

Annexure C				
Technical Specifications for Supply, Installation and Prove-out of IIoT solution for real-time monitoring of dynamic characteristics of welding in STBW (Straight Tube Butt Welding) & Panel processing machines in BHEL Trichy				
Sl. No.	Particulars and BHEL Specification		Bidder's Offer (with complete Technical Details)	Deviations, if any
1.0	Purpose & Scope			
1.1	Supply, installation and proveout of IIoT solution for Real-time monitoring of dynamic characteristics of welding in 12 machines	Bidder to note		
1.2	Critical welding parameters like date, time, machine ID, joint no., welding voltage, welding current, chuck speed / travel speed, ambient temperature and shielding gas flow from the machine shall be captured.	Bidder to note		
1.3	Data shall be continuously captured using required sensors in each machine and shall be transmitted over local network and stored in a server in required format	Bidder to note		
2.0	Existing machine details			
2.1	STBW 1, 2 & 3 (WTEC)/Unit-II & STBW 1 & 6 / Building 50			
2.1.1	Tube Diameter: 25.4mm to 76.1 mm Tube wall thickness: 2.0mm to 12.5mm Tube length (In feed): 2.0m-15m Tube Materials: Carbon Steel : SA192, SA210A1, SA210C Alloy Steel : SA209T1, SA213T11, SA213T22, SA213T91, T-23, T-93 Stainless Steel : SA 213 TP304H, SA 213 TP321H, SA 213 TP347H Pulsed MIG/MAG welding power source: TYPE: OTC CPDP 350 Duty cycle: 350A 60% Initial Current: 50-350 A MIG/MAG wire feeder: TYPE: OTC CMH-1407 Drive: 4-Roller driven Feeder Motor Capacity: 75W Control System Motion Control Unit: Siemens SIMOTION D435 Driving Module: Sinamic S120 (3 axis driving capacity) HMI: TP1200 12" touch panel Input & Output: EM200	Bidder to note		
2.2	STBW 4, 5 & 6 (PRIMO)/Unit-II			
2.2.1	Tube Diameter: 25.4mm to 76.1 mm Tube wall thickness: 2.0mm to 12.5mm Tube length (In feed): 2.0m-15m; Tube Material: Carbon Steel : SA192, SA210A1, SA210C Alloy Steel : SA209T1, SA213T11, SA213T22, SA213T91, T-23, T-93 Stainless Steel : SA 213 TP304H, SA 213 TP321H, SA 213 TP347H Pulsed MIG/MAG welding power source: TYPE: OTC DP 400 Duty cycle: 400A 60% Initial Current: 50-400 A MIG/MAG wire feeder: TYPE: OTC CM7401-U6515 Drive: 4-Roller driven Feeder Motor Capacity: 75W Control System - STBW 5 & 6 PLC : Beckhoff CP6231-0001-0010 with TwinCAT-2 PLC and built-in HMI Driving Module: Sinamic S120 (3 axis driving capacity) Input & Output: Through EtherCAT coupler (EK 1100) Control System - STBW 4 PLC : Siemens S7-1200(CPU-1215C) Driving Module: Sinamic S120 (3 axis driving capacity) HMI: Siemens KTP1200 12" touch panel Input & Output: Siemens SM-Modules	Bidder to note		
2.3	STBW 3 / Building 50			
2.3.1	Tube Diameter: 25.4mm to 76.1 mm Tube wall thickness: 2.0mm to 12.5mm Tube length (In feed): 2.0m-15m; Tube Material: Carbon Steel : SA192, SA210A1, SA210C Alloy Steel : SA209T1, SA213T11, SA213T22, SA213T91, T-23, T-93 Stainless Steel : SA 213 TP304H, SA 213 TP321H, SA 213 TP347H Pulsed MIG/MAG welding power source: TYPE: YD-350GL Duty cycle: 350A 60% Initial Current: 50-400 A Control System PLC : Mitsubishi FX3U-128M Drives MR-J4-350A4 & MR-J4-70A	Bidder to note		

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2.4	STBW 4 / Building 50				
2.4.1	Tube Diameter: 25.4mm to 76.1 mm Tube wall thickness: 2.0mm to 12.5mm Tube length (In feed): 2.0m-15m; Tube Material: Carbon Steel : SA192, SA210A1, SA210C Alloy Steel : SA209T1, SA213T11, SA213T22, SA213T91, T-23, T-93 Stainless Steel : SA 213 TP304H, SA 213 TP321H, SA 213 TP347H Pulsed MIG/MAG welding power source: TYPE: WELBEE-P400 OUT: 30A/15.5V TO 400A / 34 V Control System PLC : Mitsubishi FX5U-80MT/ES Drives MR-J4-350A4 & MR-J4-70A		Bidder to note		
2.5	STBW 8 / Building 50				
2.5.1	Tube Diameter: 25.4mm to 76.1 mm Tube wall thickness: 2.0mm to 12.5mm Tube length (In feed): 2.0m-15m; Tube Material: Carbon Steel : SA192, SA210A1, SA210C Alloy Steel : SA209T1, SA213T11, SA213T22, SA213T91, T-23, T-93 Stainless Steel : SA 213 TP304H, SA 213 TP321H, SA 213 TP347H Pulsed MIG/MAG welding power source: TYPE: DP-400 OUT: 30A/15.5V TO 400A / 34 V Control System PLC : SIMATIC S7-1200 Master: 6ES7-151-8AB01-0AB0 Slave: 6ES7 - 215-1AG40-0XB0 Drives MR-J4-350A4 & MR-J4-70A		Bidder to note		
