

BHARAT HEAVY ELECTRICAL LIMITED**UNIT'S ADDRESS:**

HEEP, RANIPUR,
HARIDWAR - 249403
UTTARANCHAL, INDIA

Indent No. 20171224

Date: 06-07-2017

SPECIFICATION CUM COMPLIANCE CERTIFICATION FOR SHOT PEENING MACHINE**NOTE :-**

1. Vendor must submit complete information against clause no. 41. The offer would only be considered if complying this clause.

2. The vendor should fill the "Offered" Column in compliance to specified requirements and also "Deviations" Column, where there is deviation from the requirement. Duly filled specification cum compliance certificate should be submitted along with the offer. Inadequate, incomplete, ambiguous or unsustainable information against any of the clauses of the specifications/requirements shall be treated as non-compliance. Any changes made to the clauses of the specification cum compliance certificate will be treated as non-compliance and may lead to rejection of the offer.

SCOPE: **SUPPLY, ERECTION & COMMISSIONING OF SHOT PEENING CENTER WITH SPECIFICATIONS AS BELOW :**
No of Machines : 1 No.

Sl. No.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
01.00	PURPOSE & WORKPIECE MATERIAL				
01.01	10 axes indexing type Robotic Automatic Shot Peening Centre is required for controlled shot peening in profile and fillet platform (refer sketch IX of Clause 10.02) of bar type Drum stage blades (T root / Double T root / Hook root) and in fir tree root (refer sketch X of Clause 10.02) of Free standing module stage LP blades of steam turbine blades. Shot peening of Fillet platform at root side to be done on blade material INCONEL 617 and NIMONIC 80A having tensile strength up to 1000-1300 N/mm ² and hardness more than 260 HBW. The complete tensile stresses to be removed from profile and fillet platform area after shot peening. Other part of the blade should be covered by suitable fixture / other means. Fir tree blade root of module stage to be shot peened on blade material X10CrNiMoV12-2-2 and X5CrNiCuNb16-4 having tensile strength up to 1130 N/mm ² and hardness up to 335 HBW. Compressive stresses to be generated in fir tree blade root area after shot peening as per clause no. 3.03. The other part of blade should be covered by suitable fixture / other means.	Vendor to accept & confirm			
02.00	Blade sizes to be shot peened are as follows:				
2.01	For bar type blades (clause no. 10.02), serial no. 1, 2 & 3: blade length will be from minimum 100 mm to maximum 350 mm and maximum weight will be up to 05 KG approx.	Vendor to note			
2.02	For Fir tree blades (clause no. 10.02), serial no. 4: blade length will be up to maximum 1300 mm and maximum weight will be 70 KG approx.	Vendor to note			
03.00	SCOPE OF THE PROCESS:				
03.01	The machine should be capable of running an automatic process of shot peening so that following consistent result are obtained .	Vendor to accept			
03.02	Acceptable Surface Roughness to be measured as per ISO 4287 (for S 70, S330 & S 550) after shot peening.	Better than Rz 12 µm for S550			
03.03	Complete tensile stress to be removed from shot peened area of bar type drum stage and compressive stress to be generated on fir tree blade of module stage.	Depth Compressive Stress At surface >500 MPa 50 micro meter >500 MPa 100 micro meter >500 MPa 200 micro meter >450 MPa 400 micro meter >10 MPa			

