



Bharat Heavy Electricals Limited

Sub-Contracting (Turbine)

HEEP, BHEL, Ranipur, Haridwar-249403 (Uttarakhand)

Ph. No.: 01334-285166, E-mail: sohan.singh@bhel.in, gchauhan@bhel.in

Ref. No. AIX-T/6600/EOI/24-25/2

Notice for Expression of Interest for empanelment of New Vendors

The Heavy Electrical Equipment Plant (HEEP), located in Haridwar, is one of the major manufacturing plants of BHEL. The core business of HEEP includes design and manufacture of large steam turbines, generators, condenser and so on.

We are looking for vendors who are capable of carrying out job work as mentioned in below table and as per Annexure-1.

Salient Details of Notice for Expression of Interest for empanelment of New Vendors EOI No. AIX-T/6600/EOI/24-25/2		
Sl. No.	Issue	Description
1	Description of Job work	Laser hardening process on inlet edge of free standing firtree root and aerofoil profile of Turbine Blades having material grade X5CrNiCuNb16-4 (DIN 1.4542)
2	Issue of EOI documents	From BHEL eProcurement website https://eprocurebhel.co.in/nicgep/app (Tender documents will be available for downloading from BHEL e-Procurement website till due date of submission)
3	Due date and time of offer submission	Date: 28-09-2024 Time: 13:45 Hrs https://eprocurebhel.co.in/nicgep/app <i>Offer to be submitted online only through e-procurement Portal.</i> (Bidders are requested to visit website to view corrigendum/ addenda/ amendments/ extension/ modification etc. before submitting offer).
4	Opening of EOI (Technical offer)	Date: 28-09-2024 Time: 14.00 Hrs Note: <i>This EOI being an e-tender, it shall be opened online only through the E-Procurement Portal. Participating bidders may witness the opening online only.</i>
5	Latest updates	Latest updates on the important dates, Amendments, Correspondences, Corrigenda, Clarifications, Changes, Errata, Modifications, Revisions, etc. to EOI Specifications will be hosted in BHEL e-tender portal https://eprocurebhel.co.in/nicgep/app and not in the newspapers. Bidders to keep themselves updated with all such information

Special Instructions:

1. Technical offers and inputs are required from vendors for establishment of Laser hardening process on inlet edge of free standing firtree root and aerofoil profile of Turbine Blades having material grade X5CrNiCuNb16-4 (DIN 1.4542). Vendor to clearly describe their capabilities, deviations from specifications and should also suggest possible solutions.

2. This Expression of Interest (EOI) is for identification of prospective vendors and finalization of tender specifications only and not for procurement. There is no commercial aspects associated to this EOI.
3. BHEL reserves the right to evaluate the responses, based on technical merits, in the process of short-listing and identification of the prospective vendors for further discussions.
4. Performance of Laser hardening process on inlet edge of free standing firtree root and aerofoil profile / testing / development etc. as mentioned in clauses of tender specifications are for indicative purpose only as these will be required during future tendering process for actual procurements only.
5. However, documents regarding PQR & technical conditions are to be submitted against EOI.
6. Vendors are advised to conduct a pre-bid meeting for any technical clarifications and site visit if required. In case any clarification is needed or site visit is required, bidders may contact as per following details:
 - a. Sh. Sanjiv Kumar, Email: sanjivk@bhel.in, Mobile: +91 9410395965
 - b. Sh. Anil Kumar, Email: kanil@bhel.in, Mobile: +91 8171218048
 - c. Sh. Sandip Chakraborty, Email: csandip@bhel.in, Mobile: +91 9411501631

The offers received will be technically evaluated by BHEL & successful short listed vendors will be considered for our future requirements. The offers that do not meet our Technical requirements/PQR are liable to be ignored.

Following documents/information are to be necessarily filled and submitted along with the Technical offer:

1. Duly filled, signed & stamped Annexure-A (Technical Requirements/ PQR).
2. Company Profile.
3. Financial report of the company.
4. Vendor to inform estimated delivery time for carrying out complete operation.

