12.8	Vendor should ensure the proper earthing for the machine and its peripherals.	Vendor to confirm.		
12.9	In-cycle hour counter with reset facility.	Vendor to confirm.		
13.0	SAFETY ARRANGEMENTS:			

S. No.	DESCRIPTION OF BHEL REQUIREMENT	VENDOR TO CONFIRM/SPECIFY	VENDOR's OFFER	REMARK(if any)
	<p>Following safety features in addition to other standard safety features should be provided on the machine:-</p> <ol style="list-style-type: none"> 1. Machine should have adequate and reliable safety interlocks/devices to avoid damage to the machine, workpiece and the operator due to the malfunctioning or mistakes. Machine functions should be continuously monitored and alarm / warning indications through lights/ alarm number with messages (on display and panels) should be available. 2. A detailed list of all alarms / indications provided on machine should be submitted by the supplier. 3. All the pipes, cables etc. on the machine should be well supported and protected. These should not create any hindrance to machine operator's movement for effective use of machine. 4. All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations. 5. Emergency Switches at suitable locations as per International Norms are to be provided. 6. Oil & water pipe lines should not run with electrical cable in the same tray / trench. 7. The system should be provided with suitable IR safety guards, struture should be stable and should not bulge/deform, causing harm to be surroundings, operator or the job. Wherever desirable edges should be strengthened and rounded to remove sharpness. Moreover care should be taken such that no stress concentration takes place at any point on the fixture. Testing of the system under test load is to be demonstrated before the safety personnel. Suitable test certificates are to be furnished before PDI. Relevant safety standard are to be followed. 	Vendor to confirm.		
14.0	ENVIRONMENTAL PERFORMANCE OF THE MACHINE :			
	<p>The Machine shall conform to following factors related to environment :</p> <ol style="list-style-type: none"> (a) Maximum noise level shall be 85 dB(A) at normal load condition, 1 M away from the machine with correction factor for back ground noise, if necessary. This will be measured as per international standards like DIN 45635-16. Supplier to demonstrate compliance to noise level, if so required. (b) There shall not be any emissions from the machine except fumes of cutting fluid during machining. (c) There should not be any effluent from the machine. In case there are any effluents from the machine, requisite effluent treatment plant or pollution control device should be built into the machine by the supplier. (d) No hazardous chemicals shall be required to be used in the machine. (e) If any safety / environmental protection enclosure is required it should be built in the machine by the vendor. (f) Paint of the machine should be oil/coolant resistant and should not peel off and mix up with coolant. 	Vendor to confirm.		
15.0	SPARES			
15.1	Itemised breakup of mechanical, hydraulic, electrical and electronic spares used on the machine in sufficient quantity as per recommendation of vendor for 2 years of trouble free operation on three shifts continuous running basis should be offered by vendor.	Vendor to confirm.		
15.2	a) Mechanical & Hydraulic Spares: All types of Pumps, Valves, Pressure Switches, Transducers, Flow Switches, Filters, Seals, O-rings, Hydraulic Hoses etc.	Vendor to confirm.		
15.3	b) Electrical /Electronic spares: All types of Relays, Contactors, Proximity Switches, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers, Main Power Switch, Encoders, Scanning Heads for Linear Scales, MMC module, NCU module, Operator's panel with Display Unit, Floppy Disk Unit, I/O Cards for PLC, Servo Motors for feed drives, power module & Control Cards for Main Drive as well as Feed Drives etc.	Vendor to confirm.		
15.4	All types of spares for total machine and accessories should be available for at least ten years after supply of the machine. If machine or control is likely to become obsolete in this period, the vendor should inform BHEL sufficiently in advance and provide drawings of parts / details of spares & suppliers to enable BHEL to procure them in advance, if required	Vendor to confirm.		
15.5	Recommended set of spares for all attachments are to be offered with details.	Vendor to confirm.		

S. No.	DESCRIPTION OF BHEL REQUIREMENT	VENDOR TO CONFIRM/SPECIFY	VENDOR's OFFER	REMARK(if any)
15.6	Vendor to confirm that complete list of spares for machine and accessories, along with specification / type / model, and name & address of the spare supplier required thereafter, with information on their normal life shall be furnished along with documentation & to be supplied with the machine	Vendor to confirm.		