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03.04	Peening intensity range : I) For bar type blades: 1. First shot peening to be done by shot S70 round cast steel with an intensity of 0.10-0.15 mmA and coverage $\geq 125\%$ 2. Then the shot peening to be done on the same area as per drawing by shot S330 with an intensity of 0.30-0.35 mmA and coverage $\geq 200\%$ II) For fir tree blade: Shot peening to be done on complete blade root as per drawing by shot size S550. The first two passes to with an intensity of 0.45-0.48 mmA and coverage 175 - 200%, then one pass for smoothing with an intensity of 0.25 mmA and coverage 100-150%.	Vendor to accept			
03.05	The machine should be capable of accommodating minimum and maximum size of multiple blades at a time with consistency and repeatability in clamping of blades in the fixture.	Vendor to accept			
03.06	The shot (S70, S330 & S 550) desired should be selectable from the machine control panel or through program. There should not be any need to change magna valve or vibratory sieve classifier to change shot size manually.	Vendor to accept			
04.00	BLAST CABINET WITH CAROUSEL INDEXING DOOR, ILLUMINATION, RUBBER LINING				
04.01	Blast cabinet should be fabricated from 6mm or more steel plate and should have a tubular construction. The cabinet should be rubber lined with 6 mm or more thick rubber sheets. The vendor should provide acoustic panels to keep sound levels below 80dB. The cabinet should be illuminated from inside with at least one metal halide of 250W or equivalent, which should be abrasion resistant, dust-tight and easy to maintain. One set of Pressure Gauge, Moisture Separator & Pressure Switch should be provided at the air inlet of the M/C.	Vendor to accept			
04.02	Size of the blast cabinet should be suitable for 1.3 mtrs height blade.	Vendor to accept & provide details			
04.03	One side of the cabinet operator access door should be insulated and should be double wall hinge type with proper sealing. The door should be electronically secured to prevent peening operation when it is open and should have at least one viewing window.	Vendor to accept			
04.04	At least one vision window at access door should be provided with toughened vision glass which is to be protected by a fine wire mesh and the glass should be easily replaceable.	Vendor to accept			
05.00	SHOT FEEDING DEVICE (1 for each shot type)				
05.01	This should include continuous blast generator and should consist of double pressure vessel, special pinch valve, magna valve, a mixing tube and automatic exhaust valve to depressurize the pressure vessel, when air supply is cut off. Pressure vessel is to be fabricated from 6 mm or more thick MS Plates as per IS - 2825/CE certified and should be hydraulically tested at 250 or more psi or other international certified. There should be on shot feeding device for each shot type. High pressure level sensors to be provided on each lower pot to control pressurizing & depressurizing of pots.	Vendor to accept			
5.02	The following process tolerances shut down limits are required to be maintained during the peening process:	Vendor to accept			
5.03	Shot flow: +/- 10%	Vendor to provide details			
5.04	Air pressure: 6 bar : +/- 10%	Vendor to provide details			
5.05	Nozzle translation speed: +/- 10%	Vendor to provide details			
5.06	Nozzle position: +/- 2 degree	Vendor to provide details			
06.00	MECHANICAL RECOVERY SYSTEM	Vendor to provide details			
06.01	A Suction type system to be provided in the floor of the blast cabinet chamber to collect used media. These used media then will be delivered to the shot classifier. From the classifier, usable shot sizes should be sent to the different blast generator by pneumatic / mechanical system.	Vendor to accept			
06.02	A fan should be provided to remove dust into the cartridge dust collector. The cartridge dust collector should be a self cleaning system. All filter elements should be automatically cleaned with the aid of timer card through which solenoid valve are opened and certain volume of compressed air is blown into the cartridges to keep cartridges clean and thus the clean air is discharged in to the atmosphere while the dust is collected properly.	Vendor to accept			
06.03	Filter element porosity	2 Microns or better.			
06.04	Fan motor	7.5 HP or more			
06.05	Fan Capacity	2000 Cfm or more.			
06.06	Composition of Micro fibres in filter element	Synthetic fibres with an average diameter of 0.2 Microns.			

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06.07	Composition of Substrates in filter element	Blend of cellulose fibres.			
06.08	Fractional / Gravitational efficiency of filter element	99.999% on 0.5 Micron particles.			
06.09	Suitable PVC flexible hose for the system is to be provided.	Vendor to accept			
06.10	AUTOMATIC QUICK MEDIA ADDER (3 Nos). (Each for S70, S330 & S550) : A quick media adder is connected to the main recovery duct of the respective shot. It consists of a separate storage tank to store the media in it. The storage tank is provided with a pneumatic operated flap valve for ON/OFF of the media to the suction line. The storage tank is provided with an inspection door at the top with perforated screen. When the level of media in the storage tank goes below the indicated level then level sensor will give command to the pneumatic flap valve of the respective storage tank of the quick media change system to allow the media to fall into the main recovery boot.	Vendor to accept and provide details of volumetric capacity of storage tank.			
07.00	ONLINE VIBRATORY CLASSIFYING DEVICE UNIT AND SHOT SEPARATOR (Suitable for S70, S330 & S550 Shots)				
07.01	Shot Separator (For shape segregation) should be spiral separator type to separate round and broken shots.	Vendor to accept			
07.02	Classifier (For size segregation) should have a vibration screen to separate shot mix into proper, over and under size grits.	Vendor to accept			
07.03	Drive motor power.	2 HP or more.			
07.04	Separate classifying device should be provided for each shot size and the machine should be capable of using the correct one automatically depending on the shot size selected by the operator panel. The current selected Nozzle and the Shot size working on machine should be displayed on Operator Control Panel.	Vendor to accept			
07.05	Indicator display system to show the level of shots available in the machine / tank. The Low level and High level of shots in Machine / Tank should also displayed on Operator Control Panel.	Vendor to accept			
07.06	Two viewing glasses (High pressure rating) to be provided on each pressure vessel for seeing the shot level	Vendor to Accept			
07.07	Magna valve & Pinch Valve to be changed without disturbing shots at tank. Manual Shut-Off valves should be provided before each Magna valve & Pinch Valve to stop shots flow from the tank.	Vendor to accept			
08.00	6 AXIS ROBOT WITH CONTROLLER UNIT AND TEACH PENDANT				
08.01	Robot supplied should have coordinated movement with turntable to move the blast nozzle in a curved path of blade profile of both concave and convex curvatures of the steam turbine blades. All movement should be programmable.	Vendor to accept			
08.02	All 3 nozzle should be mounted on the robotic arm. Any one nozzle should be in operation at a time for the respective peening media w.r.t. the program selected in order to do peening operation perpendicular to the job surface w.r.t. the nozzle position.	Vendor to accept			
08.03	Robot should be of FANUC, ABB or KUKA make only. Vendor should offer details of robot being supplied.	Vendor to accept			
08.04	Integrated Controller should be provided of FANUC, ABB or KUKA. Details of the controller to be submitted along with the technical offer.	Vendor to accept			
08.05	Teach Pendant with suitable cable length should be provided. The program can be made and stored in the system with the help of Teach Pendant by touch point stick system mounted on nozzle keeping the stick perpendicular to the curved job surfaces.	10 m cable length			
08.06	The robot should have high sensitivity collision detection provision.	Vendor to accept			
08.07	Special protection for the robot from oil, dust and shots spray entry should be provided by suitable means.	Vendor to accept			
08.08	The programmable logic controller should be built in. Details for this controller are to be provided.	Vendor to accept and provide details.			
08.09	Payload Specifications of robot	30kg or more			
08.10	Motion range of Robot should be sufficient enough to cover the entire profile/ fillet of blades mentioned in clause 10.02 for the purpose of shot peening on specified area of blade profile. The robot should be able to articulate easily, with the blast nozzle mounted on it.	Vendor to accept & provide details of the robot's motion range.			
08.11	Positioning repeatability of Robot should be +/- 0.08 mm or better.	Vendor to accept			
09.00	INDEXING DOOR AND ROTARY TABLE FOR BLADE MOUNTING				