Only Technical BID along with the documents mentioned above should be submitted against Tender No. **AIX-T/6600/EOI/24-25/2**, Due Date-28.09.2024

General Remarks:

1. This notification shall be published on www.bhel.com, www.eprocurebhel.co.in and www.hwr.bhel.com. The bidders will have to submit signed offer / bid through BHEL NIC portal only. Each page of quotation should be signed and stamped by authorized representative of vendor, else the offer is liable to be rejected. Unsigned bids are liable to be ignored.
2. Last date for downloading tender documents shall be 28.09.2024 till 13:45 Hrs. (IST). Tenders will be received up to 13:45 Hrs. (IST) on 28.09.2024 will be considered and opened on the same day at 14:00 Hrs. (IST).

3. No EMD & Tender fee are to be submitted.
4. The Quotation should be from the Principal / Original Manufacturer, failing which the quotation may likely to be ignored.
5. Late offers will not be considered in any case. BHEL will not be responsible for any type of delay.
6. Amendments / Corrigendum, if any, will be hosted on above websites only.
7. For any further details please log on to www.bhel.com, www.eprocurebhel.co.in or www.hwr.bhel.com.

Registration process for items required by BHEL is always open at <https://supplier.bhel.in>. Prospective suppliers (including MSEs & owned by SCs/STs) may visit this site and apply for registration in the respective unit.

E-Procurement Portal Inputs

Procedure for Submission of Offer for E-Tender procedure for Submission of Tender is available in the "Bidder Manual for BHEL Bidders" at E-tender portal <https://eprocurebhel.co.in/nicgep/app>. Terms and conditions mentioned therein shall form integral part of the NIT and bidders shall abide by the same.

Hardware and Software requirements for participating in e-tender

Please refer the website for the minimum system requirements and setting document for Bidders under the link: <https://eprocurebhel.co.in/nicgep/app>

Digital Signature

Bidders against tender will necessarily have to obtain class – III DSCs. Procedure for application is available on www.bhel.com. To know the procedure for obtaining Digital Signature Certificate (DSC), suppliers who are not having the DSC are advised to visit our website [http://www.bhel.com/home.php/Tender Notifications/Sample Checklist](http://www.bhel.com/home.php/Tender%20Notifications/Sample%20Checklist).

NIC portal Helpdesk Contacts

For any technical related queries please call at 24 x 7 Help Desk Number

0120-4001 002

0120-4200 462

0120-4001 005

0120-6277 787

International bidders are requested to prefix 91 as country code

Email Support

Address: A) For any Issues or Clarifications relating to the published tenders, bidders are requested to contact the respective Tender Inviting Authority.

B) Technical support: eproc@nic.in

Note: Offers/tenders submitted in the E-tender portal shall only be considered for further evaluation. Offers sent by FAX / E-mail / any mode other than E-tender would not be entertained.

The Tenderers must submit their Tenders, as detailed below:

SPECIAL NOTE: All documents to be submitted should be uploaded in respective places in the E-Tender portal as per the list mentioned given in this NIT. BHEL shall not be responsible for incomplete documents.

For & ON BEHALF OF BHEL, HARDWAR

Manager (AIX-T)

BHARAT HEAVY ELECTRICALS LIMITED



UNIT'S ADDRESS:

HEEP, RANIPUR,
HARIDWAR - 249403
UTTARANCHAL, INDIA

EXPRESSION OF INTEREST (EOI) FOR LASER HARDENING PROCESS ON INLET EDGE OF FREE STANDING FIR TREE ROOT TURBINE BLADES OF MATERIAL X5CrNiCuNb 16-4

SCOPE: ESTABLISHMENT OF LASER HARDENING PROCESS ON INLET EDGE OF FREE STANDING FIR TREE ROOT TURBINE BLADES OF MATERIAL X5CrNiCuNb 16-4

NOTE:

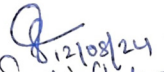
VENDOR SHOULD FILL THE "OFFERED" COLUMN IN COMPLIANCE TO SPECIFIED REQUIREMENTS AND ALSO "DEVIATIONS" COLUMN, WHERE THERE IS DEVIATION FROM THE REQUIREMENT. DULY FILLED SPECIFICATION CUM COMPLIANCE CERTIFICATE SHOULD BE SUBMITTED ALONG WITH THE OFFER. INADEQUATE, INCOMPLETE, AMBIGUOUS OR UNSUSTAINABLE 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.

