

	Bharat Heavy Electricals Limited, Piping Centre, Chennai Technical Delivery Conditions for Forgings for Hangers and Supports	TDG : 15 Rev. 01 Date : 18.10.2016 Page : 1 of 5
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1.0 SCOPE

- 1.1 This technical delivery condition specifies the requirements for supply of carbon steel finished forgings for hangers and supports applications.
- 1.2 The size, specification, quantity shall be as per purchase order.

2.0 MATERIAL

- 2.1 Material specification: SA105 or equivalent as approved by BHEL.
- 2.2 The steel used for forging shall confirm to relevant ordered specifications in all aspects. However, carbon content in SA105 shall not exceed 0.25% in product analysis and also the silicon content shall not be less than 0.1% in both ladle and product analysis.

3.0 FORGING PROCESS

- 3.1 The amount of hot working shall be such as to ensure complete soundness and adequate uniformity of structure and mechanical properties.
- 3.2 Minimum forging reduction in area shall be 1:4 from ingot to finished forging.
- 3.3 The rough forgings must be as close as possible to the final shape and size.

4.0 HEAT TREATMENT

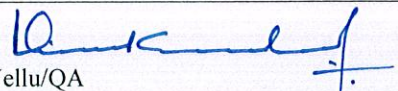
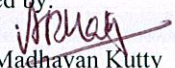
- 4.1 The forgings shall be supplied in normalised and shot blasted condition as specified below.

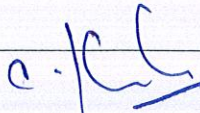
Normalising temperature: 870-900 deg.C; **Soaking Time:** 30 minutes per Inch of thickness.

Rate of Heating: For thickness $\leq 100\text{mm}$, 200deg.C/hour max.
For thickness $> 100\text{mm}$, 150deg.C/hour max.

- 4.2 The heat treatment particulars, heating rate soaking time, temperature, cooling media etc., shall be indicated in Heat Treatment chart and reported in Test Certificate.

5.0 SURFACE CONDITION : Merged with clause-10.0

Revised by :  Vivekananda Yellu/QA	Reviewed by :  C. Vaithianathan/QA
Approved by:  A.P. Madhavan Kutty Quality	Accepted by:  G. Panneerselvam MM


 C. Karunakaran
 Engineering

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6.0 TESTING

6.1 **Chemical composition** – Product analysis shall be done for each heat as per S50 of ASTM960.

6.2 Mechanical Testing:

6.2.1 Testing of mechanical properties shall be done using specimen from finished heat treated material or identical specimen which has under gone same degree of working and forging reduction.

6.2.2 One tensile and one bend test shall be conducted per heat per size, per heat treatment lot. If more than one heat is included in one heat treatment batch, each heat shall be tested.

6.2.3 **Tensile test:** shall be conducted according to ASTM A370 for SA105.

6.2.4 **Hardness test** shall be carried out as per specification requirement. Maximum hardness shall be 190BHN.

6.2.5 **Bend test:** The test specimen shall have width of 25.4mm thickness of 19mm. The test specimen shall satisfactorily cold bent through 180 deg. over thin section without fracture, mandrel radius 6.3mm.

7.0 NON-DESTRUCTIVE TESTING

7.1 All the accessible surface of the forgings shall be **Magnetic Particle Inspected** as per ASTM E709.
The forgings having linear indications like cracks, folds, silvers and other injurious material defects are not acceptable.

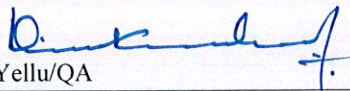
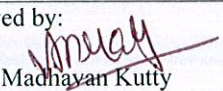
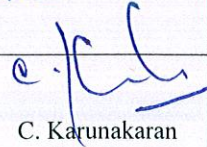
7.2 **Ultrasonic testing** shall be done for the forgings diameter (or) thickness above 50mm as per SA 388. Acceptance to - ASME sec-VIII Div.2, Cl.3.3.4

7.3 **Merged with clause-7.2**

7.4 **Merged with clause-7.2**

8.0 REPAIR

8.1 Repair involving fusion welding is prohibited.

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	Bharat Heavy Electricals Limited, Piping Centre, Chennai Technical Delivery Conditions for Forgings for Hangers and Supports	TDG : 15 Rev. 01 Date : 18.10.2016 Page : 3 of 5
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9.0 MARKING AND PACKING

