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 HARIDWAR	Technical Delivery Condition for Sub-contracting for Finish Machining of IP Rotor for 800 MW ST	Page 1 of 4
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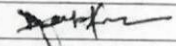

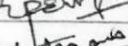

Scope of Work


I.P. Rotor of 800 MW Steam Turbine is proposed to be subcontracted for complete Turning operation including machining of Blade Grooves, Sealing Fin Grooves and machining of Coupling Holes as per machining details & technical requirements furnished in drawing no. 01020130000 & Blade groove plan drawing no. 91020430051 (sheet 1 & 2). Scope of work for finish machining includes the followings: -

A) The raw material of the Turbine shaft Rotor is forging of steel grade X12CrMoWVNbN10-1-1, having Tensile Strength ≤ 1000 Mpa. The Rotor forging will be sent to the vendor after completing weld overlay & subsequent machining at BHEL Haridwar.

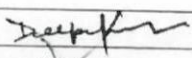
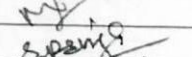
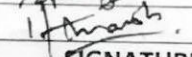
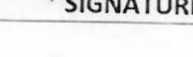
B) Scope of work for machining by vendor includes the following: -


1. Complete turning of the IP Rotor including Machining of turbine side & generator side journals, balancing weight grooves, as per drawing no 01020130000.
2. Machining of turbine side & generator side coupling holes, machining of barring gear teethes (Detail-V), speed sensor slots (Detail-U), Detail-O as per drawing no 01020130000.
3. Machining of profile contours, Radii, Tapers, Blade grooves & Inter stage sealing fin grooves etc. shall be carried out as per 'Groove Plan of IP Rotor' drawing no. 91020430051 (sheet 1 & 2). All the axial dimensions in specified tolerances are to be maintained from reference plane.
4. With reference to the aforementioned scope of work and drawing no 01020130000, the vendor must note the following points and exercise special care during the machining of I.P. Rotor:
 - i. Outside coupling face of turbine side & generator side of the Rotor will be machined, leaving 1 mm allowance for finish machining. Accordingly, a step on spigot dia. 450 mm will be 6 mm instead of 7 mm on turbine side and a step on recess dia. 450 mm will be 13 mm instead of 12 mm on generator side.
 - ii. Spigot diameter 450 mm on turbine side (refer SEC D-D) will be machined, leaving 0.2 mm allowance on outer diameter.
 - iii. Recess diameter 450 mm on generator side (refer SEC Y-Y) will be machined, leaving 0.2 mm allowance on inner diameter.
 - iv. Refer Detail-Q: Except drilling & tapping of 60 bore holes of M30 & dia. 31.5 mm, remaining machining of the detail-Q are to be done as per drawing.

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 HARIDWAR	Technical Delivery Condition for Sub-contracting for Finish Machining of IP Rotor for 800 MW ST	Page 2 of 4
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
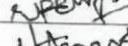
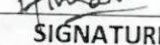
- v. Turbine side journal (\varnothing 520 mm) and Generator side journal (\varnothing 475 mm) will be machined, leaving 2 mm allowance on diameters.
 - vi. Generator side coupling flange, Outer Diameter 935 mm (refer main view of the drg) will be machined, leaving 2 mm allowance on diameters.
 - vii. Turbine side coupling flange, Outer diameters 770 mm & 780 mm (refer SEC D-D) will be machined, leaving 2 mm allowance on diameters.
 - viii. Refer shaft seal Detail- R and Detail-S: Sealing fin grooves as per detail -Y and Z are not to be machined, in place of that only diameter 597 h6 is to be maintained with **surface finish of Ra 0.8**. Other radii, tapers & diameters of the detail R & S are to be machined as per drawing.
- C) With reference to the drawing no 01020130000, following details/ dimensions of the drawing are **not** to be machined by Vendor.
- i. Insertion grooves of turbine side & generator side of the Rotor, are **not** to be machined by the vendor.
 - ii. Refer SEC X-X, locking pin holes of dia16 are **not** to be machined.
 - iii. Refer Detail-Q, 60 bore holes of M30 & dia. 31.5 are **not** to be machined.
 - iv. Refer SEC A-A, 22 holes of M8 are **not** to be machined.
 - v. Refer detail Y & Z, Shaft sealing grooves are **not** to be machined.
 - vi. Refer detail-N1, 3 holes of M10 are **not** to be machined.
 - vii. Refer SEC D-D, corner radius of R2.5 on dia. 450 mm is **not** be machined.
 - viii. As per Technical requirement-1 of the drg. Balancing and Overspeed Test of the Rotor, will be in BHEL scope.
- D) All other requirements of QP, Standards and T.R. on the drawing to followed.
- E) Special care to be exercised with respect to the following points and party to confirm adherence to the same point-wise while submitting the offer: -
- i. No flaws like blow holes, shrinkage, inclusions, cracks etc. should open up during machining. However, if any flaw opens up during machining, vendor shall immediately intimate detail and location of flaw and corrective action proposed. Further machining will be suspended till BHEL approves corrective action.

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 HARIDWAR	Technical Delivery Condition for Sub-contracting for Finish Machining of IP Rotor for 800 MW ST	Page 3 of 4
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- ii. BHEL shall furnish clarifications, if any, w.r.t. the scope of work or drawing/dimensions / technical requirements to the party to enable it to submit technical / commercial offers.
- iii. Vendor must ensure that all requirements indicated in the drg. regarding:
 - o Surface finishes (Ra value indicated in microns)
 - o Sizes and tolerances
 - o Geometrical accuracies e.g. run-outs, concentricity, parallelity, perpendicularity etc. shall be fully met.