Clause No:	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
1.0	PURPOSE, WORKPIECE MATERIAL & PROCESS				
1.1	Inlet edge hardening of LP steam turbine blades with fir tree roots and twisted aerofoil profile having material grade X5CrNiCuNb16-4 (DIN 1.4542) (tensile strength up to 1130 N/mm ² and hardness up to 335 HBW) is required. The aerofoil of the blades are manufactured by milling and grinding of envelop forged raw materials. Inlet edge of the blades are to be laser hardened for corrosion resistance (Hardness to be achieved after laser hardening : At surface: ≥430 HV 0.1 and at depth of 2 mm from the surface: ≥400 HV 0.1)	Vendor to comply.			
1.2	Controlled laser hardening is required to be done on the inlet edge and suction side of the blade as per the drawing (sketch 1: Left hand blade; sketch 2: Right hand blade) of the blade. The length of the hardened region is 465 mm +/- 5 mm and width of 28 mm -0/+ 3 mm. The hardening process should ensure that no tensile residual stresses occur in the hardened area as a result of laser treatment. The process should also ensure that no cracks occur in the hardened region as a result of laser hardening. After laser hardening, an immediate post heat treatment is required without exposing the blades in moisture. Formation of dew on the blade before post heat treatment should be avoided. <u>An example of parameters of are shown below for reference only:</u> Laser hardening by 2 nos. 6 KW diode lasers with simultaneous running. Precipitation hardening at 445 °C Dwell time 8 Hrs Heating rate ≤ 100 °C/Hr Cooling rate ≤ 100 °C/Hr	Vendor to comply and provide details of their available resources.			
1.3	The Vendor to provide details (Make, specifications) of available facilities of laser hardening system (Along with details of laser head, power of laser, laser generator, type of beam collimation optics, beam control systems, job handling systems, payload of articulating robot.	Vendor to comply and provide details.			
1.4	Vendor to provide the process plan and inspection plans along with the offer.	Vendor to comply and provide details.			
1.5	Vendor will sign a non-disclosure agreement before receiving the drawings and documents (sketch 1, sketch 2 and annexure1).	Vendor to accept.			
2.0	BLADE DETAILS				
2.1	Blade drawings: Sketch 1, Sketch 2 are attached	Vendor to accept.			
2.2	Blade material: X5CrNiCuNb16-4 (DIN 1.4542) (Mechanical and chemical properties are at Annexure 1 for reference).	Vendor to accept.			
3.0	TRIAL AND DEVELOPMENT OF LASER HARDENING CAPABILITY AT VENDOR'S WORKS				

