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GREY IRON CASTINGS - Gr: FG 200		
1 GENERAL This specification governs the quality requirements of Grey Iron Castings having a tensile strength of 200 N/mm ²		
2 APPLICATION Suitable for general engineering purposes.		
3 CONDITION OF DELIVERY As cast or cast and stress relieved or rough machined or rough machined and stress relieved as specified in BHEL order/drawing. Castings shall not be painted.		
4 COMPLIANCE WITH NATIONAL STANDARD Castings shall comply with the following national standards and also meet the requirements of this specification. IS: 210-2009, Gr: FG 200 : Grey Iron Castings		
5 DIMENSION AND TOLERANCES Castings shall be true to the pattern / drawing. Holes for machining up to and including 50mm in diameter are to be cast solid, unless otherwise stated in BHEL order / drawing. Unless otherwise specified in BHEL order/ drawing, untoleranced dimensions for the casings shall be as per tolerance class 5 of BHEL standard AA0230402.		
6 MANUFACTURE The castings shall be cast from the metal melted or refined in any suitable cupola or Electric / Induction furnace or as agreed between supplier and BHEL. All castings above five tonnes shall be mould cooled. Under mould cooling process, the mould should not be disturbed until the hottest portion of the casting cools down to 300°C.		
7 HEAT TREATMENT Castings shall be stress relieved by heating in a furnace to a temperature of 520 to 580°C (recommended), whenever specified. Test pieces shall also be heat treated along with the castings they represent.		
8 FINISH All castings shall be properly fettled and dressed and all surfaces shall be thoroughly cleaned. Whenever specified, the machined surfaces shall have the surface finish as indicated in the drawing.		
Revisions: Refer 43.3 of MOM of MRC-FCF+HTM		APPROVED: INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(FCF+HTM)
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CORPORATE PURCHASING SPECIFICATION**9 FREEDOM FROM DEFECTS**

Castings shall sound, clean, free from defects such as porosity, blow holes, sand inclusions, shrinkage's, cavities, hard spots, cold shuts, cracks, etc. which may adversely affect machining and utility of castings.

No welding or repairs shall be carried out without permission of BHEL. Welding referred to here includes fusion welding in accordance with common foundry practice. The method of repair by welding (see IS 5139) and subsequent stress-relieving shall be as agreed to between the purchaser and the manufacturer.

10 CHEMICAL COMPOSITION

The composition of iron is left to the discretion of the manufacturer, but maximum limit for Phosphorous and / or Sulphur may be specified by the purchaser, if desired. In case of special castings, the detail chemical composition shall be agreed to between the purchaser and the manufacturer.

11 TEST SAMPLES

Manufacturers shall carryout mechanical testing as per following sampling plan.

11.1 Provision of Test Bars

All the test bars shall be cast separately in sand moulds and the number of test bars required shall be as specified in clause 11.2 below. They shall be cast at the same time and from the same melt as the castings, they represent. The test bar material shall be identifiable with that of the castings represented.

When castings are subjected to heat treatment and the test bars shall be heat treated together with the castings they represent.

The test bars shall be cast in dried, baked or chemically bonded moulds made mainly of aggregate of siliceous sand with appropriate binders. The average grain size of the sand shall be approximate to that of the sand in which the castings are poured. Moulds for the test bars shall be approximately at room temperature when poured. More than one test bar may be cast in a single mould, but each bar may be cast in a single mould, but each bar in the mould shall be surrounded by thickness of sand which is not less than the diameter of the bar.

11.2 Frequency of Testing

The number of tests required for each melt or batch of castings shall be as laid in Table 1 below.


Table 1 – Number of Tests

Group	Mass of individual Castings	Test Requirements	Test Samples
*1	Up to 12.5 kg	One test for every 500kg of castings or part thereof	3
*2	over 12.5 kg and up to 50 kg	One test for every 1 tonne of castings or part thereof	3
*3	over 50 kg and up to 500 kg	One test for every 2 tonnes of castings or part thereof	3
*4	over 500 kg and up to 1 tonne	One test for every 3 tonnes of castings or part thereof	3
5	over 1 tonne	One test for every 4 tonnes of castings or part thereof or One test for every casting weighing 4 tonnes or more	3

* In group 1, 2, 3 & 4 all castings represented by one test shall be poured from the same ladle or same heat as the bars provided for the test

11.3 Size of Test Bars

A test bar from which the tensile test piece is machined shall be cast as a uniform cylindrical bar of 30mm diameter. The tolerance on the diameter shall be +2mm, -0mm. The minimum length of the test bar shall be 230mm.

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11.4 Dimensions of Test Pieces

Test pieces shall conform to the dimensions as per IS:210.

Note: Test bars as specified above with proper identification and representative of the castings shall be supplied along with the consignment.

12 MECHANICAL PROPERTIES

12.1 Tensile

The test pieces prepared in accordance with clause 11 shall show a tensile strength of 200 N/mm², minimum, when tested in accordance with IS:1608.