Reference surfaces are clearly marked in the concerned drawings.
- iv. After machining, inspection report is to be submitted to BHEL for final clearance.
- v. Use Rubber/Leather sheet (10x200x2000) along with the slings during lifting of Rotor to avoid any damage of machined surfaces Or use Polyester slings & lifting beam of appropriate capacity for handling/lifting of Rotor after finish machining.
- vi. Inspection of the job at supplier's works shall be carried out as per BHEL approved quality plan by BHEL/ agency authorized by BHEL for which adequate prior notice (min. 4weeks) shall be given by the supplier.
- vii. All the machined surfaces must be protected against rust / corrosion by steam washable rust preventive suitable for six months.
- viii. Machined job shall be packed properly. Packing should be suitable to protect any damage to job (special care to be taken to protect finished machined surfaces) during handling and transportation.
- ix. All technical requirements listed in drawings shall be fully met.
- x. Identification marking is to be done as per Technical Requirement no. 9 of the drawing 01020130000.
- xi. All cross-referred documents given in Annexure-I

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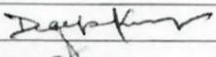

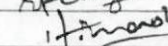
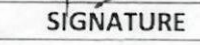
HARIDWAR

**Technical Delivery Condition for Sub-contracting for
Finish Machining of IP Rotor for 800 MW ST**

Page 4 of 4

ANNEXURE-I**List of drawings / standards to be referred**

1. IP Turbine Rotor (Finish machined drawing)01020130000
2. Groove Plan IPT.....91020430051
3. Blade groove.....31020430011
4. Blade groove.....41020439012
5. Blade groove.....41020439014
6. Blade groove.....41020439013
7. Blade groove.....41010748011
8. Blade groove.....41010719012
9. Blade groove.....41020458013
10. Blade groove.....31020430021
11. Blade groove.....31020430022
12. Identification of work pieces.....HW0400397
13. Log Sheet.....01020130000 LS
14. Log Sheet.....91020430000 LS

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Pre-Qualifying Requirements (PQR) for Finish machining of IP Rotor (Drg no: 01020130000 and Groove Plan Drg no : 91020430051)		
SL. No.	REQUIREMENT	REMARKS
1	Only those vendors who have the machines and facilities (at point no. 3 & 4) installed and operational at their works for machining operations of "IP Rotor" are requested to submit their quotes. The applicable details for these operations are as follows : (i) For finish machining of the Rotor, drawing number- 01020130000 (Sheet 1) and for Groove Plan finish machining, drawing number- 91020430051 (Sheet 1 & 2) shall be applicable. (ii) The raw material forging will be supplied to the vendor for the finish machining of the IP Rotor after the completion of the weld overlay, along with the necessary machining details. (iii) Vendor to carry out machining as per Technical Delivery Condition (TDC) and drawing provided. Vendor to provide point wise acceptance of TDC terms with their offer.	Vendor to confirm & provide point wise acceptance of TDC each terms.
2	Vendor must have suitable toolings / facility such as Marking Table / Machine Bed etc. in good working condition, to facilitate marking / transfer marking of job (as required). Vendor must have suitable facility for lifting / handling the subject job.	Vendor to confirm.
3	Horizontal Boring work :-	(a) Vendor to confirm.
3.1	Vendor must have suitable CNC Horizontal Boring machine , with suitable attachments for machining of coupling holes, machining of barring gear teeth, speed sensor slots etc. of IP Rotor as per drawing & TDC requirement.	(b) Vendor to provide machine details / specification for referred operation.
4	Turning / Lathe Operation :-	
4.1	CNC Lath Machine equipped with Hydro Static Steady and suitable for Complete Turning Operations of IP Rotor as per drawing & TDC requirements. Machine Requirement : (a) Swing Over Carriage : 1500 mm or more. (b) Center Distance : 8000 mm or more. (c) Weight Carrying Capacity : 45 Tons or more.	(a) Vendor to confirm. (b) Vendor to provide machine details / specification for referred operation.
5	Fitting work :-	
5.1	Vendor must have suitable facility / arrangement for different fitting / Marking works to be done as per drawing & technical requirements.	Vendor to confirm.
6	Vendor to confirm that above machines (as per pt. no. 3 & 4) are available at their works & are in good working condition with capability of achieving accuracies, surface finish & tolerances as per drawing requirements. If necessary, Vendor can suggest alternate machines (other than specified in pt. no. 3 & 4) for machining job with accuracies, surface finish & tolerances as per drawing, for review & acceptance by BHEL.	Vendor to confirm & submit the machine accuracies & Geometry details along with specification.
7	Vendor to submit Geometrical Accuracy Report of proposed machines (as per pt. no. 3 & 4).	Vendor to submit.
8	Vendor to confirm that all the dimensions, accuracies & surface finish of the component shall be met as per Technical Requirements & drawing.	Vendor to confirm.
9	Vendor to note that all tools, measuring equipments, technological items etc. required for manufacturing of subject item shall be arranged by vendor, in case of order.	Vendor to confirm.
10	BHEL reserves the right to verify the information provided by vendor. BHEL may also visit vendor works if so desired by BHEL. In case, the information provided by vendor is found to be false/ incorrect, their offer shall be rejected.	Vendor to note & Confirm.

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Dy. Mgr./TTX

Sachin Maggu
Mgr./NCT

Vipin Kumar
Mgr./NCT