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K Kumar
12/09/24

3.1	Eligible vendors against PQR clauses will be provided a test piece of the material X5CrNiCuNb16-4 (DIN 1.4542) of size approx. 150 mm x 150 mm having thickness >5 mm for initial trial purposes. The trials will be considered successful only if the vendor achieves required hardness on the test sample piece. Vendor to arrange to collect the sample piece from HEEP, Haridwar within 10 days of first intimation from BHEL on their own and submit the achieved results within 1 month from the date of collection.	Vendor to accept and comply.			
3.2	Only after successful completion of achieving hardness and other requirements (in 2 sections of sample test piece) as mentioned in clause 4.0 and sub clauses on test piece as mentioned above, the vendor will be given 2 blades (1 of each hand) for establishment of laser hardening process.	Vendor to accept and comply.			
3.3	Blades will be handed over to vendor against bank guarantee as per BHEL norms.	Vendor to accept and comply.			
3.4	Vendor will be responsible for transportation to and for vendor's and BHEL works.	Vendor to accept and comply.			
3.5	Vendor to complete the development of laser hardening and testing activities within 2 months from the date when blades are handed over to the vendor. Representatives of BHEL may visit vendor's works for witnessing laser hardening process, hardening process and tests. For arranging scheduled technical visit of BHEL representatives to vendor's works, vendor will inform BHEL at least 7 days before scheduled visits.	Vendor to accept and comply.			
3.6	Failing to establish the required test results, vendor will be disqualified from the tender.	Vendor to accept and comply.			
4.0	LASER HARDENING REQUIREMENTS & PARAMETERS				
4.1	Area of laser hardening and tolerance: As per attached drawings and clause number 1.2 above.	Vendor to accept and comply.			
4.2	Measurement of results will be as under: Samples will be taken from 1 number of laser hardened blade from each hand of a row. Refer annexure 1 for details against below mentioned clauses:	Vendor to accept and comply.			
4.3	Visual control: Undercuts or melting spots are not acceptable. In order to avoid undercuts or melting spots, the laser will be run on extra length in the region of blade tip for stabilization of the temperature.	Vendor to accept and comply.			
4.4	Surface hardness measurement: Surface hardness to be measured (HV5 in accordance with ISO 6507-1) at 3 positions i.e. at positions 1, 2, 3. The values of surface hardness will be as below (Ref annexure 1): Position 1: ≥ 400 HV 0.1, Position 2: ≥ 430 HV 0.1, Position 3: ≥ 430 HV 0.1.	Vendor to accept and comply.			
4.5	Residual Stress Evaluation: Residual stress values are to be measured at the points and distances as shown in annexure 1 and are to be submitted in tabular format. There should not be any tensile residual stresses in the measured values. The material will be regarded as hardened in the transition between hardened and unhardened state if hardness is >360 HV5.	Vendor to accept and comply.			
4.6	Microscopic pictures showing hardness width and depth: Microscopic pictures of 11 sections in the hardened profile are to be taken from test blade at 0 mm, 50 mm, 100 mm, 150 mm, 200 mm, 250 mm, 300 mm, 350 mm, 400 mm, 440 mm, 465 mm from the top of hardened zone. Corresponding hardness width and depth will be shown as shown in example picture. Microstructures at penultimate cross sections (before the end and start of the hardened region) should be provided. Microstructures should possess uniform structure.	Vendor to accept and comply.			
4.7	Hardness profile mapping: 3 numbers of profile section photographs with positions of hardness lines and hardness depth profile graphs are to be shown for test blade at 50 mm, 250 mm, 440 mm from the top of hardened zone. Hardness to be measured at 10 equal distances for each mm length from the surface. No hardness value should be less than 400 HV 0.1 within 2 mm depth from the surface.	Vendor to accept and comply.			
5.0	PRE QUALIFICATION REQUIREMENTS				


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 Eng. Team & NPS - Trade


 Kumar
 12/08/24

5.1	Vendor must be a reputed OEM/ Organization/ institute which provides solutions for controlled laser hardening of heavy engineering equipments. Vendor must have in-house facility of laser hardening, furnace for controlled heat treatment and testing as per requirement mentioned above.	Vendor to comply and provide details of machineries and facilities.			
5.2	Vendor to provide at least 2 purchase order copies as proof of their experience. Price may be concealed in suitable manner. This is for establishment of vendor's credentials as per clause 5.1.	Vendor to comply and provide details.			
5.3	Vendor to provide name, postal address, email IDs and phone number of the customer(s) as per clause 5.1, 5.2.	Vendor to comply and provide details.			
5.4	Vendor to provide performance certificate/ copy of MOM/ acceptance certificate from the referred customer at clause number 5.2 regarding satisfactory performance of their laser hardening services.	Vendor to comply and provide details.			
5.5	Vendor should be ISO 9000 certified. Copy of certificate to be submitted with the offer.	Vendor to comply and provide details.			
5.6	BHEL may verify feedback of referred customer.	Vendor to accept.			
5.7	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 and legal action may be taken as per BHEL policies.	Vendor to accept.			


