

BHARAT HEAVY ELECTRICALS LIMITED

INSULATOR PLANT JAGDISHPUR



PURCHASING SPECIFICATION

REF:JP-PS-12-0002/NT

REV:00

DATE:31.08.2018

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SPHEROIDAL GRAPHITE IRON CASTINGS

1.0 GENERAL

This specification governs the requirements of Spheroidal Graphite Iron castings. SG Iron Castings, governed by this specification of BHEL EPD shall generally be in compliance with the provisions of IS-1865:1991 and ASTM A536-84 (Reapproved 1999)

2.0 SCOPE

All Insulator fittings like Socket Caps and Flanges

3.0 CONDITION OF DELIVERY

The Castings shall be supplied in galvanised / un-galvanised / as Cast condition as per Purchase order.

4.0 DIMENSIONS & TOLERANCES

Shall confirm to relevant castings and machine drawings.

5.0 MANUFACTURE

5.1 MELTING

Shall be done in an electric furnace

5.2 HEAT TREATMENT

5.2.1 ANNEALING

Annealing shall be undertaken if non-homogeneity is observed with respect to Metallurgical Morphology and Mechanical properties. Annealing cycle shall be designed by the vendor and copy of the same shall be furnished to BHEL for scrutiny.

6.0 FINISH AND WORKMANSHIP

The castings shall be properly Fettled, Shot blasted to ensure removal of Fused Sand and Heat treatment scales from the surface. Machining shall also be done if mentioned in the Purchase Order. The castings shall clearly bear such letters, figures or marks as specified in the drawing apart from vendor's identification mark. Such identification mark shall be incorporated on the Castings after prior approval of BHEL.

7.0 FREEDOM FROM DEFECTS

The castings shall be sound, clean and free from Porosity, Blow holes, Hard spots, Cold shuts, Distortion and other harmful defects. Galvanised items shall be further free from defects such as those mentioned in IS:2629.

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8.0 MECHANICAL PROPERTIES

Test specimen / sample castings when tested shall confirm to the following stipulations.

Table : Mechanical properties measured on Test bars from separately Cast test samples.

Grade as per IS-1865: 1991	Grades as per ASTM-A536	Tensile strength (min) (N/mm ²)	0.2% Proof stress min. (N/mm ²)	% Elongation (min) Lo=3D	For information only	
					Brinell hardness	Predominant constituent of Matrix
SG 500/7	—	500	320	7	160 – 240	Ferrite + Pearlite
SG 450/10	—	450	310	12	160 – 210	Ferrite
—	65-45-12	448	310	12	—	Ferrite
SG 400/15	—	400	250	15	130 – 180	Ferrite
—	60-40-18	414	276	18	—	Ferrite

Note : Test sample for Tensile Test shall be separately Cast test samples fully in compliance with CI 10.1 of IS:1865:1991

Table : Typical Brinell Hardness Ranges

Grade	Brinell Hardness Range	Predominant Constituent of Matrix
H 200	170 – 230	Ferrite + Pearlite
H 185	160 – 210	Ferrite
H 155	130 – 180	Ferrite

9.0 MICROSTRUCTURE

The specimen shall reveal a microstructure as follows :
 Carbon nodules distributed uniformly in a matrix of ferrite or ferrite + pearlite.
 1 sample/heat treatment or 1 sample/1000 nos to be checked for microstructure.
 Acceptance norm as per ASTM – A247 and IS: 7754-1975 (Reapproved in 2003)

10.0 CHEMICAL COMPOSITION

Shall confirm to drawings, when specified.

11.0 TESTS FOR ZINC COATING (Applicable to Galvanised components)

Tests for uniformity of Zinc coating and mass of Zinc coating shall be done in accordance with EPD test Procedure EL-TP-012. The component shall withstand minimum six dips of one minute each and mass of Zinc coating shall be 610 gm/m² minimum. In case of requirement of higher values for these characteristics the same shall be indicated in the order / drawing.

Note : The test for uniformity of coating shall not be applicable for items with an overall size more than 200mm × 150mm × 100 mm and / or weight exceeding 4 kg.

