

**EXPRESSION OF INTEREST**

**WELD OVERLAY SYSTEM FOR HP & IP ROTORS OF  
660/700/800MW**

**QUALIFYING CONDITIONS-**

- i. Only OEM (Original Equipment Manufacturer) vendors, who have supplied and commissioned at least one similar Weld Overlay System of the nearly same or higher sizes (Welding boom & column with travel length: X axis- 5-9.5m, Y axis- 2-4m, Z axis- 2-4m, Rotor Supporting Rollers capacity-30 to 60 MT & provision of manipulator/ positioned for rotation of rotor) in the past ten years and such Welding System presently working satisfactorily for more than one year after commissioning, should respond.
- ii. The following information should be submitted by the vendor about the companies where similar Weld Overlay Systems have been supplied-
  - a) Name of the customer / company where similar Weld overlay System is installed
  - b) Complete postal address of the customer
  - c) Month & Year of commissioning
  - d) Broad specification of the Weld overlaying System(s) with local heat treatment system mentioning Job Size & its weight
  - e) Name and designation of the contact person of the customer
  - f) Phone, FAX no. and e-mail address of the contact person of the customer
  - g) **Important- Performance certificate from the customers regarding satisfactory performance of weld overlaying system 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**
- iii. Offer of only those vendors will be considered who will qualify above qualifying conditions of Expression of Interest. Other offers shall not be considered.
- iv. **Vendor must reply point wise to Technical Feature (clause-B) of Expression of Interest.**

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## EXPRESSION OF INTEREST

### WELD OVERLAY SYSTEM FOR HP & IP ROTORS OF 660/700/800MW

Weld Overlay System consists of following-

1. Column & boom Type Submerged Arc Welding (SAW) & Gas Metal Arc Welding (GMAW) Machine
2. Positioner/ Manipulator for rotating the rotor in both directions with variable speed with provision of vertical height adjustment
3. Rotor Supporting System suitable for supporting the Rotor
4. SAW/GMAW Power source & Welding Heads
5. CNC Welding Process Control Panel
6. Other features
7. Associated accessories – Voltage Stabilizer, Air Compressor with Air Dryer & Flux Drying Oven
8. Local pre heating & post weld heat treatment system

#### A. Rotor Details and Basic Welding Conditions :

- 1) The weld overlay system should be capable of carrying out weld overlay on following rotors
- 2) **Size & Weight:**
  - i. 660MW IP Rotor- Length- 5892mm, Weight (approx)- 30400 Kg
  - ii. 800MW IP Rotor- Length- 6242mm, Weight (approx)- 36300 Kg
  - iii. 660/800MW HP Rotor- Length-5475mm, Weight (approx)- 17100 Kg

Note- However, weld overlay system should be capable of carrying out weld overlay on rotor of length- 7000mm (maximum) & weight - 45 MT (maximum).
- 3) **Material:** Alloy Steel Machined Forging grade X12CrMoWVNbN 10 11/ X12CrMoWNiVNbN10 11(B) - chemical composition and other properties as per annexure-I.
- 4) **SAW consumables:** 1.2Cr 0.5% Mo wires with matching fluxes, dia 2.0mm, 2.4mm & 3.0mm.  
**GMAW consumable:** 1.2Cr 0.5Mo, dia 1.2mm.
- 5) **Preheat/ Interpass Temperature:** 220 - 260°C / 300 °max.  
**Stress Relieving Temperature:** 660-680 °C

#### B. Technical Features-

1. **Column & boom type SAW & GMAW machine.**
  - a. Motorized horizontal movement ( X axis) parallel to rotor axis, Travel- 9500 mm



- b. Motorized vertical movement ( Y axis), Travel- 3000 mm  
c. Motorized horizontal movement ( Z axis) perpendicular to rotor axis, Travel- 3000 mm  
d. Column rotation movement by 360 degree  
e. Provision of movement control of the all axis by a joystick on operator panel  
f. Provision of movement in all 3 axis in slow & rapid mode