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Sl. No.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
09.01	Rigid steel fabricated indexing table is mounted at front of the peening cabinet for indexing 0-180° (+/-). Indexing is achieved by servo geared motor with position sensing. Indexing table is provide with 2 servo controlled turntable as 7th & 8th axis of robot and one table is always inside the cabinet while other is outside for loading/unloading the job. The wall separating both turntables is with double insulated wall equipped with central rotating axis. Complete indexing table is provided with rubber seal to prevent any leakage of shot from the opening during peening operation. A collection hopper is provided for both turntables to collect and drain the spillage media from turntable top into recovery mini hopper	Vendor to accept & provide details of servo-motor & drive.			
09.02	The top of the table is covered with 6 mm thick Chrome Manganese steel to protect against abrasion. Turntable is housed with taper roller bearing housing and is properly sealed to protect against dust and dirt.	Vendor to confirm			
09.03	For bar type blade : Five or more satellite are mounted on the each indexing turntable and is driven by Servo motor as Robot's 9th & 10th Axis. The turntable is fabricated from heavy duty abrasion resistance steel structure for strength and rigidity. The jobs can be loaded outside the cabinet on the satellite of turntable while other turntable will be inside machine for operation. The position of each turn table and each satellite should be displayed on the operator panel during operation.	Vendor to accept & provide details of servo-motor & drive.			
09.04	For fir tree blade : The fixture for fir tree blade should be mounted on the servo controlled turntables so that one table is always inside the cabinet while other is outside for loading/unloading of the job. The fixture should cover all parts of blade by any means other than root which is to be shot peened.	Vendor to confirm			
09.05	Diameter of rotary table	600mm minimum			
09.06	Maximum load capacity of indexing turn table	150kg or more			
09.07	Rotational speed of rotary table	0-20rpm or more			
09.08	Rotary table servo motor power	1.1 kW or more kW			
09.09	The rotational speed should be selectable from the teach pendant of the robot.	Vendor to accept			
09.10	Accuracy of Turn table	Vendor to provide details			
09.11	Loading capacity of each satellites	15 Kg or more			
09.12	The distance/ gap between the satellites on the turntable should be apart enough so that the shot peening on one blades at one satellite should not shot peen the other blades mounted on the other satellite.	Vendor to accept			
09.13	Work station to be at lower/ reachable height for loading unloading of blades	Vendor to accept			
09.14	Suitable arrangement for loading / unloading of bigger LP fir tree freestanding blade at outside turntable should be provided.	Capacity = 250 Kg or more. Vendor to confirm and provide details.			
10.00	FIXTURING				
10.01	The rotary table should be provided with an arrangement for fixtures for following blade drawings supplied with BHEL technical specification as per the following clause. The requisite fixtures to be offered item wise. Necessary masking elements to be offered item wise for all the mentioned blades. NOTE:- drawings will be provided to the vendor only after they have signed a non-disclosure agreement with BHEL.	Vendor to accept			
10.02	1. SKETCH - I & SKETCH - II Material : Inconel 617M (bar type blade) 2. SKETCH - III & SKETCH -IV Material : NiCr20Ti Al (bar type blade) 3. SKETCH - V & SKETCH - VI Material : NiCr20Ti Al (bar type blade) 4. SKETCH - VII & SKETCH - VIII Material : X10CrNiMoV12-2-2 (fir tree blade sketch) 5. SKETCH - IX (Profile and fillet area to be shot peened for sketch I to VI of serial nos. 1, 2 & 3) 6. SKETCH - X (Fir tree root area to be shot peened for sketch VII to VIII of serial nos. 4) Note- SKETCH - I, III, V, VII and SKETCH - II, IV, VI, VIII are 2 variants of a blade - left hand and right hand respectively. Profile and root strak data will be provided for the 3D modeling / tool path generation / Fixture manufacturing. (Drawing will be provide only after vendor has signed non-disclosure agreement with BHEL)	Vendor to accept			
11.00	PC FOR PROGRAMMING				
11.01	A latest configured PC for programming of the machine, having suitable hardware configuration along with printer and UPS (with capacity to power the supplied computer for 30 minutes) is to be provided. The operating system should be Windows 7 based.	Vendor to accept			