16.0	PACKING:			
	Sea worthy & rigid packing for all items of complete machine/equipments, system, all accessories and other supplied items to avoid any damage/loss in transit. When machine is despatched in containers, all small loose items shall be suitably packed in boxes	Vendor to confirm		
17.0	HYDRAULIC SYSTEM : Details should be submitted by the vendor.			
17.1	System should be centralised. Hydraulic Tank shall preferably be located at floor level	Vendor to confirm		
17.2	Make Rexroth / Vickers Sperry or equivalent from a reputed manufacturer. (Details to be submitted)	Vendor to confirm		
17.3	Filtration System	Vendor to confirm		
17.4	Failure indication	Vendor to confirm		
17.5	Automatic shut off provision (Details to be submitted)	Vendor to confirm		
17.6	Refrigerated type cooling and electric heating (Electric heating only if required) system of sufficient capacity to maintain complete Hydraulic System, including lubrication oil, hydrostatic oil and gearbox oil, etc. at a temperature not exceeding 40 deg C irrespective of the ambient conditions. Complete details should be submitted	Vendor to confirm		
17.7	Hydraulic pump capacity (flow / pressure) -	Vendor to specify		
17.8	Each pump should have an independent motor. Tandem pumps should not be used.	Vendor to confirm		
		Vendor to confirm		
18.0	First filling of all required Oils & Grease etc. to be supplied by vendor. Indigenous (Indian) source or Indian equivalent and specifications of oils/ greases are also to be provided by the vendor.	Vendor to confirm		
19.0	DOCUMENTATION:			
19.1	Four sets of following documents & test certificates (Hard copies) in English language are to be supplied with the system /equipment. One set of manual is to be sent before hand.hould	Vendor to confirm		
19.2	Operating manuals of Machine & system.	Vendor to confirm		
19.3	Programming Manuals of Machine & system	Vendor to confirm		
19.4	Detailed Maintenance manual of machine with all drawings of machine assemblies/sub-assemblies/parts including Electrical / Pneumatic/ Coolant / Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list also	Vendor to confirm		
19.5	Maintenance, Interface & commissioning manuals for system & feed drives.	Vendor to confirm		
19.6	Operating and maintenance manuals of the equipment and supplied accessories should contain system description, block diagram, schematic drawings, circuit diagrams & hardware details, Trouble shooting charts,	Vendor to confirm		
19.7	Manufacturing drawings for all supplied tool holders, coolant connections, adapters, sleeves, fixtures etc.	Vendor to confirm		
19.8	Catalogues, O&M Manuals of all bought out items including drawings, wherever applicable.	Vendor to confirm		
19.9	Detailed specification of all rubber items and hydraulic/lube fittings	Vendor to confirm		
19.10	Operating Manuals, Maintenance Manuals & Catalogues for supplied Automatic Tool Offset & Job Measuring Systems, Voltage Stabilizer, Isolation Transformer, Air-Compressor and all supplied Accessories.	Vendor to confirm		
19.11	PLC program print-outs with comments in English.	Vendor to confirm		
19.12	PLC program on CD, NC data & PLC data on floppy.	Vendor to confirm		
19.13	Complete back-up of hard disk on GHOST CD and clear written Instructions (3 copies) to take back-up and reloading of a new hard disk.	Vendor to confirm		
19.14	Complete Master List of parts used in the machine shall be submitted by the vendor.	Vendor to confirm		
19.15	One additional set of all the above documentation on CD ROM, wherever possible.	Vendor to confirm		
20.1	TRAINING			

S. No.	DESCRIPTION OF BHEL REQUIREMENT	VENDOR TO CONFIRM/SPECIFY	VENDOR's OFFER	REMARK(if any)
20.1	BHEL Persons should be trained at supplier's works for mutually agreed period in the area of (a) Electrical, Electronic & maintenance for machine & other supplied equipments (b) Mechanical & Hydraulic maintenance of the machine & other supplied equipments (c) Operation of the machine & other supplied equipments. So that they should be in a position to run/maintain the system independently.	Vendor to Confirm.		
20.2	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	Vendor to Confirm.		
20.3	Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel.	Vendor to Confirm.		
20.4	Vendor to quote for training on man / week basis	Vendor to Confirm.		
20.5	Vendor should commit to organize training of Electronics Engineer and Programmer at the system Manufacturer's works for advanced features and specialised training if so required by BHEL	Vendor to Confirm.		