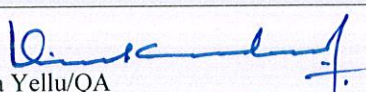
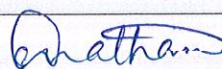
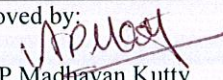
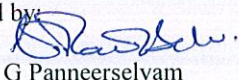
- 9.1 The following details shall be hard stamped on the face of the forgings.
- Specification and Grade.
 - Variant No.
 - Melt Number.
 - Maker's Emblem.
 - Inspecting Authority's Seal.
- 9.2 All forgings shall be coated with transparent rust preventive coating unless otherwise specified in P.O./Drg.

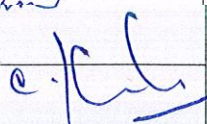
10.0 WORKMANSHIP

- 10.1 The parting line flash shall be removed and the surface shall have a smooth workman like finish.
- 10.2 Forgings shall be supplied in proof machined or shot blasted condition as specified in P.O./Drg.

11.0 INSPECTION AND CERTIFICATION

- 11.1 The steel used for manufacturing/forging shall be inspected at works/NABL approved Laboratory and the test certificate shall be countersigned by an inspecting authority nominated by BHEL.
- 11.2 The forging shall be inspected by the inspecting authority nominated by BHEL and the test certificate shall be countersigned by the inspecting authority.
- 11.3 Three original test certificates furnishing the following details and typed in English and counter signed by the Inspecting Authority shall be given.
- Purchase Order No, Certificate Number.
 - Specification and Grade.
 - Quantity and Size.
 - Process of Steel Making.
 - Chemistry – Melt wise.
 - Heat Treatment details.
 - Mechanical Properties.
 - N.D.T results with reference standard.

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 Engineering

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11.4 The format of test report is as follows.

TEST REPORT

1. Name of forge :
2. Name of Purchaser :
3. Purchase Order Number :
4. Raw material details :
 - a. Maker
 - b. Specification
 - c. Process of Steel Making
 - d. Heat No. / Code No.
5. Sl. No. :

6. FORGING DETAILS

Name of Part : Drawing Number : Qty:

Non-destructive test results if any :

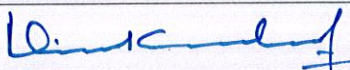
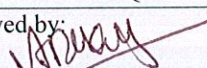
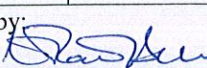
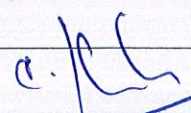
Manufacturer's identification :

CHEMICAL ANALYSIS

Element %		C	Mn	Si	S	P	Cr	Mo	Ni
As per Specification	Min.								
	Max.								
TC Value Extract									

MECHANICAL PROPERTIES

		Yield Strength (kg/mm ²)	Tensile Strength (kg/mm ²)	% Elongation	% Reduction Area	Bend Test D=2t/t	Hardness Value BHN
As per Specification	Min.						
	Max.						

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Approved by : 	Accepted by : 
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	 C. Karunakaran Engineering

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Actual Values							
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We hereby certify that items mentioned above have been tested by us and are found to be in accordance with the requirements of relevant material specification – TDG/QP.

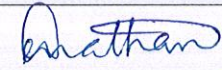
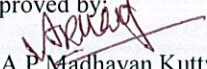
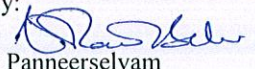
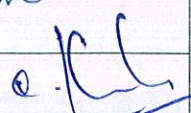
Place :
Date :

Signature of the
Representative of Forge

SIGNATURE OF THIRD PARTY INSPECTORS

Records of the Revision

Revision :01, Clauses
2.2 revised & interchanged as 2.1
4.1 revised
5.0 merged with cl.10.0
6.1 revised
6.2.4 revised
6.2.5 & 6.2.6 merged
7.1 revised
7.3 & 7.4 merged with 7.2
9.0 revised
10.0 added & further clauses re-numbered
11.1 revised
11.4 (Test report – Mechanical properties- Impact test deleted)

Revised by :  Vivekananda Yellu/QA	Revised by :  C. Vaithianathan/QA
Approved by:  A.P. Madhavan Kuty Quality	Accepted by:  G. Panneerselvam MM  C. Karunakaran Engineering