



PURCHASE SPECIFICATION

Rev. 01

**MANUFACTURING AND SUPPLY OF
PROTOTYPE 3D IMPELLER**

Dt. 06. 07. 2013

Specification No.
**BYH-13-548-
50/P-02**

DESCRIPTION:

Manufacturing and supply of Prototype 3D impeller as per the enclosed technical specification and Drg. No. RD DG 3 TM 13 900.

Vendor' Scope of work:

Supply of raw material & manufacturing of single piece shrouded Prototype 3D impeller of 450 mm dia as per R&D design and required processes like heat treatment, stress relieving, over speed test, dynamic balancing, run outs, polishing etc... as per applicable international standards that are followed for manufacturing of such impellers.

BHEL will provide the following:

- i) CAD model
- ii) CNC Part Programming

Technical specifications:

1. Impeller material shall be ASTM A 182-12a. Impeller material / mechanical properties shall be as per attached document "HY 19377" shall be followed for all manufacturing processes (as per enclosed process chart Annexure-1), Testing, Inspection, Cleaning & Packing, except for material specifications. Heat treatment shall be carried out to achieve desired mechanical properties as per Class-L2 (page 3 of 5) of attached document HY 19377.
- 2) Dimensions indicated in the drawing are tentative and may vary during detail design. Vendor shall consider 10% margin over the specified values, with fixed impeller diameter of 450 mm.
- 3) Manufacturing of impellers shall be from single piece of blank material by scoop milling with "cusp free" milling surface in channels.
- 4) Dimensional tolerances shall as per typical impeller manufacturing drawing attached for information. All the manufacturing tolerances, run outs & finishes shall be maintained as per applicable international standards and practice.
- 5) Fillet radius between hub/shroud and blade shall be R6.
- 6) All the applicable tests like over speed test 1.15 of times rated speed (rated is 8790 rpm), dynamic balancing, run outs etc. and stage / final inspections shall be as per applicable international standards.
- 7) Coordinate measurement of accessible surface area of blade profile as far as possible (reachable with FARO-Arm) using tactile method.

Prepared by K S R Swamy Approved by Dr. N. K. Singh MS

TURBOMACHINERY LABORATORY

Corporate R&D Division, BHEL, Vikasnagar, Hyderabad 500093

	PURCHASE SPECIFICATION		Rev. 01
	<u>MANUFACTURING AND SUPPLY OF PROTOTYPE 3D IMPELLER</u>		Dt. 06. 07. 2013 Specification No. BYH-13-548- 50/P-02


- 8) Low Speed dynamic balancing at 1200 rpm. G2.5
- 9) Final surface finish to be achieved 2.0 microns or better.
- 10) Stage inspections & final inspections shall be carried jointly by BHEL & Vendor at vendor works.
- 11) Vendor shall furnish material test certificates and inspection reports to assess the acceptable limits of deviations if any.
- 12) Operations to be carried out by the vendor for manufacturing of single piece shrouded type Impellers are indicated in the Process Chart (Annexure-1).

Note:

- A) The vendor shall have experience in supply and machining of single piece shrouded type impellers by scoop milling technique.
- B) Vendor shall provide the credentials regarding manufacturing & supply of single piece shrouded 3D impellers along with the technical bid.
- C) The vendor shall enclose a selected list of customers for whom single piece shrouded type impellers have been manufactured.
- D) The vendor shall not be a manufacturer and seller of centrifugal compressors. Statement confirming this is to be submitted along with the technical bid.
- E) BHEL reserves the right to verify the information submitted by the vendor. **The offer with false/ incorrect/incomplete information may be rejected.**
- F) Vendor must submit complete information against clause Nos. A, B, C and D. The offer meeting this clause would only be processed. BHEL reserve the option to disqualify the tender in case of non-conformity of the above conditions ("A" to "E").
- G) At the time of placement of order vendor shall submit non discloser agreement for our technical specifications and drawings.