## 2. Positioner/ Manipulator for rotating the rotor

- i. Motorized rotator capable of rotating the rotor through a flexible coupling/ carden joint
- ii. Speed of the rotor : from 0.01 rpm to 1.0 rpm, infinitely variable through knob on control panel
- iii. Provision of rotation of rotor clockwise/ anti clockwise separately & clockwise & anti clockwise alternatetively in programme & manual mode both.
- iv. The rotation movement should be controlled by main control panel through operator panel.
- v. Provision of vertical movement of face plate of rotator for coupling of rotor
- vi. Provision of motorised sliding movement of rotator on rail along the axis of rotor so that it can be moved forward & backward during loading & unloading of rotor
- vii. Provision of suitable carden shaft coupling between manipupator & rotor to take care of any misalignment

## 3. Rotor Supporting System suitable for supporting the Rotor

- a. Two sets of rollers (rolling units with support blocks and supports) of self centering type
- b. Maximum Loading of rollers- 60 MT
- c. Diameter of the rotor in contact with rollers - from 490 mm to 2000 mm
- d. All the four rollers should be made of steel with surface hardened to withstand rotor surface temperature upto 350° C in contact with rollers during welding / PWHT.
- e. All the rollers should be mounted on rails so that it can be moved along the axis of the rotor for placement of rotor.

## 4. SAW/GMAW Power source & Welding Heads

### a. SAW/GMAW Power Source

- i. Rectifier type power source suitable for weld overlaying application with SAW & GMAW process  
Note- Single power source should be capable of carrying out weld overlay with both SAW & GMAW process.
- ii. Welding Current Range, 100-1000A
- iii. Welding voltage range, 19-44V
- iv. Rated Outpur at 100% duty cycle (10 minutes)- 1000A
- v. Open circuit voltage - 65V (max)
- vi. Input Supply - 415V  $\pm$  10% variation, 3 phase, 50 Hz  $\pm$  3% variation
- vii. Forced air cooling of power source

### b. SAW Welding Head

  
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- i. SAW welding head mounted on the welding boom end with long length SAW straight Torch & wire feeder unit
  - ii. SAW torch will be used to carry out weld overlay on horizontal face of rotor.
  - iii. Welding head should be suitable for single wire type feed.
  - iv. Suitable for welding wire sizes of diameter 2.0, 2.4 & 3.0 mm
  - v. Wire Feeder unit - Light weight, compact and rigid wire feeder with powered and grooved Roller drive and wire straightener
  - vi. Provision for precise adjustment of the welding torch cross to the boom while weld overlaying towards vertical wall on the both ends of the rotor.
  - vii. Provision of tilting angle of the torch both in manual & automatic mode
  - viii. Provision of Flux Storing, Heating, Feeding and Recycling System

**c. GMAW Welding Head**

- i. GMAW welding head mounted on the welding boom end with long length straight Torch, wire feeder unit, Cooling unit, Gas Manifold & Fume Extraction unit
- ii. GMAW torch should be capable of carrying out weld overlay on vertical face of rotor.
- iii. Welding head should be suitable for single wire type feed
- iv. Wire Feeder unit - Light weight, compact and rigid wire feeder with powered and grooved Roller drive and wire straightner
- v. Provision for precise adjustment of the welding torch cross to the boom while weld overlaying towards vertical wall on the both ends of the rotor.
- vi. Provision of tilting angle of the torch both in manual & automatic mode
- vii. Provision of suitable Fume Extraction System for GMAW process

**5. CNC Welding Process Control Panel**

- i. **Important- CNC welding process control will integrate all the modules of Weld Overlay System e.g. column & boom, manipulator, roller support etc through control panel.**
- ii. Software module of process control unit should contain following-
  - a. Provision of selecting welding process- SAW or GMAW
  - b. Provision of feeding welding parameters e.g. voltage, wire feed rate, welding speed, dia of rotor at weld overlay location, preheat temperature etc.
  - c. Provision of flux feeding & flux exhaust for SAW process
  - d. Provision of feeding gas flow rate, pre purge, post purge etc for GMAW process
  - e. Provision of feeding welding parameters on layer-to-layer basis for horizontal & vertical weld overlay. These parameters include position and angle of welding head at the start and at the end of each layer with provision of tilting of welding head.
  - f. Provision of adjustment of main welding parameters e.g. voltage, welding speed & wire speed during weld overlay process