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 12/08/2024
 SANJIV KUMAR
 DGM (TBM & NBS)

ANNEXURE: 1

POSITION AND VALUES OF SURFACE HARDNESS MEASUREMENT:

Material	HV5		
	Position 1	Position 2	Position 3
X5CrNiCuNb16-4	≥ 400	≥ 430	≥ 430

L= Length of the hardened area

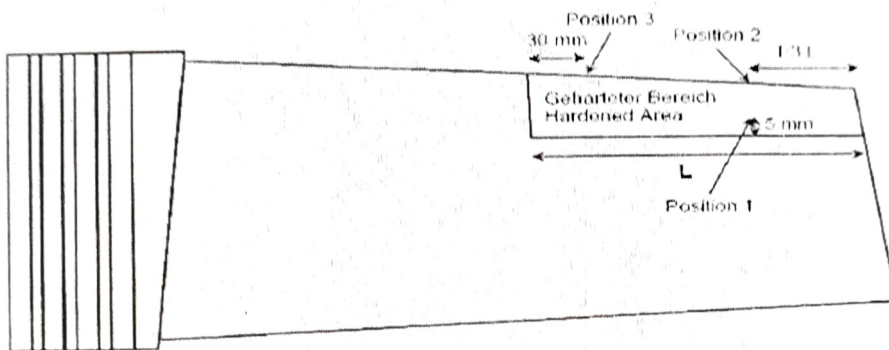
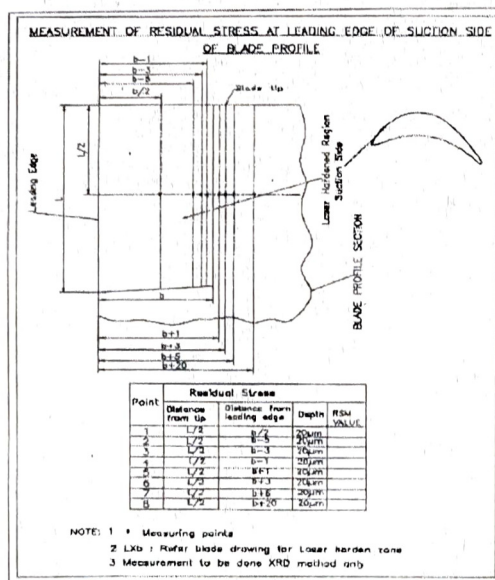


FIG .1: Positions for measuring the hardness on the surface

RESIDUAL STRESS EVALUATION

- The manufacturing process has to assure that no Tensile residual stresses occur in the Hardened area.



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MICROSCOPIC PICTURES SHOWING HARDNESS WIDTH AND DEPTH:

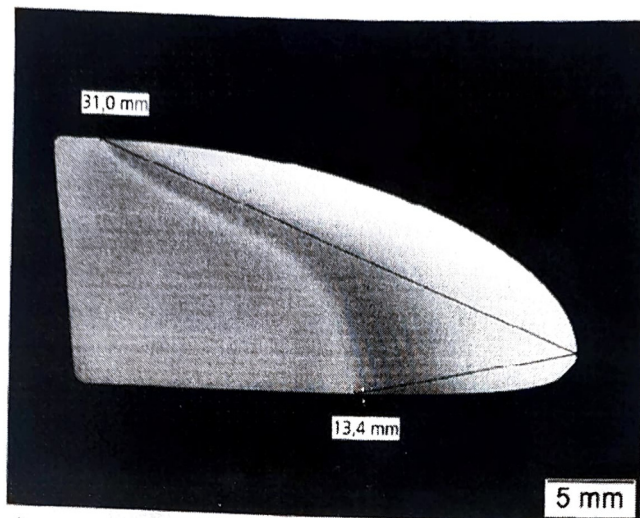


fig. 7: Cross section of a leading edge, hardened by laser assisted solution annealing followed by age hardening
sample: CB-27-2.07; X=300