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11.02	Back-up of each program should be possible to save in the PC through network.	Vendor to accept			
12.00	SOFTWARE				
12.01	Parametric programs for shot peening different types of blade profile & roots as mentioned in clause 10.02 to achieve desired peening intensity are to be supplied. The system should have sufficient storage capacity to save the programs on machine as well as on PC.	Vendor to accept minimum 250 programs			
12.02	Customized diagnostic software, example mimic diagram for monitoring, various control measurement and proper functioning of machine elements should be supplied. S-7 software to visualize PLC ladder diagram along with WINCC (if applicable) should be provided. System software of robot unit should also be provided on PCMCIA Card.	Vendor to accept			
13.00	MACHINE CONTROL PANEL				
13.01	A dust & rodent proof and wired for 415V/3P/50 Hz. power control panel should be provided. It should have Start / Stop switches for all the motors in the machine, On / Off switch for operation sequence, blast nozzle, gun reciprocation and illumination. An emergency stop should also be provided. Audio visual alarm indicating cycle start, cycle completion and fault display should be provided in the control panel. The control panel is to be properly illumination for maintenance purpose and should have forced cooling arrangement.	Vendor to accept			
13.02	A coloured touch screen HMI of size 12" minimum to be provided for the operator interface. Siemens or equivalent make.	Vendor to accept & provide details			
13.03	A membrane keyboard or touchscreen should be provided for operating the panel.	Vendor to accept & provide details			
14.00	SERVO VOLTAGE STABILIZER				
14.01	Oil / Air Cooled Servo Controlled Voltage Stabilizer suitable for complete machine, its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions.	Vendor to offer & to provide electrical drawings for the same.			
14.02	Spares Package for Servo Voltage Stabilizer, with item-wise breakup, are to be recommended and offered by the vendor in sufficient quantity for 2 years of trouble free operation considering two shifts running of the machine. Detailed list is to be submitted. Price of unit quantity of each item is to be quoted. The following should be necessarily offered along with the spares package :- Variacs-2 nos., Correcting servomotors- 4 nos., Control cards-2 nos of each type, Control Transformers - 3 no. each type.	Vendor to offer			
14.03	Make	Neel, Suvik, Servomax, Aplab or Auto Electric			
14.04	Model, Rating & Input/ Output Voltage etc.	Vendor to inform			
14.05	Monitoring device with cut-off facility for under/over output voltage, Devices for load current measurement, MCCB at input for overload/short circuit protection. (Details to be submitted)	Vendor to inform			
15.00	ULTRA ISOLATION TRANSFORMER				
15.01	Ultra Isolation Transformer suitable for complete machine , its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions.	Vendor to offer			
15.02	Make	Neel, Suvik, Servomax, Aplab or Auto Electric			
15.03	Model, Rating & Input/Output Voltage etc.	Vendor to inform			
15.04	Monitoring device with cut-off facility for under/over output voltage, Devices for load current measurement, MCCB at input for overload/short circuit protection. (Details to be submitted)	Vendor to inform			
15.05	Catalogue of the Isolation Transformer shall be submitted with the offer.	Vendor to submit			
15.06	Spares Package for Isolation Transformer, with item-wise breakup, are to be recommended and offered by the vendor in sufficient quantity for 2 years of trouble free operation considering two shifts running of the machine. Detailed list is to be submitted. Price of unit quantity of each item is to be quoted.	Vendor to accept and provide details.			
16.00	PLC & PROCESS SEQUENCE				
16.01	PLC for sequence and operation controls of variables to ensure repeatability of shot peening process is to be provided. Preferably Siemens make S7-1200 or higher model.	Vendor to accept			