2.6	20-Torch/Unit-II				
2.6.1	Tube Diameter: 25.4mm to 76.1 mm Tube wall thickness: 2.0mm to 12.5mm Tube length (In feed): 2.0m-15m; Tube Material: Carbon Steel : SA192, SA210A1, SA210C Alloy Steel : SA209T1, SA213T11, SA213T22, SA213T91, T-23, T-93 Stainless Steel : SA 213 TP304H, SA 213 TP321H, SA 213 TP347H Pulsed MIG/MAG welding power source: TYPE: DM-500 OUT: 30A/15.5V TO 400A / 34 V Control System PLC : Mitsubishi Q series Q03UDECPU, Q06HCPU & Q02HCPU		Bidder to note		
3.0	Technical requirements				
3.1	List of parameters to be monitored	Range			
3.1.1	Welding Voltage	0 to 60 V DC	Bidder to confirm		
3.1.2	Welding Current	0 to 350 A (max) 0 to 150 A (nominal)			
3.1.3	Gas flow (LPM)	0 to 40 lpm			
3.1.4	Ambient Temperature	0 to 50 deg C			
3.1.5	Chuck speed / Travel Speed	0 to 10 rpm (or) 0 to 1000 mm/min			
3.2	Data Acquisition Panel and Sensors / Transducers				
3.2.1	The vendor shall install a fully wired Data Acquisition Panel (DAQ Panel) along with all necessary sensors in all the welding machines which will collect data from the machines.		Bidder to confirm		
3.2.2	The DaQ panels shall be placed near to existing control panel of the machine. DAQ shall be installed separate enclosure with suitable ingress protection and ventilation. Panel Enclosure Powder coated MS Enclosure RAL7035, IP54 or better Rating Panel make: Rittal/Elsteel/Hoffman		Bidder to specify		
3.2.3	DAQ shall capable of capturing minimum 60 values of each parameter every minute (1 reading per second of each parameter)		Bidder to confirm		

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3.2.4	Vendor shall ensure that the installed sensors have high lifecycle of operation and are compatible for installation in rugged environment. The sensors shall be of reputed makes like LEM, IFM, Balluf, Festo, SMC or other makes acceptable to BHEL. Details of the sensors to be provided with the offer.	Bidder to specify		
3.2.5	All the data are to be timestamped. DAQ also shall have synced with intranet time. Realtime Clock also shall be provided.	Bidder to confirm		
3.2.6	Data capturing for the above parameters shall be trigger-enabled	Bidder to confirm		
3.2.7	The parameters shall be recorded joint-wise in a sequential manner (with basic numbering of joints according to timestamp).	Bidder to confirm		
3.2.8	Data capturing module shall be IP-based and integrated into our intranet. Static IP will be provided by BHEL Team.	Bidder to confirm		
3.2.9	All the recorded data are to populate an Oracle DBMS table (compatible to Oracle).	Bidder to confirm		
3.2.10	Vendor shall ensure communication, connectivity and power requirements for all sensors in the DAQ panel itself.	Bidder to confirm		
3.2.11	DAQ panel incoming supply shall be of 230VAC. BHEL will provide 230V AC 50Hz power supply. Necessary conversion of voltage will be vendor scope. Bidder shall ensure necessary protection to their system from voltage fluctuations. Use of necessary galvanic isolation is recommended.	Bidder to confirm		
3.2.12	All cables shall be safely routed through cable conduits/hoses wherever necessary. Vendor shall ensure that the supplied cables are of required lengths according to site conditions.	Bidder to confirm		
3.2.13	Physical IOs: Analog Input (4-20mA): minimum 8 numbers, Digital Inputs: Minimum 8. Vendor to specify other input as necessary	Bidder to specify		
3.2.14	Security: Access protection using user and password authentications	Bidder to confirm		
3.2.15	Tropicalization of control panels	Bidder to confirm		
3.2.16	Standards: Programming: IEC 61131, EMC: IEC/EN 61000, Vibration: IEC/EMC 60068 (or better)	Bidder to confirm		
3.2.17	Ports: TCP/IP RJ45 Port, RS485 Serial Port. Vendor to provide details about others	Bidder to confirm		
