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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARATH HEAVY ELECTRICALS LIMITED. It must be not used directly or indirectly in any way detrimental to the interest of the company.		SUPPLY, ERECTION & COMMISSIONING OF FLUORESCENT PENETRANT INSPECTION FACILITY 1. SCOPE This specification provides a standard for the procurement, acceptance and installation of a Fluorescent Penetrant line and associated material handling system that is compliant with ASTM E1417. 2. PURPOSE Fluorescent Penetrant Inspection facility is required for Inspection of Frame 5, Frame 6 and Frame 9 Turbine Buckets and Nozzles. 3. JOB SPECIFICATION 3.1 Maximum Size of the job : 600x800x300 mm -1 Nos 3.2 Maximum weight of the job: 90 Kg -1Nos 4. FEATURES OF FPI FACILITY 4.1 PENETRANT DIP AND DRAIN STATION- 2 no.s 4.1.1 Penetrant Dip tank should have minimum dimensions 600 x 600 x 500 mm (W x H x L) approx. with top opening for easy job loading. 4.1.2 The Tank should be made of Stainless steel 2mm thick sheet, supported by MS Tubular structure. The bottom support should be fabricated at the height of 100mm from the floor level. 4.1.3 Penetrant should drain when the pneumatic grills are at open condition and drips the excess penetrant to the same tank. 4.1.4 Slope to be provided at the bottom of the tank for easy draining of solution with a drain valve. 4.1.5 Pneumatic lid to be provided along with roller platform. 4.1.6 Timer to Monitor dwell should be provided. 4.1.7 Control panel should be positioned underneath the penetrant drain station. 4.1.8 Drain to be provided at the bottom of the tank to remove the contaminated penetrant from the tank. 4.2 WATER WASH STATION - 2no's (Pre-wash and Post wash) 4.2.1 To remove the coolant oil and dust on the component before conducting FPI. 4.2.2 Water wash station should have minimum dimensions of 800 x 600 x 500 mm (W x H x L) approx. with top opening for easy job loading 4.2.3 The Tank should be made of Stainless steel 2mm thick sheet, supported by MS Tubular structure. The bottom support should be fabricated at the height of 100mm from the floor level. 4.2.4 Slope to be provided at the bottom of the tank for easy draining of waste water with a drain valve.			
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARATH HEAVY ELECTRICALS LIMITED. It must be not used directly or indirectly in any way detrimental to the interest of the company.			4.2.5 1/2" plumbing line with gate valve, hand spray gun, flexible hose and clamps, provision for Hydro wash gun for effective washing to be provided. 4.2.6 Water and Air pressure gauges, temperature gauge to monitor the system parameters to be provided. 4.2.7 Post wash stations should be provided with Black hood enclosure with exhaust fan, provision for black light for monitoring the washing performance. 4.2.8 Pneumatic lid to be provided along with roller platform. 4.2.9 Drain to be provided at the bottom of the tank to remove the contaminated water from the tank. 4.3 EMULSIFIER DIP AND DRAIN STATION- 1 no's 4.3.1 EMULSIFIER DIP AND DRAIN STATION-for applying emulsifier. 4.3.2 Penetrant Dip tank of should have minimum dimensions of 600 x 600 x 600 mm (W x H x L) approx. with top opening for easy job loading. 4.3.3 The Tank should be made of Stainless steel 2mm thick sheet, supported by MS Tubular structure. The bottom support should be fabricated at the height of 100mm from the floor level. 4.3.4 Slope to be provided at the bottom for easy draining of the liquid with a drain valve. 4.3.5 The system should be programmable for no. of cycles to have gentle agitation of pneumatic roller grills in UP/Down direction. 4.3.6 Timer to Monitor dwell time should be provided. 4.3.7 Pneumatic lid to be provided along with roller platform. 4.3.8 Emulsifier dwell time timer with alarm should be provided. 4.3.9 Drain to be provided at the bottom of the tank to remove the contaminated emulsifier from the tank. 4.4 RE-CIRCULATING HOT AIR DRIER STATION -- 1no' 4.4.1 Drier Chamber to be used to dry parts that have come into contact with water during the preparation/cleaning surface process performed immediately before application of the penetrant or to dry parts after excess penetrant. Hot air circulation drier stations to be used 4.4.2 Drier chamber of size approx. 600 x 600 x 400 mm (W x H x L). The drier body should be made of mild steel modular tank supporting structure with MS tubular structure and should be able to take a load of 100kg. 4.4.3 Heat resistant insulation sheets should be provided inside the drier chamber to arrest the temperature losses. 4.4.4 Job mounting split grill to be provided at the bottom of the tank. 4.4.5 Heaters and fans of suitable capacity should be provided. 4.4.6 Maximum temperature of 80°C should be maintained inside the drier chamber. 4.4.7 The drier station to be provided with 3KW heaters.		