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16.02	The following should be displayed on operator's panel along with other relevant information:- 1. Shot Size Selection. 2. Shot Flow rate. 4. Working pressure. 5. Peening time. 6. Hour counter with reset facility.	Vendor to accept			
16.03	Following function should be displayed on Robot Pendant along with other relevant information :- 1. Motor Position of 6 Axis Robot 2. Position of Turntable 3. Turntable RPM 4. Position of Satellite	Vendor to accept			
17.00	CLOSE LOOP AIR PRESSURE REGULATOR & MAGNA VALVE.				
17.01	Close Loop Air Pressure Regulator should be supplied for regulating air pressure through PLC. Magna valve should be supplied for controlling variable flow rates through PLC. To protect magna valve against excessive wear, there should be a pinch valve above the magna valve. The controller should be capable of being recalibrated for shot type and size for higher accuracy. At the same time the Magna valve should be capable of accommodating the Cast Shot Size S70, S330 and S550. The shot flow controller should have a large digital display, high / low alarm contacts, monitor flow in Kg / min, etc.	Vendor to accept			
17.02	The air pressure should be controlled using the control panel and values should be visible on operator's screen.	Vendor to accept			
17.03	This system is to be provided for separately for each shot size and the machine should be capable of automatically using the correct system depending on the shot size selected in the operators panel..	Vendor to accept			
18.00	COMPRESSED AIR TREATMENT EQUIPMENT				
18.01	Refrigerator Air Dryer, Compressed air vessel with pre and post filters should be provided to entrap moisture and other suspended particles to provide dry and clean air into the machine. The air vessel should have automatic electronic drainage system to drain moisture and other suspended particles.	Vendor to accept			
18.02	The system should be IP 44 or better rated.	Vendor to accept			
18.03	A compressed air vessel is to be provided with a mounted ducting.	3000 Ltrs or more			
18.04	All pneumatic ducting and piping network for connecting the system to BHEL source of pneumatic point is to be supplied by vendor.	Vendor to accept			
19.00	ALMEN GAUGE, ALMEN STRIP "A-1", ALMEN TEST STRIP HOLDER (ALONG WITH DUMMY BLOCK), DIGITAL COVERAGE CHECKER, SHOT FLOW CALIBRATION SYSTEM AND SURFACE ROUGHNESS TESTER				
19.01	The Digital Almen Gauge with magnetic grip and fool proof end stops as per standard SAE J442 should be supplied of M/s Electronic Incorporation.	1. Measuring range - 0.0001" to 0.025" 2. Resolution - 0.0001" or better. 3. The gauge should have an easy to read display.			
19.02	500 no. Almen strips "A-1" as per standard SAE J442 should be supplied along with the machine.	1. Length - 76.1 +/- 0.3mm 2. Width - 18.987 +/- 0.065mm 3. Thickness - 1.295 +/- 0.025mm 4. Flatness - +/- 0.025mm 5. Hardness - HRC 44-50			
19.03	Almen strip holders and Dummy blocks (for holding almen strip) for each type of blade root mentioned at clause no. 10.02 is to be provided.	4 no. almen strip holders 1 dummy block			
19.04	Digital coverage checking Device: Shot peening system to be supplied with digital means of checking and verifying 100% coverage on the component being shot peened. The Digital coverage checking Device should be of M/s TOYO SEIKO.	Vendor to accept & provide			
19.05	Before commencement of a peening cycle, it is required for the nozzle carriage to execute a dry cycle with a visual check to ensure that nozzle(s) is targeting the areas required to be covered.	Vendor to accept			
19.06	The dry cycle is to be carried out in conjunction with a laser arrangement for a visual check of travel path.	Vendor to accept			