3.2.18	Make: Siemens/ABB/Phoenix Contact/Schneider or other makes acceptable to BHEL.	Bidder to specify		
3.2.19	All materials for this project are under vendor scope.	Bidder to confirm		
3.3	Communication			
3.3.1	BHEL shall provide LAN connectivity to the DAQ panel from the near by network switch.	Bidder to confirm		
3.3.2	DAQ shall be accessible over the intranet.	Bidder to confirm		
3.3.3	Protocol Support: Profinet, MQTT, HTTPS, FTP, SMTP or other acceptable to BHEL	Bidder to specify		
3.3.4	Ports: RJ45 Ethernet Interface - 1 No minimum, 1-RS485 Serial - 1 No minimum (optional). Vendor to specify others, if any	Bidder to specify		
3.3.5	Interface Other features: HTLM5 Web server. Vendor to specify others, if any	Bidder to specify		
3.3.6	DAQ shall also have Local data storage for minimum period of one month.	Bidder to specify		
3.3.7	All communication and power cables shall be suitable for industrial application and conforming to pertinent IS/IEC standard along with EMC compatibility. Vendor to provide details.	Bidder to specify		
3.4	Middleware			
3.4.1	The DAQ panel shall be connected to BHEL LAN Network through which the data should be transferred to a data integration middleware installed on a computer. On-premises middleware tool to collect, store and integrate the machine performance data in structured format to the enterprise IT Systems	Bidder to confirm		

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3.4.2	Bidder shall provide network enabled PC of suitable specification necessary to meet the requirement of the IIOT system. PC shall be capable of continuous operation required by the acquisition system. It shall also be compliant to ISMS policy of BHEL. Vendor shall provide detailed specification.	Bidder to confirm		
3.4.3	The data integration middleware should have a temporary database to store the data locally which should be a time series database. Further, the data from temporary database shall be integrated to BHEL's existing SAP Database (Oracle DB).	Bidder to confirm		
3.4.4	Online status of the DAQs shall be indicated in the Middleware.	Bidder to confirm		
3.4.5	Middle ware shall automatically sync the locally stored from the DAQ after any communication failure.	Bidder to confirm		
3.4.6	The solution should not have any recurring expenses, so that the system shall be completely on premises and locally installed. The Data integration middleware shall act as a bridge between Data Acquisition system and the IT system BHEL SAP.	Bidder to confirm		
3.4.7	All softwares and firmwares used shall be opensource or with lifetime license. No additional cost shall be levied to BHEL for them.	Bidder to confirm		
3.4.8	Edge Gateway Integration: Through Modbus, MQTT, or other opensource protocol	Bidder to confirm		
3.4.9	Enterprise software integration: SAP Connector, MQTT Ejector, REST API Support or other opensource integraters.	Bidder to specify		
3.4.10	Data Storage:	Vendor to specify		
3.4.11	Protocol support: MQTT, Modbus, REST APIs, ODBC or other protocol type acceptable to BHEL.	Bidder to specify		
3.4.12	Security: All communication to the SAP system must be secured SSL/TLS using X.509 or equivalent standard. Authentication should be secured delegated access using OAuth2 or equivalent standard. The Middleware must have User management, which is tied security mechanisms to prevent malicious access. Configuration files that have sensitive information like keys and passwords must be kept encrypted until they are loaded onto the system. Database passwords, keys / passwords for connecting to the SAP, shall all be encrypted.	Bidder to confirm		
4.0	Scope of Supply and Delivery Period			
4.1	Supply, installation and proveout of IIoT solution for Real-time monitoring of dynamic characteristics of welding in 1 machine comprising of DAQ panel, sensors/transducers, communication and power cables etc. Prove-out encompasses establishment of communication over BHEL intranet and population of Oracle database	Bidder to confirm		