21.0	ERECTION & COMMISSIONING & PROVING FOR PERFORMANCE OF THE EQUIPMENT LINE			
21.1	The installation, commissioning and proving of the system for desired performance on our actual jobs is to be done by the supplier at BHEL works. Supplier may quote charges for the above separately. Manufacturer should comply with the following during Erection, Commissioning and proving: (a) Experienced & qualified team fully conversant with the work scope should be deputed. It is the sole responsibility of the supplier to ensure that all the team members have valid ESI, PF and other statutory account & confirming to factories act. BHEL would presume that all the members deputed fulfill the above requirements. Further, the party would have to deal with any non-conformance /obligation arising out of the same. (b) Erection & Commissioning work has to be completed in one go except where it is agreed with mutual consent. (c) Drawings related to civil work should be sent to BHEL atleast 8 weeks in advance. (d) Any help required from BHEL during Erection & Commissioning has to be indicated in the offer itself. Except where agreed, rest has to be organised by the manufacturer. (e) Supplier's team is required to comply with general discipline, industrial safety rules and workshop norms while doing the work. Any work with safety hazards etc. should not be done in any case. No work should be done without proper authorization or permission.	Vendor to confirm.		
21.2	Supplier to take full responsibility for carrying out the erection, start up, testing of machine, it's control & all types of other supplied equipment, test pieces etc. Service requirement like power, air & water shall be provided by BHEL at only one point to be indicated by supplier in their foundation/layout drawings. Other requirements like crane and helping personnel shall also be provided by BHEL. Details of these requirements should be informed by vendor in advance.	Vendor to confirm		
21.3	Erection & Commissioning of Voltage stabilizer, Isolation Transformer & Air Compressor shall also be responsibility of the vendor.	Vendor to confirm		
21.4	Successful proving of BHEL components by the supplier shall be considered as part of commissioning. All tests, as mentioned at clause 22 (Machine Acceptance) shall form part of the commissioning activity.	Vendor to confirm		
21.5	Tools, Tackels, instruments and other necessary equipment including Laser equipment required to carry out all above activities should be brought by the supplier. .	Vendor to confirm		
21.6	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on returnable basis.	Vendor to confirm		
21.7	All Cover Plates required for the machine and its peripherals including pits, if any, shall be supplied and installed by the vendor. The plates should be sourced from India	Vendor to confirm		
21.8	Portion, if any, of the machine, accessories and other supplied items where paint has rubbed off or peeled during transit or erection should be repainted and merged with the original surrounding paint by the vendor. For this purpose, the vendor should supply sufficient quantity of touch-up paint of various colours of paint used.	Vendor to confirm		
21.9	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to confirm		

S. No.	DESCRIPTION OF BHEL REQUIREMENT	VENDOR TO CONFIRM/SPECIFY	VENDOR's OFFER	REMARK(if any)
21.10	Charges, duration, terms & conditions for E&C should be furnished in detail separately by vendor along with offer.			
21.11	Actual job shall be proved at Bhopal in all respect for accuracy and performance during commissioning. special tools for equipment proving, if any, shall be brought by the supplier.	Vendor to confirm		
21.12	During erection & commissioning, BHEL operators & engineers will be trained by the supplier's experts/ engineers.	Vendor to confirm		
22.0	MACHINE ACCEPTANCE: (Tests/Activities should be Performed by Vendor)			
22.1	Tests/Activities should be carried out at supplier's works on the machine before dispatch .	Vendor to confirm		
22.2	Geometrical accuracies as per test chart.	Vendor to confirm		
22.3	Tests/Activities should be carried out at BHEL works while commissioning the machine :	Vendor to confirm		
22.4	The machine should be tested for continuous running of 48 hrs. If any break down occurs during this test, the test should be repeated for 48 hrs from that time.	Vendor to confirm		
22.5	Demonstration of all features of the machine, control system & accessories to the satisfaction of BHEL for efficient and effective use of the machine	Vendor to confirm		
22.6	Demonstration by actual use of all supplied attachments and accessories to their full capacity.	Vendor to confirm		
22.7	Proveout manufacturing line	Vendor to confirm		
22.8	Two weeks supervision of independent operation of machine by BHEL after job proveout	Vendor to confirm		
22.9	Training of BHEL machine operators in operation of complete machine & accessories etc by the supplier's experts / engineers during their stay at BHEL works	Vendor to confirm		
23.0	LEVELING & ANCHORING SYSTEM			
	Complete anchoring system including foundation bolts, anchoring materials, fixators, leveling shoes etc should be supplied	Vendor to confirm		