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19.07	Shot Flow Calibration Unit: There should be integrated shot flow calibration unit in the machine which confirms the shot flow by means of drop test of shots by 'Catch & Weight' method automatically. The path program for the drop test is to be incorporated into the machine program and is required to be carried out without any manual intervention, with all doors closed.	Vendor to accept			
19.08	A portable manually operated surface roughness tester (Mitutoyo make) is to be provided for checking of surface roughness of peened area of blades after peening. The surface roughness value is to be stored in the PC for the each job in the printable format.	Vendor to accept & provide			
20.00	SHOT PEENING MEDIA				
20.01	Cast steel shots type S 70, S330 & S 550 (for achieving the desired results) should be quoted for initial charging and for subsequent consumption of 1000 hours peening. Also initial charging quantity and per hour of consumption rate should be defined in technical offer.(in kgs)	Vendor to accept & offer details			
21.00	BASIC NOZZLE AND BLAST HOSE				
21.01	Boron carbide blast nozzles of required orifice for shot peening the blade root of all types of blades mentioned in clause 10.02 are to be supplied. The blast hose should be of suitable diameter and of the requisite length. The blast hose should be suited to the offered nozzles. Details of the blast nozzle with drawing of nozzle should be provided.	Vendor to provide details of nozzles & hose pipes for S70, S330 & S550			
22.00	DOCUMENTATION (5 printed copies and 1 electronic copy to be supplied along with machine in English)	Vendor to accept			
22.01	Basic equipment operation and maintenance manuals	Vendor to provide			
22.02	Detailed assembly drawings with clear marking of each component and giving reference of manufacturer for each assembly/sub assembly	Vendor to provide			
22.03	Detailed spare part list along with specification, part number and address of manufacturer	Vendor to provide			
22.04	Detail drawing of nozzles and their holders should be provided	Vendor to provide			
22.05	Electrical schematic and pneumatic/ hydraulic diagram of the machine.	Vendor to provide			
22.06	Commissioning and interface manual of drive controller.	Vendor to provide			
22.07	Interface description of robotic system with PLC.	Vendor to provide			
22.08	Detailed circuit diagrams of drive controller.	Vendor to provide			
22.09	Wiring diagram and connector details.	Vendor to provide			
22.10	PLC (Ladder Logic diagram) statement list along with comments in English language.	Vendor to provide			
22.11	Back up of all software (licensed copy) e.g. diagnostic software, user program etc.	Vendor to provide			
22.12	Operation and maintenance manual of robot controller.	Vendor to provide			
22.13	Alarm list and fault diagnostic manual	Vendor to provide			
22.14	Service and user manual for all bought out items	Vendor to provide			
22.15	Installation and start up manual of Drive Controller.	Vendor to provide			
22.16	S7 Programming manual	Vendor to provide			
22.17	Backup of PLC, HMI on USB Drive (1 TB or More) and Backup of Robot system software, Teach pendant on USB drive.	Vendor to provide			
22.18	Written procedure for setting the robot zero positions of robot axes.	Vendor to provide			
22.19	Data report for shot flow, air pressure, shot size, surface roughness and total peening time to be generated automatically for each job/recipe and to be saved in the PC in the printable format	Vendor to accept.			
22.20	Written procedure for backup / restore of PLC, HMI, Teach Pendant and Robot system software.	Vendor to accept.			
23.00	TRAINING				
23.01	1 weeks Training of BHEL engineers in the following fields shall be provided at supplier works during pre-acceptance.	Vendor to accept			
23.02	i. PLC / MMI / Drives / Robotic / CNC maintenance.	Vendor to accept			
23.03	ii. Mechanical / Pneumatic maintenance.	Vendor to accept			
23.04	iii. Operation and programming.	Vendor to accept			
23.05	Vendor will teach preparation of parametric programming to the trainee deputed for operation & programming training. In case training facility in robotic components is not available at supplier's works, same shall be arranged by vendor at authorized training centre of robot manufacturer.	Vendor to accept			
23.06	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	For vendor's information.			
23.07	Competent, English speaking experts shall be arranged by the vendor for satisfactory & effective training of BHEL personnel.	Vendor to accept & confirm			

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23.08	Vendor to quote for Training on per man per day basis	Vendor to accept and submit necessary details.			
24.00	SPARES				
24.01	Spares for at least 2 years, two-shift trouble free operation of machine should be offered. The spare package should include all attachments, accessories and peripherals. The spares' offer should contain individual item wise list along with price breakup, specification and source of supply.	Vendor to accept			
24.02	The spares offer should necessarily include the following apart from any other item that is required to meet the condition of clause 24.01. Incase any of the following items are not used in the machine, the vendor to clearly specify this against the item. However if at a later date, it is determined by BHEL that such an item is being used in the machine, the vendor will have to supply the item in the quantity mentioned to BHEL Haridwar at no extra cost.	Vendor to accept			
25.00	Electrical & CNC Spares should include the following :-	Vendor to accept			
25.01	PLC CPU	1 no.			
25.02	PLC Input Card	1 no. each type			
25.03	PLC Output Card	1 no. each type			
25.04	Proximity Switches	5 no. each type			
25.05	Limit Switches	4 no. each type			
25.06	Operator Display	1 no.			
25.07	Controller unit for Magna valve	1 no. each type			
25.08	Stepper/drive motor (not the robot motor) (if used in machine)	1 no. each type			
25.09	Push Buttons	16 no.			
25.10	Indicating Lamp	8 no.			
25.11	Vibratory Motor	1 no. each type			
25.12	AC drive (if used in the machine)	1 no. each type			
26.00	Mechanical Spares should include the following :-	Vendor to accept			
26.01	Blast Hose	15 mtrs			
26.02	Nozzle Holder	5 no.			
26.03	Rubber Bush for nozzle holder	10 no			
26.04	Blasting Nozzle	5 no. each type			
26.05	Rubber sleeves	20 no. each type			
26.06	O-rings/seals	5 no			
26.07	Coupling for blast hose	5 no			
26.08	Hose Connector	4 no.			
26.09	Exhaust Valve	2 no.			
26.10	Special Pinch valve	2 no.			
26.11	Solenoid valves	2 no. each type			
26.12	Filter Element for dust collector	4 set			
26.13	Pressure Switch	2 no. each type			
26.14	Air Regulator	1 no.			
26.15	Bearings if used in machine	1 no. each type			
26.16	Belts if used in machine	1 no. each type			
26.17	Pulleys if used in machine	1 no. each type			
26.18	Air Filter	2 no. each type			
26.19	Vibratory Classifier Sieve for S70. S330 & S550	2 sets of meshes for each shot type			
26.20	Mixing tube	2 no.			
26.21	Abrasive nipple	2 no.			
26.22	Bucket Elevator belt	2 no.			
26.23	Buckets for bucket elevator	2 no.			
26.24	Bellows for Robot	2 no.			