12.2 Hardness (Brinell)

Hardness shall be measured on actual casting at three different places. The castings shall have a Brinell hardness in the range of 160 to 220 HB, when tested in accordance with IS 1500.

13 OPTIONAL TESTS

If specified in the drawing/order, the following tests shall be conducted.

13.1 Non-destructive test

Magnetic Particle Inspection as per BHEL standard AA0850133 and norms of acceptance as per AA0850134 at level 2.

13.2 Hydraulic

Hydraulic test shall be conducted by the manufacturer. In case hydraulic testing as prescribed on the BHEL order/drawing is not carried out at the manufacturer's works, the same shall be carried out by BHEL after necessary machining. However, the manufacturer shall guarantee against any leakage when tested at BHEL's end.

Test pressure and duration of test shall be as specified in BHEL order/drawing.

14 RETEST

Retest shall be done as per IS:210.

15 REPAIR OF CASTINGS

Repair of castings shall not be carried out by the manufacturer without the prior permission of BHEL.

16 SCOPE OF THIRD PARTY INSPECTION


Wherever, separate quality plan is not attached, the scope of third party inspection shall be as follows:

- 1) Review of supplier's declared chemical composition.
- 2) Selection of test samples for mechanical tests and witness of mechanical tests.
- 3) Witness of Non-destructive tests as applicable.
- 4) Review of HT charts.
- 5) Dimensional inspection.

17 TEST CERTIFICATES

Three copies of test certificates shall be supplied unless otherwise stated on order, preferably in the test certificate format annexed to this specification (Annexure -1).

In addition, the supplier shall ensure to enclose one copy of the test certificate along with their dispatch documents to facilitate quick clearance of the material.

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The following details shall be furnished in the test certificate:

- 1) Dimensional inspection
- 2) Detail of heat treatment
- 3) Hardness value
- 4) NDT
- 5) Optional tests called for in the drawing/order.

18 PACKING AND MARKING


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

- AA19702: GREY IRON CASTINGS - Gr: FG 200
- BHEL Order No.
- Consignment/Identification No.
- Melt No.
- Weight
- Supplier's Name

19 REFERRED STANDARDS (Latest Publications Including Amendments):

1) IS: 210 2) IS:1500 3) IS:1608 4) AA0230402 5) AA0850133 6) AA0850134

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ANNEXURE 1 - RECOMMENDED TEST CERTIFICATE FORMAT FOR CASTING

SUPPLIER'S NAME AND ADDRESS TEST CERTIFICATE FOR CASTINGS															
1. Customer:								6. Cast No. & Date:							
2. TC No. & Date:								7. Batch No.:							
3. PO No.:								8. Heat Code:							
4. Process of Melting:								9. Spec. No.:							
5. Deoxidisation Process:								10. Test Bar Size:							
11. CASTING COVERED BY TEST CERTIFICATE															
S.No.		Drawing No. & Item No.				Description				Quantity & Weight					
12. CHEMICAL COMPOSITION (PERCENT)															
Element		C	Si	Mn	S	P									
As per Min.															
Specn. Max.															
Actual Values															
17. HEAT TREATMENT (To be accompanied by Recorder Chart, Whenever Called for)															
Condition		Temp. °C				Soaking Time, Hrs.				Cooling Medium					
14. MECHANICAL PROPERTIES															
		T.S. N/mm ²		Y.S. 0.5/0.2% Proof N/mm ²		% Elongation 5.65vSo GL		% R.A. Min.		Hardness BHN (Min.3 values)		Impact value Joules		Bend	
As per Min.															
Specn. Max.															
Actual Values															
15. SURFACE FINISH (When called for in the order / drg.)															
16. DIMENSIONAL INSPECTION															
17. NON-DESTRUCTIVE TESTS															
Nature of Test		Acceptance level		Instrument used		Range		Results		Any other detail					
Ultrasonic															
Radiographic															
Dye penetrant/ Magnetic Particle															
18. OTHER TESTS IF ANY (Microscopic, Hydraulic, Etc)															
19. IDENTIFICATION OF CASTINGS AS PER CPS															
<p>We hereby certify that the items mentioned above have been tested and inspected in our presence and are found to be in accordance with drawings, specifications and purchase order.</p> <p>Signature & Seal of the inspecting Officer (Purchase Representative)</p> <p style="text-align: right;">Signature and Seal of the Chief of Quality Control Chief Metallurgist of Supplier. Date :</p> <p>INSTRUCTIONS</p> <p>a) If steel is produced by LD or Oxygen process, Nitrogen content should be furnished and shall not exceed 0.009%.</p> <p>b) Test certificates are to be furnished as per purchase order and specification, in A4 size transparent paper.</p> <p>c) All the entries including signature should be in block colour ink.</p> <p>d) If testing is done by outside agencies, the original TCs shall be furnished.</p> <p>e) The actual Test Certificate may run into more than one A4 size paper, if needed, to facilitate filling up of details.</p>															