24.0	TOOLS FOR ERECTION, OPERATION & MAINTENANCE :			
	Special tools and equipment required for erection and necessary tools like Torque Wrench, Spanners, Keys, grease guns etc.for operation and maintenance of the machine should be supplied. List of such tools should be submitted with offer	Vendor to confirm		
25.0	OPERATING CONDITIONS & THERMAL STABILITY :			
25.1	Total machine including system and all supplied items should work trouble free and efficiently under following operating conditions and should give specified accuracies. Supply: Voltage: 415 V - 10%, +10% Hz +3%, - 3% No. of phases = 3 Ambient Conditions: Temperature = 5 to 50 degree celsius Relative Humidity = 95% max. Power Frequency: 50	Vendor to confirm & furnished		
25.2	Weather conditions are tropical, Atmosphere may be dust laden during some part of the year. Machine shall be kept in the normal shop floor condition. Max. temperature variation is up to 25 deg Celsius in 24 hours.	Vendor to confirm & furnished		
25.3	Thermal Stability of the complete machine keeping in view specified ambient conditions and accuracy requirements of BHEL components and trouble free operation of the machine should be ensured by vendor. (Confirm that machine is suitable for above and details of provisions on the machine for the same should be furnished)	Vendor to confirm & furnished		
26.0	AMBIENT CONDITION & TROPICALISATION			
26.1	All electronic components should be tropicalised to withstand environmental temp. Variation from 4 to 50 degree C and RH variation from 5 to 95%.	Vendor to Confirm.		

S. No.	DESCRIPTION OF BHEL REQUIREMENT	VENDOR TO CONFIRM/SPECIFY	VENDOR's OFFER	REMARK(if any)
27.0	STRESS RELIEVING OF ALL FABRICATED ITEMS			
	All fabricated bracketories are to be stress relieved. No castings are to be used for the manufacturing of the fixture.	Vendor to Confirm.		
28.0	MATERIAL & HEAT TREATMENT OF ALL MAJOR COMPONENTS			
	All wear components (in motion) needs to be properly heat treated for maximum durability.	Vendor to Confirm.		
29.0	PROVEOUT OF BHEL COMPONENTS :			
29.1	Drawings of proveout components are enclosed. Vendor to submit preliminary process, time study & tool list recommended by them along with the offer. Change in process/tools may be mutually discussed and agreed. Complete machining of prove out components shall be done by Vendor at BHEL works to the specified design accuracy and surface finish, using cutting tools and programs to be provided by the vendor to prove the machine after complete erection, tests & test piece machining etc. Material for the proveout components shall be provided by BHEL. Vendor should submit the programs, setting schemes, process sheets, tooling layouts, time studies etc. in advance for the prove out components. Vendor shall be fully responsible for machining of proveout components as per drawing and other requirements specified by BHEL to the full satisfaction of BHEL. Clarifications, if any required by vendor, regarding accuracy requirements of the proveout components, whether specified or not, should be discussed and cleared by vendor during initial technical discussions.	Vendor to offer.		
29.2	During proveout, all tools shall be set by using supplied Tool Offset Measuring System and final job inspection shall be done by supplied Job Measuring System. Vendor shall be responsible for any deviation/rejection in proveout component due to wrong machining or malfunctioning of the machine during proveout machining and also for the delay in machining due to improper recommended tooling etc. The cost of such deviation / rejection, if any, shall be refunded by the vendor to BHEL.	Vendor to confirm		
29.3	Pre dispatch Inspection and Guarantee certificate of the equipment	Vendor to confirm		
30.0	GENERAL: THE SUPPLIER SHOULD FURNISH THE FOLLOWING INFORMATION ALONG WITH THE OFFER			
30.1	Equipment model	Vendor to specify		
30.2	Total weight of the system	Vendor to specify		
30.3	Floor area required (Length, Width, Height) for complete equipment & accessories	Vendor to specify		
30.4	Full technical details/specifications, general arrangement drawing, etc.	Vendor to submit.		
30.5	Control diagrams illustrating construction of the system / equipment.	Vendor to submit.		
30.6	Detailed catalogues, sketch/ photographs and technical literature of the equipment and accessories/ attachments.	Vendor to specify		
30.7	General arrangement drawing of the equipment showing the constructional features, capacities of the individual components, etc should be furnished along with the offer.	Vendor to specify		
30.8	Weight of heaviest part of machine	Vendor to specify		
30.9	Weight of the heaviest assembly / sub-assembly of the machine	Vendor to specify		
30.10	Dimensions of largest part/ sub-assembly/ assembly of the machine	Vendor to specify		
30.11	Detailed catalogues, sketch/ photographs of the m/c and accessories/ attachments should be submitted with the offer.	Vendor to specify		
30.12	Hydraulic, Pneumatic & oil pipings should be preferably metallic except places where flexible pipings are essential.All the pipes required for the same shall be included in the standard scope of the machine.	Vendor to specify		