Sl. No.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERRED	DEVIATION	REMARKS
26.25	Diaphragm for exhaust valve	2 no.			
26.26	Magna valve	2 no. each type			
26.27	Sieve classifier	2 no. (for each type)			
26.28	Pinch Valve	2 no. each type			
26.29	Clamping unit for classifier	1 set			
26.30	Exhaust Fan used in Suction type system	1 no.			
27.00	Spares for Robot should include :-	Vendor to accept			
27.01	Axis Servo Unit (for each axis)	1 no.			
27.02	CPU unit / main board	1 no.			
27.03	Power Supply	2 no. for each axis			
27.04	Servo motor for axis	1 no.			
27.05	Operator Panel	1 no.			
27.06	Profibus Master/Slave unit	1 no.			
27.07	Memory board/flash rom card	1 no.			
27.08	Tech Pendant unit (loaded as used on the machine)	16 Nos. of each type			
27.09	Battery	2 no. each type			
27.10	Fibre Optical Cable (as used on the machine)	1 no.			
27.11	Robot protection cover	4 no.			
27.12	200 mA fuse (If required)	Vendor to accept			
28.00	The colour of equipment and all peripherals shall be Apple Green RAL 6011.				
29.00	TROPICALISATION:	Vendor to accept			
29.01	All electrical / electronic equipment should be tropicalized.	Vendor to accept			
29.02	All electrical & electronic control cabinets & panels should be dust and vermin/rodent proof.	Vendor to accept			
29.03	All electrical components in the cabinets should be mounted on DIN Rails.	Vendor to accept			
29.04	All motors shall conform to IEC or Indian Standards or equivalent standards.	Vendor to accept			
29.05	Vendor should ensure the proper earthing for the machine and its peripherals /accessories. Any material requirement for the same should be informed with foundation design/ drawings. The vendor can take earthing connection from the nearest available location of the production shop.				
30.00	OPERATING CONDITION:	Vendor to accept			
30.01	Input power supply condition Voltage = 415 V +10% / -15%	Vendor to accept and give the details.			
30.02	Compressed air available at one point - 6 Kgs/Cm Sq. If the required compressed air pressure for operating of the machine is more that the stated pressure, the vendor to quote suitable compressor (of Indian make preferable) as an optional item. Also vender has to give the details of air pressure required for smooth running of machine.	Vendor to accept			
30.03	Temperature range during the year - 1 to 48 Deg. C (Panel AC to be used in the main electric panel)	Vendor to accept			
30.04	Relative humidity - 95 % RH Max.	Vendor to accept			
30.05	The tropical environment consists of dust-laden atmosphere during some part of year.				
31.00	TOOLS FOR ERECTION, OPERATION & MAINTENANCE	Vendor to accept and submit necessary details.			
31.01	Tools and Equipment required for erection of the machine shall be brought by the vendor. Necessary tools required for operation and maintenance of the machine should also be supplied by the vendor. List of such tools should be submitted with offer. It should necessarily include Fluke make Clamp meter.				
32.00	FOUNDATION				

Sl. No.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERRED	DEVIATION	REMARKS
32.01	Foundation Design: In case any special foundation is required for installing the machine, detailed foundation drawings to be offered. The vendor should agree to supply 5 copies of machine layout and foundation drawings (hard copies as well as AutoCAD drgs) within one month of Placement of LOI / Order.	Vendor to accept and submit necessary details.			
33.00	LEVELING & ANCHORING SYSTEM				
33.01	Complete set of anchoring materials including foundation bolts, nuts, washers, fixators, levelling shoes etc. for alignment and fixing of the machine on the floor should be supplied. Details to be submitted.	Vendor to accept and submit necessary details.			
34.00	ERECTION & COMMISSIONING:				
34.01	Supplier to take full responsibility for carrying out the erection, start up, testing of machine, it's control & all types of other supplied equipment/accessories 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 (capacity of EOT Crane in the shop is 5 Ton only) and helping personnel shall also be provided by BHEL. Details of these requirements should be informed/discussed by vendor and agreed with BHEL in advance. In case crane of higher capacity is required, representative of vendor to hire mobile crane from local sources at their own cost.	Vendor to accept			
35.00	PRE-ACCEPTANCE:				
35.01	Pre acceptance of the machine will be made at vendor's works by BHEL representatives. Geometrical accuracy of the machine [position turntable] & Robot repeatability should be demonstrated.	Vendor to accept			
35.02	Shot Peening trials will be done during pre-acceptance with 2 blade types (2 blades per type - total 4 blades) on the machine being supplied. These 2 blade type will be decided from those mentioned in clause 10.02. During pre-acceptance, all tests shall be witnessed by the BHEL team and all machine functions shall be verified.	Vendor to accept			
35.03	The blades for pre-acceptance tests will be supplied by BHEL, however the vendor will have to arrange for transport for these blades from BHEL and back after the pre-acceptance tests. The vendor will also have to provide suitable Bank guarantee for these blades.	Vendor to accept			
35.04	Vendor shall arrange all necessary facilities for measurement of Surface finish, Coverage checking, Residual Compressive Stresses and Peening Intensity. These will be measured as mentioned in clause 3. During pre-acceptance, all tests shall be witnessed by the BHEL team and all machine functions shall be verified.	Vendor to accept			
36.00	FINAL ACCEPTANCE				
36.01	Final acceptance will be at BHEL's Works where the following will be tested.	Vendor to accept			
36.02	Machine positioning, accuracy and repeatability (details to be furnished along with technical bid)	Vendor to accept			
36.03	Overall features and performance of the machine.	Vendor to accept			
36.04	Successful Peening of 10 Nos. of each type of blade as per clause 10.02	Vendor to accept			
36.05	Vendor shall arrange all necessary facilities for measurement of Surface finish, Coverage checking, Residual Compressive Stresses and Peening Intensity. These will be measured as mentioned in clause 3	Vendor to accept			
36.06	Supervision of one full week (6 working days) of continuous peening of blade roots after completing the peening in prove out blades. During this period necessary training in machine operation, maintenance and programming shall also be extended to BHEL operators.	Vendor to accept			
36.07	The machine will be treated as finally commissioned and will be taken over only after successful completion of all final acceptance activities and supervision as mentioned above.	Vendor to accept			
37.00	OPERATIONAL SAFETY:				
37.01	The design of the machine will be such as to provide utmost operational safety. Mechanical and electrical stoppers, Electronic interlocks should be provided.	Vendor to accept			
37.02	Emergency Switches at suitable locations as per International Norms should be provided. Measures should be provided to ensure that the machine shuts down safely in case of sudden power cut.	Vendor to accept			
37.03	All doors shall be electrically protected so the peening is not possible with door open condition.	Vendor to accept			
37.04	In case door opens during operation, peening cycle should stop immediately.	Vendor to accept			

