	PRODUCT STANDARD <u>HYDRO TURBINE ENGINEERING</u>	HT 00215
		Rev. 04
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<u>GENERAL REQUIREMENTS OF</u> <u>HIGH PERFORMANCE (CRITICAL) STEEL CASTINGS</u>		

1.0 APPLICATION:


These requirements are in addition to those included in the material specification and have been especially framed for the high performance castings subjected to severe conditions of operation e.g. B.F. valve door, spherical valve body & door, servomotor cylinders, end covers of spider for pelton turbine, deflectors, nozzle bodies, Kaplan runner hub, bearing shell, stay vanes & stay ring etc.

2.0 MATERIAL SPECIFICATION:

BHEL std. AA 19521 – 1.5% Mn steel casting or ASTM A 148 Gr 80-50 or any other specification as called on the drawing. Secondary refining is to be done either by VAD (Vacuum Arc Degassing) or VD (Vacuum Degassing). The casting manufacturer must have the relevant facilities in-house. Casting to be supplied in heat treated condition.

3.0 DIMENSIONS/MACHINING REQUIREMENT:

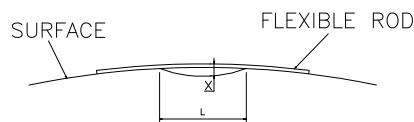
3.1 Unless otherwise specified on the drawing, following will be applicable.

3.1.1 If the drawing calls for finish machined dimensions, the vendor shall supply the casting in rough machined condition leaving 3 - 5 mm m/cing allowance on tool point on all faces marked thus  on the drawing for final machining at BHEL works.


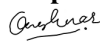

3.1.2 If the drawing calls for rough machined dimensions, vendor shall supply the casting in rough machined condition to drawing dimensions.


3.1.3 Dimensions which are called with specific note for finish machining shall be supplied with finish machined dimensions and no allowances to be left on such dimensions by casting vendors.

3.2 For as cast surface permissible undulation to be as per sketch. X/L ratio should not be more than ± 0.02 .



As cast surfaces to have surface finish of 25 micron or better.

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4.0 NON DESTRUCTIVE TESTS:

- 4.1 Scope: All castings shall be 100% examined by “Ultrasonic method (UT)” , “Magnetic particle inspection (MPI)” & DP test. Also refer the drawing.

The defects which cannot be definitely interpreted by “UT” shall be further examined by “radiography”.


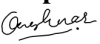

4.2 PROCEDURE & ACCEPTANCE NORMS:


	NDT	Procedure	Acceptance Level
A.	Ultrasonic Test	ASTM– A609	ASTM A609 Level-2 for thickness up to 50mm and Level -3 for thickness beyond 50mm. or BHEL Std. AA0850104 Level-II (up to 50mm thickness & below). Level-III (above 50mm thickness)
B.	Magnetic particle test.	ASTM-E-709 or BHEL Std. AA0850133	ASTM-E-125-63 Degree-2 with no linear inclusions or cracks. or BHEL Std. AA0850134 Level-2
C.	Radiography test	ASTM-E-1030-84	ASTM-E-446, E-186, E-280 (as applicable to thickness)
D.	Dye Penetrant test	CCH 70.1 or BHEL Std. AA0850131	CCH 70.1 RE 70-1 Class-2 or BHEL Std. AA0850132 Level -II

5.0 REPAIR OF CASTING:

No major defect shall be repaired or welded without written sanction from BHEL or its representative. Defect shall be considered major if it exceeds 20% of wall thickness or 25mm whichever is smaller in depth, or that which exceeds 160 sq.cm. in area. A cluster of minor defects shall be considered a major defect. All other defects shall be considered minor.

The defects must be chipped down to sound metal and tested using appropriate NDT method such as magnetic particle / dye penetrant etc. When defects have been removed the vendor shall submit a

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drawing detailing the nature, location, shape & size of each defect to BHEL for approval along with proposed procedure for weld repair (electrodes to be used, preheating temp., post weld heat treatment etc.).

When the repair has been completed (after the consent of the purchaser), non-destructive tests previously carried out shall be repeated together with any additional tests (NDT) considered necessary by the purchaser's representative.

It is preferable to carry out weld repair prior to carrying out normal heat treatment of the casting. In case the weld repair is carried out after normal heat treatment then the casting shall be stress relieved / heat treated (as earlier) depending upon the extent of repairs. Record of all weld repair (including minor repairs) shall be furnished to BHEL along with the details of post weld heat treatment & NDT.

6.0 **MEASUREMENT OF THICKNESS:**

When direct measurement of thickness is not possible ultrasonic method to be used to measure and record the thickness as per drawing.

7.0 **PAINTING:**

Casting shall be thoroughly shot blasted and supplied in unpainted condition.

