


TD-106 Rev No. 00		PRODUCT STANDARD PUMPS HYDERABAD		FP50717	
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<u>CASTING, AUSTENITIC-FERRITIC STAINLESS STEEL</u>			
Ref. Doc		Revisions : Refer to record of revisions :	Prepared : ASK	Approved : MSR	Date : 22.09.21

1.0.0 INTENT OF SPECIFICATION:

This specification governs the quality requirements of Austenitic-Ferritic (Duplex) Stainless Steel Castings.

2.0.0 APPLICATION:

These castings are required for pumps components like Impellers, diffusers etc.

3.0.0 CONDITION OF DELIVERY:

3.1.0 The steel shall be made by electric furnace process with or without separate refining such as AOD, VOD.

3.2.0 These castings shall be supplied in rough machined and finally stress relieved condition, unless otherwise specified in the drawing or purchase order.

3.3.0 The casting surface shall be free of adhering sand, scale, cracks as determined by visual inspection, MSS SP-55. Un-acceptable surface discontinuities shall be removed and verified. Castings shall not be peened, plugged or impregnated to stop leaks or disguise rejectable indications.

4.0.0 COMPLIANCE WITH NATIONAL STANDARDS:

The standard shall comply with ASME BPVC II A, SA-995. The material shall confirm to the applicable requirements of specification ASME BPVC II A, SA-703M including specific requirements of this specification.

5.0.0 HEAT TREATMENT:

Casting shall be heated to a minimum of 1040 degC, hold for sufficient time to heat the casting uniformly to temperature, quenched in water/rapid cooled by other means.



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5.1.0 CHEMICAL COMPOSITION:


The steel shall conform to chemical composition indicated below. Chemical components inspection should be conducted by ladle analysis. PMI test shall be carried out on the actual material.


Carbon, max	0.04
Manganese, max	1
Silicon, max	1
Phosphorus, max	0.04
Sulfur, max	0.04
Chromium	24.5 - 26.5
Nickel	4.7 - 6.0
Molybdenum	1.7 - 2.3
Copper	2.7 - 3.3
Tungsten	--
Nitrogen	0.10 - 0.25


6.0.0 MECHANICAL PROPERTIES:

Tensile strength (MPa) min.	Yield strength (0.2% offset) (MPa) min.	Elongation in 50mm, (%) min.
690	485	16

- 6.1.0** One tension test shall be made from each heat and shall conform to the requirements as prescribed in the above table.
- 6.2.0** Tensile test may be conducted as per any reputed international standard, on a test specimen integrally cast or separately, for each heat/melt and heat treatment batch. The test piece for mechanical properties inspection shall be mounted on the original casting and heat treatment shall be done along with the original casting.
- 6.3.0** The size of test specimen shall be selected appropriate to the casting thickness and to carry out repeat tests if required. Heat no. /melt no. of the casting shall be stamped on the test coupons by BHEL or BHEL nominated agency. The test sample shall be supplied along with actual consignment.
- 6.4.0** If any specimen shows defective machining or develops flaws, it may be discarded and another substituted from the same melt.
- 6.5.0** To determine conformance with the tension test requirements, an observed value shall be rounded off in accordance with practice E 29 to nearest 5 MPa for yield and tensile strength and to nearest 1% for elongation.