Sl. No.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERRED	DEVIATION	REMARKS
37.05	The motion of the nozzle should stop immediately when it touches with the work piece or fixture.	Vendor to accept			
38.00	ENVIROMENTAL PERFORMANCE OF THE MACHINE:				
38.01	Maximum noise level shall be 80 dB (A) at 1 meter away from the machine with correction factor for back ground noise, if necessary. This will be measured as per international standards like ISO 2151. Supplier to demonstrate compliance to noise level, if asked for.	Vendor to accept			
38.02	There shall not be any emission from the machine and hence no disposal system shall be required.	Vendor to accept			
38.03	No Effluent Treatment Plant or Pollution Control Device shall be required.	Vendor to accept			
38.04	No hazardous chemical shall be used in the machine.	Vendor to accept			
38.05	Dust and broken shots shall accumulate properly for future disposal.	Vendor to accept			
38.06	Gases used in cooling devices/refrigerant type air dryer shall be environment friendly. Details to be submitted.	Vendor to accept & submit details.			
39.00	GUARANTEE:				
39.01	Vendor shall offer performance guarantee of the machine with all its peripherals including robot and robot controller for a period of 24 months from the date of final acceptance of the machine as in clause no. 36	Vendor to accept			
39.02	In case of any problem during guarantee period, trained personnel of the party would attend the problem within 6 working days. Any parts needed to be replaced by the vendor during guarantee period, shall be arranged by the vendor, duly freight and duty paid by them.	Vendor to accept			
40.00	GENERAL INFORMATION				
40.01	All the information and drawings attached with tender document are exclusive property of BHEL Hardwar. Under no circumstances these should be passed to any third party without prior permission of BHEL and must not be used directly or indirectly detrimental to the interest of BHEL.	Vendor to accept			
41.00	QUALIFYING CONDITIONS				
41.01	Only those vendors (OEMs) should quote who have supplied and commissioned at least one multi axes with robot of atleast 6 axes Robotic Shot Peening Machine having ability of segregating, handling & peening three different sizes of shots (one out of three shot sizes should be S550 or bigger) within the machine, in the past ten years (on the date of opening of Tender) and referred machine is presently working satisfactorily for more than one year after commissioning (on the date of opening of Tender). The following information should be submitted by the vendor about the companies where referred machine(s) have been supplied. This is required from all the vendors for qualification of their offer.	Vendor to accept & submit details.			
41.02	1. Name of the customer / company where referred machine is installed.	Vendor to submit			
41.03	2. Complete postal address of the customer.	Vendor to submit			
41.04	3. Month & Year of commissioning of referred machine	Vendor to submit			
41.05	4. Parameters of machine(s) supplied (shot size) and application for which the machine is supplied.	Vendor to submit			
41.06	5. Name and designation of the contact person of the customer.	Vendor to submit			
41.07	6. Phone, FAX no. and email address of the contact person of the customer.	Vendor to submit			
41.08	7. Performance certificate from the customers regarding satisfactory performance of machine supplied to them (Original Certificate or through E-mail directly from the customer). The original performance certificate may be returned after verification by BHEL, if required.	Vendor to submit			
41.09	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 accept			