8.0 **INSPECTION**

8.1 Inspection shall be carried out at vendor's works by BHEL inspector and / or by BHEL appointed third party inspection agency and / or customer's inspection agency as specified in enquiry / PO. All test samples shall be removed in the presence of inspection agency and hard stamped.


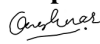

8.2 BHEL quality assurance plan wherever supplied along with PO / enquiry, shall be applicable. Else, vendor shall submit his QA Plan for approval by BHEL / BHEL's customer.


9.0 **TEST SAMPLES:**

Test pieces for mechanical tests shall be prepared from integrally cast keel blocks from each casting of weight above 500 kg.

Retesting

If the results of mechanical tests are found unsatisfactory, retesting shall be performed on double the number of specimens which gave unsatisfactory results.

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In case of unsatisfactory results shown by even one specimen on retesting, reheat-treatment is allowed after which the casting shall be treated as a new one.

10.0 **TEST CERTIFICATES:**

Following test certificates shall be supplied unless otherwise stated on the order.

- Dimensional inspection
- Details of heat treatment, VAD / VD
- Chemical composition
- Results of mechanical tests including impact testing and hardness testing.
- Results of NDT and additional tests called for in the drawing / purchase order.
- Gas analysis results.

11.0 **PACKING & MARKING:**

Castings shall be suitably packed to prevent corrosion and damage during transit. Each package or casting (when supplied separately) shall be legibly marked with the following information :

BHEL Order No. :
 BHEL Drg. No. :
 Heat No. :
 Casting Sl. No. :
 Identification No. :
 Weight :
 Vendor's Name :


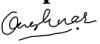

NOTE


- Identification details to be painted on the casting.
- Hard stamped test pieces to be dispatched along with the casting.

12.0 **REJECTION & REPLACEMENT:**

In the event of any casting proving defective from foundry causes in the course of preparation, machining, testing or erection, such casting shall be rejected, notwithstanding any previous certification of satisfactory testing and/or inspection.

The vendor shall undertake to replace the rejected castings at his own cost and the rejected castings shall be sent back to the vendor after fulfilling the commercial terms and conditions.

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13.0 GENERAL

13.1 In case of any contradiction between the clauses of PO, this document & material specification, QA plan or drawing, the following hierarchical order of overriding will be applicable.

1. Drawing - (most important)
2. P.O
3. HT 00215
4. QA plan
5. Material specification.

13.2 Vendor has to compulsorily supply 2 nos. test pieces per heat with proper identification for testing at BHEL works.

13.3 Before start of manufacturing, vendor has to get confirmation of latest revision of the drawing from HT Engg. / BHEL. Vendor must also have the QA Plan approved before manufacturing starts.

14.0 DEVIATION FROM SPECIFICATION:

Any deviation from the BHEL specifications shall be intimated by the vendor for approval by BHEL, Bhopal. In the absence of this, it /will be deemed that all our requirements given in the drawing and specification are acceptable to the vendor in totality.

15.0 CHANGES DUE TO REVISION:

- Clause 2.0 modified and clause 3.2 added in Rev-04.


16.0 ANNEXURES:

Nil

Note:

- VAD - Vacuum Arc Degassing
- VD - Vacuum Degassing

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CHECK LIST


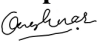

(Check list to be filled in and submitted along with the offer)

- | | |
|---|----------|
| 1. Material shall be as per drg. | YES / NO |
| 2. Dimensions shall be as per drg. | YES / NO |
| 3. Heat treatment shall be done as per spec. of material | YES / NO |
| 4. DP test shall be done as per spec | YES / NO |
| 5. MPI shall be done as per spec. | YES / NO |
| 6. UT shall be done as per spec. | YES / NO |
| 7. Radiography shall be done where defects can't be interpreted with UT | YES / NO |
| 8. Impact testing shall be done | YES / NO |
| 9. Hardness test shall done | YES / NO |
| 10. Mechanical testing shall be done as per material specification | YES / NO |
| 11. Chemical composition shall be done as per material specification | YES / NO |
| 12. Type of furnace used | EAF / IF |
| 13. Gas analysis results | YES / NO |
| 14. Secondary refining shall be done by | VAD / VD |
| 15. What secondary refining facility vendor has got in-house | _____ |
| 16. TCs shall be submitted as per clause 10 | YES / NO |
| 17. Keel blocks shall be cast integral with each casting | YES / NO |
| 18. Before dispatch each casting shall be properly marked | YES / NO |
| 19. Nature of packing in which casting shall be shipped | _____ |
| 20. Deviations, if any | _____ |
| 21. BHEL's enquiry no./date | _____ |
| 22. Name of project | _____ |

Name/stamp of vendor

Name and authorized signature

Date: _____

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