Deliverables:

- Inspection plan containing manufacturing procedure and various stage inspections to be followed.
- Finished single piece shrouded impeller.
- Over speed test report
- Transfer of material identification report
- Liquid penetrant test report
- Measurement protocol
- Low speed dynamic balancing report
- Certificate of conformance
- Project management and documentation/final inspections per applicable international standards

Prepared by		Approved by	2
	K S R Swamy	Dr. N. K. Singh	
TURBOMACHINERY LABORATORY			
Corporate R&D Division, BHEL, Vikasnagar, Hyderabad 500093			



PURCHASE SPECIFICATION

Rev. 01

**MANUFACTURING AND SUPPLY OF
PROTOTYPE 3D IMPELLER**

Dt. 06. 07. 2013
Specification No.
BYH-13-548-
50/P-02

Annexure-1

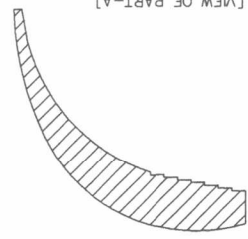
PROCESS CHART

Sl. No.	Description of process.	Remarks
1	Procurement of raw material.	
2	Raw material testing by UT / X-ray for defects.	
3	Turning and Initial Boring.	
4	Scoop milling.	
5	Stress relieving after machining.	
6	Heat treatment for achieving the desired strength of material.	
7	Testing of heat treatment sample for mechanical properties. Test piece shall be prepared as per attached typical impeller manufacturing drawing.	
8	Final machining & finishing by scoop milling.	
9	DP (liquid penetrant) test.	
10	Blade profile inspection using tactile method.	
11	Spin test (Over speed test).	
12	Repeat DP test after spin test.	
13	Final machining of bore.	
14	Machining of seal steps at impeller shroud.	
15	Run out checking on impeller seal steps.	
16	Manufacturing of mandrill & Lock nut for low speed balancing.	
17	Low speed dynamic balancing at 1200 rpm.	
18	Impeller cleaning.	
19	Project management and documentation/final inspections per applicable international standards.	
20	Packing & forwarding to BHEL R&D.	

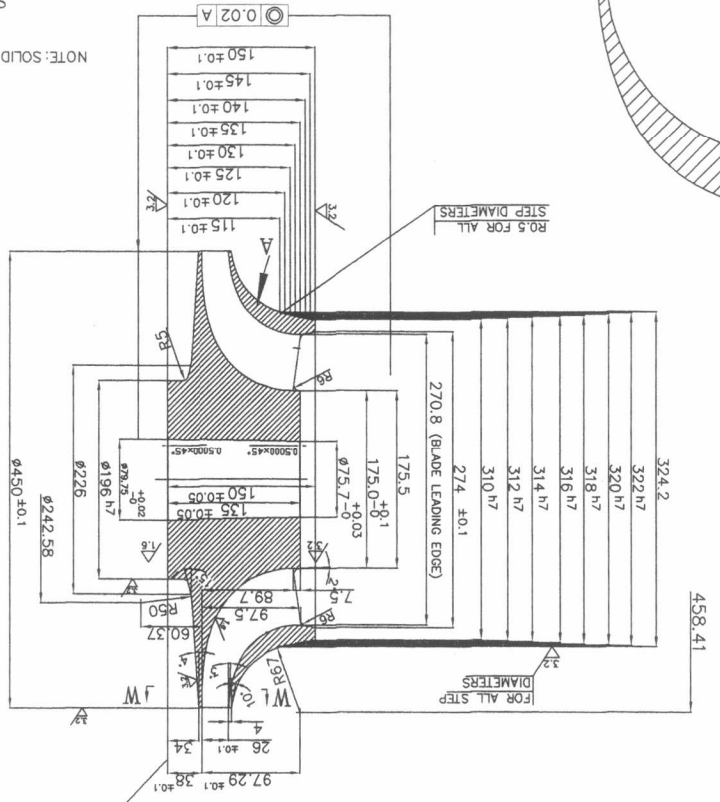
Note: Vendor's scope of work is not limited to the operations mentioned above. Any operations that are required to achieve the desired quality, tolerances & accuracies as per BHEL specifications shall be carried out by the vendor.