30.13	Material specifications which are used in the manufacturing of the equipment.	Vendor to submit.		
30.14	Overall dimensions and space requirements.	Vendor to submit.		
30.15	Power requirements.	Vendor to submit.		
30.16	Total connected load (KVA)	Vendor to specify		
30.17	along with offer, reference list of customers to whom similar/identical system/equipment have been supplied mentioning broad specifications of the supplied machine.	Vendor to submit.		
30.18	Point wise reply to each & every point of our specification is must. If not compiled, then the offer will not be considered.	Vendor to submit.		
30.19	Optional accessories, consumables and supporting facilities.	Vendor to specify		

S. No.	DESCRIPTION OF BHEL REQUIREMENT	VENDOR TO CONFIRM/SPECIFY	VENDOR's OFFER	REMARK(if any)
30.20	FOUNDATION : (Indentor to Suitably modify this clause based on size of the machine/equipments line): The preliminary layout drawing for getting BHEL's approval within one month from the date of Letter of Intent (LOI) / P.O. Soil condition data will be furnished by BHEL along with the approval. Complete Foundation Design including details viz. static / dynamic load details etc. and Final Layout drawings shall be submitted by the supplier within three months after getting BHEL's approval. The layout should consist of all requirements pertaining to complete machine including space requirement for Voltage Stabilizer, Isolation Transformer, Air compressor, cooling arrangements & any other accessories. BHEL shall construct complete foundation for the machine under supervision of supplier and at supplier's responsibility. Vendor should arrange equipments required for the testing of foundation, if required by the vendor. The vendor shall also indicate detailed specifications of grouting compound and Grouting procedure etc. for foundation bolts of the machine.	Vendor to submit.		
32	QUALIFYING CONDITION:			
32.1	<p>Only those vendors (OEM), who have supplied and commissioned at least one number of similar or higher rating "WELDING MACHINERIES LINE OF TRANSFORMER RADIATOR ELEMENTS" and "WELDING MACHINERIES LINE" for similar applications in the past ten years (on the date of opening of tender) and such machine is presently working satisfactorily for more than one year after commissioning (on the date of opening of tender) should quote. However if such machine(s) has/had been supplied to BHEL, then such machine should be presently working satisfactorily for more than six months after its commissioning and acceptance (on the date of opening of tender) in BHEL should quote. The following information should be submitted by the vendor about the companies where similar machines have been supplied. Vendor can outsource works other than "UNIT-1 (LINE INVOLVE WELDING)" to authorised vendor. Documents of such authorised vendor shall be submitted to BHEL. However entire responsibility of the work will be on the vendor.</p> <p>The outsourced / authorised vendor, should have supplied and commissioned at least one number of similar or higher rating machines for similar applications in the past ten years (on the date of opening of tender) and such machine is presently working satisfactorily for more than one year after commissioning (on the date of opening of tender) should quote. However if such machine(s) has/had been supplied to BHEL, then such machine should be presently working satisfactorily for more than six months after its commissioning and acceptance (on the date of opening of tender) in BHEL should quote. The following information should be submitted by the vendor about the companies where similar machines have been supplied</p> <p>Authorization certificate of all outsource suppliers/vendors will be required for qualification of their offer, absence of these certificate can lead to dis-qualification of the vendor.</p>	Vendor to submit.		
32.2	Name of the customer / company where similar equipment is installed/ supplied. (Copy of purchase order should be attached).	Vendor to specify		
32.3	Complete postal address of the customer.	Vendor to specify		
32.4	Year of commissioning.	Vendor to specify		
32.5	Name and designation of the contact person of the customer.	Vendor to specify		
32.6	Phone, FAX no. and email address of the contact person of the customer.	Vendor to specify		
32.7	Performance certificate from the customers regarding satisfactory performance of equipment supplied to them & issued with in one year of tender opening. (original certificate or through E-mail directly from the customer).The original may be returned after verification by BHEL, If required.	Vendor to note & submit		
32.8	BHEL reserves the right to verify the information provided by vendor. In case the information provided by vendor is found to be false/incorrect, the offer shall be rejected.	Vendor to confirm		