  
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- g. Provision of observing various parameters at any time e.g. voltage, current, wire speed, welding speed, pre heat temperature including details of layer number, seam number, height of weld overlay completed/ balance weld overlay height etc
- h. Provision of restart of weld overlay from same location after unexpected stop e.g. power failure
- i. Provision of selecting manual/ automatic mode of welding process.
- j. Provision of generating programmes, saving of programmes , editing of programmes & deletion of programme of different welding process of components.
- k. Provision of joysticks to control the movement of the machine manually.
- l. Provision of remote service facility
- m. Provision of password protection for changing critical parameters
- n. Provision of dry run of welding torch before start of actual weld overlay for each layer.

**6. Other features**

- i. Provision of suitable Infrared temperature sensor (digital highly accurate pyrometer) for non-contact type temperature measurement of the rotor during preheating & weld overlaying
- ii. Provision of CCTV Camera system to monitor welding process before and after the welding area.
- iii. Provision of suitable carden shaft coupling between manipulator & rotor to take care of any misalignment
- iv. Provision of suitable platform for good access to the weld overlay area

**7. Associated Accessories**

- i. **Suitable Servo Controlled Voltage Stabilizer** for complete machine for unbalanced load & supply conditions considering specified power supply & ambient conditions (5-50 deg.C)
- ii. **Suitable Screw type air compressor system** consisting of air compressor & refrigeration type air dryer to supply dry and filtered air
- iii. **Suitable Flux Drying oven** (Top loading type) for baking/ removal of moisture from flux before welding

**8. Local pre heating & post weld heat treatment system**

- i. **Purpose:** Electrical heated local heat treatment system is required at two locations on the rotor at its bearing areas for preheating the rotor at 220-260°C, maintaining temperature of the rotor during weld overlaying and subsequently for in-situ stress relieving the weld overlaid rotor at 660-680 °C.
- ii. After weld overlaying the rotator will be continued to rotate in clockwise & anticlockwise direction for post weld heat treatment of the weld overlaid areas at 660-680 °C to avoid deformation
- iii. Local heat treatment system should be inclusive of-
  - a. Heat Treatment Transformer

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- Power Rating at 100% duty cycle- 300 KVA (min)
- b. Temperature Control Station along with built-in paperless temperature recorder
  - Suitable programmable Temperature Controller
  - 24-point paperless recorder
- c. Customized horizontally Split Furnaces (in two parts) for each type of rotor
  - Separate horizontally Split Furnaces furnace for both Turbine & Generator end of rotor
  - Provision of opening on top for weld overlay and on bottom for cleaning of welding residue/ slag
  - Furnace should be brick insulated for bottom section & top section of the furnace should be insulated with ceramic fiber blankets
  - Provision of sufficient number of control zone in each half of the furnace
  - Provision of heating by ceramic pads suitable for maximum temperature 750°C. Heating pads shall be mounted on the casing
  - Furnaces should be fitted with 4 adjustable legs fitted on wheels
  - Design of splitted furnace should be such that it can be placed/ removed before start/ after completion of weld overlay easily without fouling with any part of Weld Overlay System e.g. rollers/ rails of rotor supporting system
- d. Associated accessories-
  - Connection cable from transformer to control station with plug & socket
  - Connection cable from control station to furnace with plug & socket
  - Jumper Cable
  - Compensating cables with plug and socket
  - Compensation jumper leads with plugs
  - 6-point thermocouple connector for shaft on generator end
  - 12-point slip-ring-rotor mounted on adjustable tripod for turbine end
  - Thermocouple attachment unit
  - Calibration unit with 6 point cable
  - Hand-held Thermometer

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