Prepared by	K S R Swamy	Approved by	Dr. N. K. Singh	3
TURBOMACHINERY LABORATORY				
Corporate R&D Division, BHEL, Vikasnagar, Hyderabad 500093				

FIG-A [MEW OF PART-A]



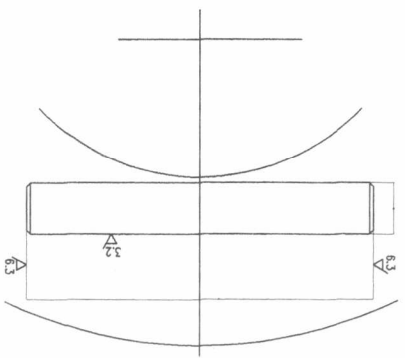
VIEW-M



R0.5 FOR ALL STEP DIAMETERS

FOR ALL STEP DIAMETERS

FIG-B

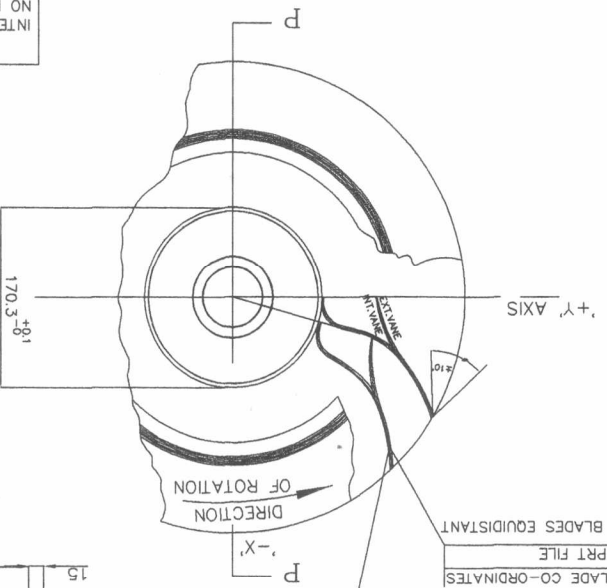


SECTION P-P

NOTE: SOLID MODEL WILL BE SUPPLIED FOR MACHINING.

STAGE 9 IMPELLER

VIEW-M



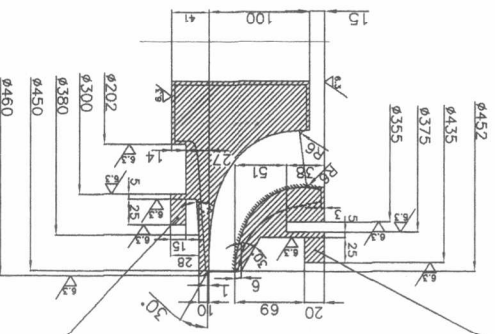
FOR BLADE CO-ORDINATES USE .PRT FILE FOR BLADE EQUIDISTANT

MAX DEVIATION PERMISSIBLE ON PLANARITY IS ±0.1MM (MEASURED IN BETWEEN VANES THE VANES = ± 0.5 TOLERANCE ON PITCH OF)

ALL DIMENSION ARE TENTATIVE AND SUBJECT TO MINOR CHANGES EXCEPT OUTER DIA

CAUTION NO DEVIATION PERMITTED INTERCHANGEABLE JOB

FIG-C



RECOVER FROM THIS RING A TEST PIECE ACCORDING TO FIGURE-B AND PRESERVE THE REMAINING MATERIAL FOR FURTHER TESTS.

6.3 / 1.6 / 3.2

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		BHRL R & D	
DATE		17.6.2013	
DRAWN		V KUMAR	
CHKD		K.S.R. SWAMI	
APPRO. P.D.S.		17.6.2013	
NO. OF		17.6.2013	
REV.		17.6.2013	
DRAWING NO.		RD DG 3 TM 13 900	
CODE		430	
TITLE		3D IMPELLER #450 CCW	
DEPT.		SHARAT HEAVY ELECTRICALS LTD.	
UNIT		HYDRABAD-500093	
SCALE		1:1	
WEIGHT (KG)		REF. TO ASBY. DND.	
MATERIAL		NTS	
NO. OF		42.0	
REV.		12	