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARATH HEAVY ELECTRICALS LIMITED. It must be not used directly or indirectly in any way detrimental to the interest of the company.			4.4.8 Pneumatic lid along with roller platform to be provided for arresting the leakage of temperature. 4.4.9 Terminal box for heaters, thermostat and other electrical controls to be provided. 4.4.10 Timer to monitor the 'drying time' to be provided. 4.4.11 Digital type temperature controller to be provided to set the required temperature. 4.5 DRY DEVELOPER APPLICATION STATION (Cloud Chamber) -1 no 4.5.1 Developer station of dimensions 600 X 600 X 500 mm (LXBXH) approx. should be provided. 4.5.2 The Tank should be made of Stainless steel 2mm thick sheet, supported by MS Tubular structure. The bottom support should be fabricated at the height of 100mm from the floor level. 4.5.3 Crowned bottom should facilitate the developer to settle down at the desired point. 4.5.4 Cloud formation should happen through re-circulation air blowers. 4.5.5 Job mounting split grills to be provided at the bottom portion of the tank. 4.5.6 Pneumatic lid to be provided along with roller platform. 4.5.7 Transparent window should be provided to see the cloud formation inside the tank. 4.5.8 1" powder collecting outlet with dummy flange to be provided. 4.5.9 Air agitation SS plumbing line with FRL, Solenoid valve should be provided. 4.5.10 Timers to monitor developing time to be provided. 4.5.11 Bottom opening to be provided for collecting the contaminated developer. 4.6 INSPECTION BOOTH. 4.6.1 Inspection station should comprise of: A segregated wooden booth or darkened area within which ambient light can be restricted to a maximum intensity of 20 lux. 4.6.2 SIZES 1200 X 600 x 2200 mm (L x W x H) working area and working height of 900 mm. 4.6.3 Structure should be MS tubular type with Novopan Table top. 4.6.4 The table top should be covered with black rubber mat which should be chemical and heat resistant. 4.6.5 Inspection hood structure should have a height of approximately 1300mm from the tabletop. 4.6.6 Inspection booth should have a hood black duck cloth covering all sides with front side sliding opening 4.6.7 12" Exhaust fan should be provided at top/rear side of the hood structure 4.6.8 One white light with junction box should be provided at inside the inspection booth. One no of adjustable black light to be provided for inspection. 4.6.9 Fresh air fan inside the booth to be provided 4.6.10 Inspection station should be equipped with white light of minimum 2000 lux intensity for indication verification.					
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARATH HEAVY ELECTRICALS LIMITED. It must be not used directly or indirectly in any way detrimental to the interest of the company.		4.7 PNEUMATIC GRILLS ASSEMBLY- 7 No's (Penetrant 1, penetrant 2, Pre-wash, Emulsifier, Post wash, Drier, Developer stations) Pneumatic grills should have following features: 4.7.1 500 X 500 mm roller grill platform, 4.7.2 Ø25 mm Stainless steel rollers, 4.7.3 Up/ down arrangements through Pneumatic cylinder, total travel 450mm, 4.7.4 Solenoid with electrical integration to PLC 4.7.5 Structure at rear side of the tank to support the pneumatic Up and down movement along with Guide rods and bearings, housing etc. 4.7.6 Lid coupled with Pneumatic grill. 4.7.7 Pre-wash station lid fitted with water wash nozzles and air nozzles for auto wash cycle. 4.7.8 Drier and Developer lids are with air tight to avoid any leakages. 4.7.9 Post wash station without lid to facilitate the manual wash under UV light. 5. CONSUMABLES: 5.1. Necessary consumables for FPI inspection of the component should be supplied by the vendor. 5.2. Fluorescent penetrant inspection is only performed using qualified products listed in QPL-AMS-2644, in compliance with the requirements and classification of AMS-2644 should be supplied. A certificate of conformity should be available for every batch of penetrant, emulsifier and developer, issued by the manufacturer and complete with a Test Report showing the values obtained for each test required by the applicable specifications. 5.3. Water washable Penetrant, SL-2, (High Sensitivity, water washable) : 25 Liters 5.4. Post Emulsifiable Penetrant, SL-3, (High Sensitivity, water washable): 175 Liters 5.5. Dry Developer : 10Kgs 5.6. Emulsifier : 75 Liters 6. ELECTRIC CONNECTIONS 6.1 All Individual work stations should be equipped with proper electrical connections for pump, UV lamps, exhaust fan, white lamps and timers etc. Electrical panel with main controls should be provided which powers all remote electrical pendants / boxes for ON-OFF, Pneumatic functions, Fluidization circuit, heaters, Inspection lamps and Audio Visual Systems. The panel should also house the main fuses, Omron PLC and other controls etc. 7. COMPRESSED AIR 7.1 Compressed air at around 6 to 7 bar will be made available at one point. Vendor to ensure proper functioning of all systems / sub systems of the equipment at this air pressure or vendor to introduce necessary devices to decrease the air pressure to the required level. The vendor should indicate the inlet point for compressed air in the layout drawing of the machine.				