Example

HARDNESS PROFILE MAPPING

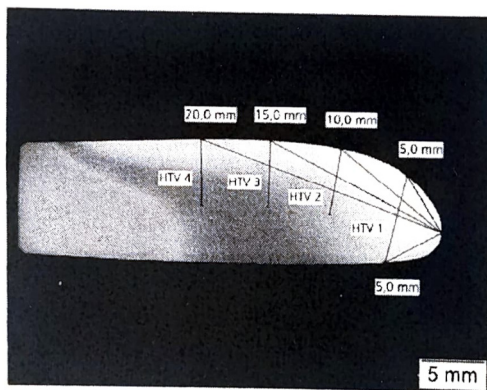


fig. 15: Position of the hardness lines
sample: CB-27-2.02; X=50

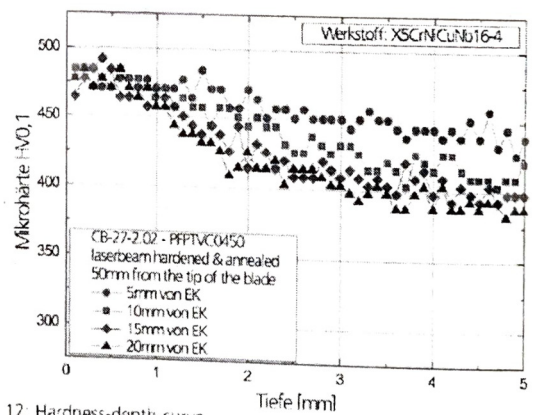


fig. 12: Hardness-depth-curve
sample: CB-27-2.02; X=50

Example

Sandip Choudhary

THE CHEMICAL COMPOSITION AND MECHANICAL PROPERTIES OF THE MATERIAL IS AS UNDER:

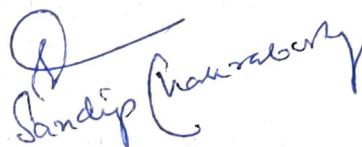
Chemical Composition

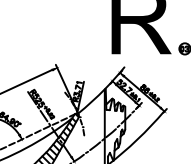
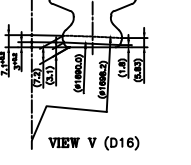
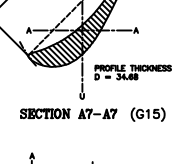
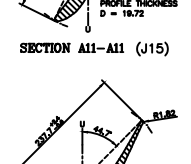
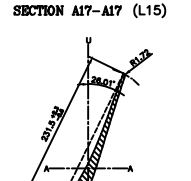
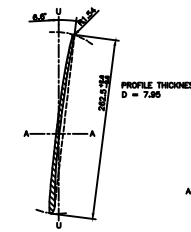
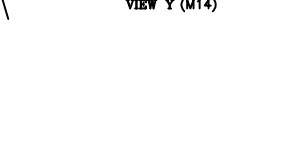
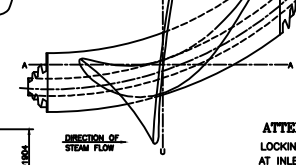
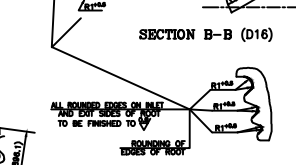
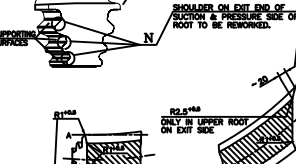
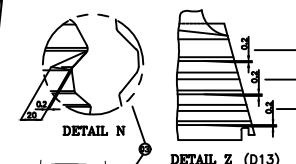
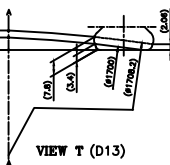
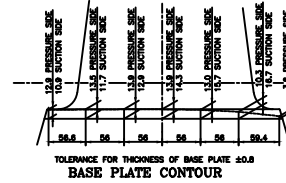
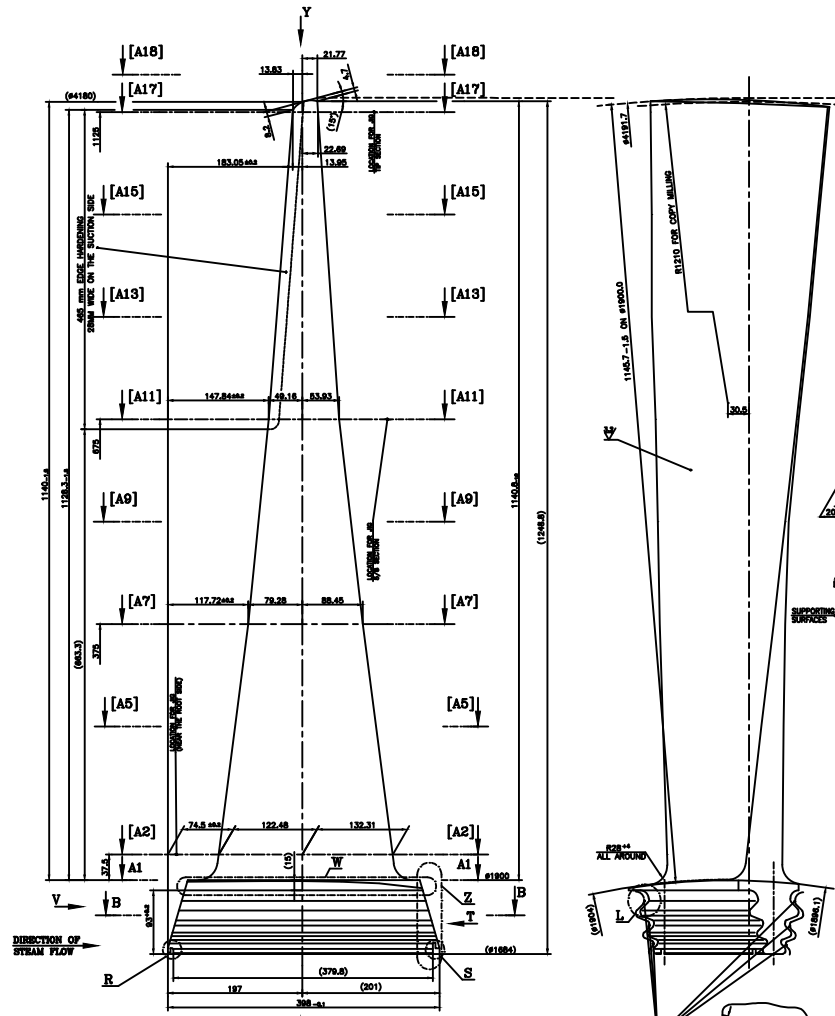
Heat analysis in weight % (modified compared to EN10088-3) shall be as follows

C	≤ 0.05	Si	0.10 – 0.35	Mn	0.30 – 0.60
P	≤ 0.025	S	≤ 0.005	Cr	15.0 – 16.0
Ni	4.2 – 5.0	Cu	3.0- 3.7	Nb	0.20-0.35

Mechanical properties:

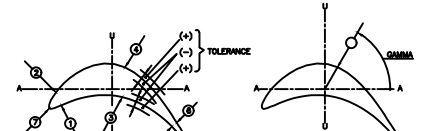
0.2% Proof stress	930-1000 N/mm ²
Tensile strength	≤ 1040 N/mm ²
% Elongation	13 min.
% Reduction in area	50 min.
Impact values	100 J min.
Brinell hardness HBW	295-335


Sandip Chakraborty



TECHNICAL REQUIREMENTS :

1. TOLERANCE VALUES FOR PROFILE :
-PROFILE TO BE CHECKED AS PER DRAWING NO. 01030758000 VAR 02.
-ALLOWABLE ORIENTATION OF PROFILE WITH RESPECT TO ROOT TO BE CHECKED AS FOLLOWS:



MEASURED POINT	CO-ORDINATES	ANGLE	TOLERANCE	UPPER	LOWER
A	U	GAMMA			
SECTION A2 A2 H=37.5					
1	-89.25	0.62	280.5	1.9	-0.3
2	-102.03	26.32	128.1	1.9	-1.8
3	2.86	-7.27	248.0	1.9	-0.3
4	23.69	31.27	56.0	1.9	-1.8
5	110.26	-96.02	215.9	1.9	-0.3
6	118.41	-90.78	29.2	1.9	-1.8
7	-121.83	-2.86	215.3	1.9	-0.3
SECTION A11-A11 H=675.0					
1	-37.31	52.03	218.3	2.3	-0.7
2	-25.10	63.63	55.4	2.3	-2.3
3	4.31	-15.87	205.0	2.3	-0.7
4	15.09	-11.85	17.3	2.3	-2.3
5	43.34	-116.04	202.2	2.3	-0.7
6	47.30	-114.62	18.2	2.3	-2.3
7	-48.77	71.34	158.9	2.3	-0.7
SECTION A17-A17 H=1125.0					
1	-13.14	91.40	184.1	2.7	-1.1
2	-6.79	91.80	0.0	2.7	-2.7
3	-3.90	-0.84	186.7	2.7	-1.1
4	0.89	-0.39	6.6	2.7	-2.7
5	14.22	-119.63	192.0	2.7	-1.1
6	17.83	-119.11	10.6	2.7	-2.7
7	-12.06	116.40	115.8	2.7	-1.1
SECTION A7-A7 H=1125.0					
1	-13.14	91.40	184.1	4.7	-1.1
2	-6.79	91.80	0.0	2.7	-4.7
3	-3.90	-0.84	186.7	4.5	-1.1
4	0.89	-0.39	6.6	2.7	-4.6
5	14.22	-119.63	192.0	3.9	-1.1
6	17.83	-119.11	10.6	2.7	-3.9
7	-12.06	116.40	115.8	3.7	-1.1

2. SURFACE FINISH FOR THE BLADE :
- PROFILE
- ROOT
- INLET EDGE, EXIT EDGE AND FILLET : 0.5
3. BLADE PROFILE AS PER DRAWING NO. 01030758022
4. BLADE ROOT PROFILE AS PER DRAWING NO. 21030758031 (FORM 20 S). FOR ROTOR GROOVE PROFILE REFER CORRESPONDING GROOVE PROFILE DRAWING OF ROTOR.
5. BLADE FORGING AS PER DRAWING NO. 01030758000 VAR 02
6. THE BLADE IS TO UNDERGO THE FOLLOWING AFTER FINAL MACHINING :
- MACHINING TESTING ACCORDING TO HIR0983001.
- VIBRATION TESTING FOR STATIC FREQUENCIES AS PER TECHNOLOGICAL PROCESS NO. HIR0980018.
- THE ALLOWABLE BAND WIDTH FOR STATIC FREQUENCY FOR EACH MODE OF VIBRATION IS AS BELOW :
- MOMENT WIDTHING FOR SUBMITTING OF BLADES AS PER TECHNOLOGICAL PROCESS NO. HIR0980020.
- FREQUENCY VALUES SHOULD BE MEASURED AND REPORTED AT LEAST UP TO TWO DECIMAL PLACE.

MODE	STATIONARY FREQUENCIES IN BENCH TEST	FREQUENCY DROP IN ROTOR
1	39-41	1Hz
2	90-96	6Hz
3	155-165	-
4	185-198	-
5	298-310	-
6	330-354	-

7. THE INLET EDGE IS TO BE LASER HARDENED AS PER TECHNOLOGICAL PROCESS NO. HIR0983005
SHOT PEENING ON COMPLETE PROFILE OF BLADE IS TO BE DONE AFTER LASER HARDENING AS PER CLAUSE 8.5 OF HIR0983005.
8. ON ALL FLANKS OF FIR-TREE ROOT, COMPRESSIVE STRESSES TO BE INTRODUCED BY SHOT PEENING
ACC. TO HIR0983004 PART A.
9. BRACKETED SECTION [] INDICATES CHECK SECTION.
10. IDENTIFICATION ACCORDING TO HIR0400367 AT THE PLACE MARKED WITH IN.

01030758000

SKETCH 2