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<div style="display: flex; justify-content: space-between;"> <div style="width: 15%; border-right: 1px solid black; padding-right: 5px;"> <p style="text-align: center; margin: 0;">COPYRIGHT AND CONFIDENTIAL</p> <p style="font-size: small; margin: 0;">The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.</p> <p style="text-align: center; margin: 0;">Ref Doc</p> </div> <div style="width: 85%; padding-left: 10px;"> <p>6.6.0 If the results of the mechanical tests for any heat, lot or casting do not conform to the requirements specified, retests are permitted as outlined in Test methods and Definitions A-370. At the manufacturer's option, castings may be reheat-treated and retested. <u>When castings are reheat treated, they may not be re-austenitized more than three times.</u></p> <p>7.0.0 <u>TESTING & INSPECTION:</u></p> <p>The following tests shall be performed on all the castings and reports enclosed.</p> <p>7.1.0 <u>LIQUID PENETRANT TEST:</u> Castings shall be examined for surface discontinuities by means of Liquid penetrant examination. Test shall be done on all the surfaces including the excavated area for repair welding. Test procedure, as per ASME Sec. V Article 6 & 24. Acceptance criteria, as per ASME Sec. VIII Div. 1 Appendix 7 including the additional criteria: <u>"Size of indication for linear defect shall not exceed 2mm"</u></p> <p>7.2.0 <u>Extract of ASME Sec. VIII Div. 1 Appendix 7:</u> Surface indications determined by liquid penetrant examination are unacceptable if they exceed the following limits:</p> <ol style="list-style-type: none"> a. All cracks and hot tears. b. Any group of more than six linear indications other than those in (a) above in any rectangular area of 38mmx150mm or less or any circular area having a diameter of 88mm or less, these areas being taken in the most unfavorable location relative to the indications being evaluated. c. Other linear indications more than 6mm long for thickness up to 19mm inclusive, more than one-third of the thickness in length for the thickness from 19mm to 57mm, and more than 19mm long for thickness over 57mm (aligned acceptable imperfections separated from one another by a distance equal to the length of the longer imperfection are acceptable. d. All indications on nonlinear imperfections which have any dimension exceeding 5mm. <p>7.3.0 <u>RADIOGRAPHY TEST:</u> Castings shall be examined for internal defects by means of X-rays or gamma rays. Extent of examination and basis for acceptance shall be agreed upon between manufacturer and the purchaser. Test shall be carried out if specifically mentioned in the drawing.</p> <p>7.4.0 <u>MICROSTRUCTURE:</u> Micro structure inspection shall be carried out and abnormal content shall not be observed by micro structure inspection.</p> </div> </div>			

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<p style="writing-mode: vertical-rl; transform: rotate(180deg);"> COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company. Ref. Doc </p> <p> 7.5.0 <u>FERRITTE CONTENT ESTIMATION:</u> Ferrite count shall be determined by point count or through image analysis or by measurement of magnetic response. Location of test shall be mutually agreed. </p> <p> 7.6.0 <u>HYDRAULIC TEST:</u> </p> <p> 7.6.1 Each casting shall be hydro tested after machining, to hydrostatic test pressures as prescribed by the purchaser. Castings shall have no leaks. </p> <p> 7.6.2 In case foundry is unable to perform the hydrostatic test until additional machining is carried out on the casting, foundry shall be responsible for the satisfactory performance of the castings under the final test indicated at clause 8.6.1. </p> <p> 8.0.0 <u>REPAIR WELDING:</u> </p> <p> 8.0.1 Repairs shall be made using procedures and welders qualified under practice ASME BPVC A488. </p> <p> 8.0.2 The composition of the deposited weld metal maybe similar to that of the casting or maybe suitably alloyed to achieve the desired corrosion resistance and mechanical properties. <u>Prior approval of the purchaser is necessary of all weld filler materials to be used prior to any weld repairs.</u> </p> <p> 8.0.3 Post weld heat treatment is necessary for adequate corrosion resistance or impact toughness and shall be carried out on defects qualifying as major defects. Weld repairs shall be subject to same quality standards as used to inspect the castings. </p> <p> 8.0.4 Weld repairs shall be considered major in case of castings that have leaked during hydrostatic testing or when the depth of any cavity prepared for repair welding exceeds 20% of the wall thickness or 25 mm whichever is smaller or the extent of the cavity exceeds 65 Sq.cm. Heat treatment after minor weld repair is not required. </p> <p> 8.0.5 Weld repairs qualifying as major defects shall be documented on sketches or photographs or both. The documents shall show the location and major dimensions of cavities prepared for weld repair and to be submitted to purchaser after completion of order. </p> <p> 8.0.6 Following points shall be observed strictly, when weld repair is carried out. </p> <p> 8.0.6.1 Defect shall be removed completely and well-grooved. </p> <p> 8.0.6.2 Groove shall be LPI tested and no defect shall be found. </p> <p> 8.0.6.3 Defect record shall be made and submitted. </p> <p> 8.0.6.4 Strain due to welding shall be avoided. </p> <p> 8.0.6.5 In case of repair welding of major defect, the base metal of the casting shall be pre-heated before welding and stress relieved after welding. </p>			

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