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12.0 SELECTION OF SAMPLES

Sampling for various tests / inspection shall be as indicated in the table below:

Sl. No.	Type of Test / Inspection	Sampling plan for supplier while production and BHEL for lot acceptance
1	Dimensional check*	2 nos per 1000 Nos or part thereof.
2	Visual & Gauge [§] Inspection	100% visual inspection by Supplier. And samples as per IS:2500 (Part I) inspection level II & an AQL of 0.65 % by BHEL
3	MPT [§]	100% visual inspection by Supplier. And samples as per IS:2500 (Part I) inspection level II & an AQL of 0.25 % by BHEL
4	Mechanical properties (Ultimate Tensile Strength **, 0.2% proof stress, % Elongation)	Tested on one test bar per treatment batch by supplier and one test bar per lot by BHEL. Test samples to be drawn at least one number per treatment (not exceeding 2000 kgs of fettled castings from one heat) Note: 1. Sufficient no. of test bars (preferably 4 nos) from same melt/heat treatment need to be produced to provide for contingencies of discordance of a test or re-tests. 2. Tensile Tests, Evaluation of Nodularity (respectively in accordance with Cl 13.1 and Cl 9.1 of IS:1865) shall be imposed only at the time of vendor approval and subsequent surveillance checks. Surveillance checks to be carried out once every 6 months irrespective of whether supplies have been effected or not, as long as the vendor is on the PMD listing -Validity of tests : As per Cl 14.1 of IS:1865; Retest : As per Cl 15 of IS:1865

* For bulk supplies only. Detailed check shall be carried out on initial sample to be approved for taking up bulk manufacture.

- ** i) In case of failure of any tensile test 'retest' can be taken up on two additional test bar pertaining to the same batch and both the additional test bars shall pass
- ii) In case a test bar breaks out of the gauge length & 'repeat test' can be taken up on are placement test bar. So also in the event of any defect traceable to the testing conditions or attributable to specimen unsoundness.

§ Test to be carried out by ASNT Level II certificate holders only.

§ Gauges will be applicable as per drawing.

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Sl. No.	Type of Test / Inspection	Sampling plan for supplier while production and BHEL for lot acceptance
5	Hardness test on Castings	2 Nos. per lot Test samples: Hardness tests shall be carried out on actual castings drawn at the rate of A) In case of Socket caps: 4 nos from among the castings (of one drawing type) per treatment / 4 nos from among the castings (of one drawing type) per lot of 1000 nos or part thereof. B) In case of Flanges: 2 nos from among the castings (of one drawing type) per treatment / 2 nos. from among the castings (of one drawing type) per lot of 1000 Nos or part thereof. Location of Hardness test samples: A) In Case of Socket caps : On the Socket head and sectioned lip portion B) In case of Flanges : On the hub or web whichever is thicker
6.	Load test on Castings (for Socket Caps)	4 nos per 1000 with min 1 no.per melt / treatment
7.	Additional test : Test for deformation	On one sample per melt
8.	Surface defects (after galvanising)	IS:2500 (Part I) Inspection level II & and AQL of 0.65%
9.	Test for Zinc coating	3 nos. per batch of 1000 nos.

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13.0 INSPECTION AT VENDOR'S PREMISES

BHEL's representative shall have free access to all parts of Vendors' premises at all times when work on the contract is being executed. The vendor shall offer BHEL's representative all reasonable facilities to convince the latter that the component is being manufactured and furnished in accordance with this specification.

14.0 TEST CERTIFICATE

The supplier shall submit test certificates giving the following information

- Purchase Order no.
- Purchasing specification no.
- Suppliers reference and name
- Batch no.
- Consignment identification
- Results of various tests as called for in this specification
- Details of Heat treatment (if any)
- Melt no. details with traceability

15.0 PACKING AND MARKING

Castings shall be supplied in lots as defined above. Each lot shall be legibly identified with the following information

- Supplier's Name
- Purchase Order no.
- Component drawing no.
- Consignment identification
- Lot (or malleablising batch no/identification)
- Quantity

16.0 REJECTION

Castings not conforming to the above stipulations shall be rejected. Also in the event of the castings proving defective in the course of any further processing the same shall be rejected notwithstanding any previous certification of satisfactory testing and/or inspection.

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