4.2	Supply and installation of IIoT solution for real-time monitoring of dynamic characteristics of welding in the remaining 11 machines comprising of DAQ panel, sensors/transducers, communication and power cables etc. and integration of all the monitoring stations to the central system POST prove-out and successful completion of activity under clause 4.1	Bidder to confirm		
4.3	Spares:			
4.3.1	All types of sensors/transducers - 2 sets	Bidder to confirm		
4.3.2	DAQ panel - 1 no	Bidder to confirm		
4.4	Delivery Period:			
4.4.1	Submission of drawings/BOI list for approval by BHEL	Within 3 weeks of placement of PO.	Bidder to confirm	
4.4.2	Supply of all materials as per clauses 4.1, 4.2, and 4.3	Within 5 weeks of drawing approval.	Bidder to confirm	
4.4.3	Completion of activity as per clause 4.1	Within 3 weeks of material supply.	Bidder to confirm	
4.4.4	Completion of activity as per clause 4.2	Within 5 weeks of completion of 4.1	Bidder to confirm	
5.0	Documentation			
5.1	Bidder shall submit the schematic/BOI list of the system during along with the technical offer.	Bidder to confirm		

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5.2	Bidder shall submit the planned architecture along with technical offer for approval.	Bidder to confirm		
5.3	Bidder shall submit detailed product information sheets including operation procedures and troubleshooting of BOI.	Bidder to submit		
5.4	Bidder shall provide all relevant performance certificates, test certificates of the supplied materials.			
5.5	Bidder shall provide backup of all licensed software, program, firmware used in the system in a pendrive. The same shall also in installed in BHEL provided PC/laptop. It should be possible to completely restore the system from the backup in case of any failure without requiring additional support.			
5.6	All documentation shall be in English.			
6.0	Training			
6.1	Necessary training for minimum period of two days for maintenance staff.			
6.2	Training for software maintenance and communication are to be provided for BHEL Staff.			
7.0	Guarantee/Warranty Terms			
7.1	Bidder shall guarantee the entire system including sensors for a minimum period of 1 year from the date of commissioning.	Bidder to confirm		
8.0	General Terms			
8.1	Bidder is encouraged to visit the site to understand the techno-commercial requirements before submitting their offer.	Bidder to note		
8.2	230V + 10% / -10%, 50HZ +/-3 Hz, 1 Phase AC power supply will be provided by BHEL at a single point near the panels. Necessary length extension of cables is under the scope of bidder.	Bidder to note		
8.3	BHEL is not responsible for any loss or damage to the contractor's equipment as a result of variations in voltage frequency or interruptions in power supply.	Bidder to note		
8.4	Bidder has to arrange for manpower and tool, tackles, crimping tools, insulation tapes etc.	Bidder to note		
8.5	Water and air will be provided at single point at the site by BHEL free of cost. Further distribution, if required, shall be under the scope of the bidder.	Bidder to note		
8.6	Boarding, lodging, accomodation, local conveyance of workmen for the entire duration shall be under the scope of the bidder.	Bidder to note		
8.7	Bidder shall ensure safety of the workmen employed. They shall be provided with necessary and recommended PPE like mask, shoes etc. Any health checkup or medical attention, if required, during the work shall be under the scope of the bidder.	Bidder to note		
8.8	Bidder shall ensure safety to men and environment while handling of the materials during installation and commissioning.	Bidder to note		
8.9	The bidder shall ensure the system is scalable for the future in case additional work centres are to be added to the system. Bidder to provide details about the same.	Bidder to submit		
9.0	Intellectual Property Rights (IPR)			
9.1	BHEL reserves the sole ownership to any IPR arising out of the works.	Bidder to confirm		