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		13. PERFORMANCE TESTING AT BHEL: 13.1 Performance test will be carried out after commissioning of the equipment at BHEL. Job prove-out will be carried out as per clause 14.0. The working of complete facility should be demonstrated to full satisfaction of BHEL personnel.				
		14. PROVE OUT OF THE FPI FACILITY : 14.1 Equipment should confirm to the requirements of ASTM E 1417. 14.2 The acceptance of FPI facility will be done by performing on PSM 5panels & Known defective specimens. 14.3 Inspection Booth should have black light & ambient white light should not exceed 20 lux or better. 14.4 Emergency OFF switches should be provided for system to shut down the system completely in case of emergency. 14.5 Inspection Booth should have black light & ambient white light should not exceed 20 lux or better. 14.6 FPI facility and general accessories should have relevant certificate of conformances (COC), operating manual of equipment. 14.7 All display meters to be fitted at readable height. 14.8 All the equipments installed to be meet with the ordered specifications and performance. 14.9 Vendor should illustrate the complete working of FPI system by conducting FPI inspection on one set of turbine buckets and nozzles. 14.10 Equipment name :Calibration of equipment's should be done as per table below: 14.11 DIGITAL PRESSURE GAUGE(Water) with calibration points 10,20,30,40,50,60 Psi and accuracy Within ± 5 Psi 14.12 DIGITAL PRESSURE GAUGE(Air) with calibration points 10,20,30,40,50,60 Psi and accuracy Within ± 5 Psi 14.13 PRESSURE GAUGE(Excess developer removal) with calibration points 1Psi, 3Psi, 4Psi, 5Psi, 10Psi and accuracy Within ± 5 Psi 14.14 DRYER TEMPRATURE INDICATOR AND CONTROLLER with calibration points 10, 20, 30,40,50,50,60,70,80 °C and accuracy with in $\pm 5.6^{\circ}\text{C}(10^{\circ}\text{F})$ or Better 14.15 LIGHT METER(WHITE AND BLACK) with calibration points Black Light ranges: 0,100,500,1200,2000,3000, $\mu\text{w}/\text{cm}^2$ / White Light Ranges : 0,50,500,1000,3000 Lux and accuracy $\pm 5\%$ 14.16 DIGITAL TIMER(Dark time adaptation) with calibration points 10 Sec, 30Sec, 60Sec, 90Sec,120Sec and accuracy with in ± 1 Second 14.17 DIGITAL TIMER(Penetrant& Developer Timer) with calibration points 10,30,60,90,120,240 minutes and accuracy ± 1 Second 14.18 DIGITAL TIMER(Pre & Post rinse & emulsification) with calibration points 10Sec,30 Sec, 60Sec, 90Sec, 120Sec,240Sec,300Sec and accuracy with in ± 1 Second				
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		15. PACKING 15.1 To ensure receipt of items in good condition			
		16. GENERAL 16.1 Painting of Equipment - As per BHEL, colour code to be done by vendor. 16.2 Vendor should provide the details of overall space required for the FPI facility including sub systems: L x W x H :- 16.3 Approximate total weight of the Equipment including accessories : 16.4 Weight of the heaviest Part or sub assembly : 16.5 Vendor to submit, along with offer, reference list of customers where similar facility have been supplied mentioning broad specifications of the supplied facility. 16.6 Detailed catalogues, sketch/ photographs of the equipment and accessories should be submitted with the offer. 16.7 Vendor should submit his latest design. In case of any variance with the present Spec., BHEL reserves the right to study & make minor changes. 16.8 All the inlet and outlet / drain valves supplied should be off brass and standard make. 16.9 All grills inside the tank should be of wire rod and spilt into 2 equal parts so that it enables the operator to easily lift the same for cleaning and draining purposes. 16.10 All drain outlet pipes to be supplied up to a length of 500mm away from the tank frame at rear side of the tanks. A common drain line connection to all these drain pipes to be shown in the foundation lay out drawing.			
		17. QUALIFYING CONDITIONS 17.1 Only those vendor, who have supplied and commissioned at least two FPI facilities for Industrial application in the past ten years and should have completed at least one year as on date of opening of tender. Such facility should be presently working satisfactorily. The following information is to be submitted by the vendor about the companies where similar FPI facility have been supplied. 17.2 Name of the customer/ company where similar equipment is installed. 17.3 Complete postal address of the customer. 17.4 Month & Year of commissioning 17.5 Application for which FPI facility is supplied with details of the job 17.6 Name and designation of the contact person of the customer 17.7 Phone/ Fax / Email address of the contact person of the customer 17.8 Performance certificate from the customer regarding satisfactory performance of the equipment supplied to them. 17.9 BHEL reserves the right to verify information submitted by vendor, in case the information is found to be false / incorrect, the offer shall be rejected.			
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