



QUALITY ASSURANCE
TECHNICAL DELIVERY CONDITIONS
FOR SUPPLY OF ROLLED / FORGED BARS APPLICABLE
TO BAP PRODUCTS

TDC : RTG : 500
Rev. No. 03
DATE: 02.04.2012

TECHNICAL DELIVERY CONDITIONS

FOR SUPPLY OF ROLLED / FORGED BARS APPLICABLE TO BAP PRODUCTS

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RECORD OF REVISIONS

REV. NO	CLAUSE NO	REVISION MADE	EFFECTIVE DATE
00	--	TDC : RTG : 057/02 is revised and re-numbered as RTG : 500	08-08-2001
01	5.2	UT incorporated for rod diameter equal to 50 mm and above instead of 63 mm	19-05-2009
	6.1	TDC : RTG : 500 revised by deleting IS : 3739 and including IS : 11185 Note: IS : 3739 gives tolerance only for rolled bars whereas IS : 11185 gives tolerance for both rolled and forged bars	
	6.2	Reduction Ratios Incorporated	
02	1.0	Various Specifications included for rolled / forged bars as applicable to Boiler Auxiliaries products.	01-03-2011
	3.0	Heat Treatment conditions elaborated for various specifications as applicable to intended purpose	
	4.0	Mechanical Properties included under clause 2.0 and hence other clause numbers re-numbered	
	5.2	Reduction Ratio modified as 4:1 minimum	
	8.1	Bars of diameter = and > than 32 mm shall be supplied as loose instead of equal to and more than 63 mm	
	8.2	Bars of diameter below 32 mm shall be supplied as bundles instead of less than 63 mm	
	8.3	Colour Coding specification added for supply of rolled / forged bars.	
11.0	End use of rolled/forged bars added		
03	2.0	Clause No. 2, Material - has been modified to include the process of making of steel and also the list of approved manufacturers for procurement of billets / blooms / Ingots for further operation were added.	02.04.2012
	3.1, 3.2	a) Diameter range for rolled bars and forged bars applicable to SA 193 B7 is added based on MM feedback and further technical deliberations had on PCM meeting of G&D held on 29.04.2011. b) Refer record notes of discussion held on 01.06.2011 and 15.11.2011 w.r.t rolled bars and forged bars diameter limitation expressed by vendors for SA 105 and SA 193 B7 materials.	02.04.2012

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REV. NO	CLAUSE NO	REVISION MADE	EFFECTIVE DATE
03	3.1, 3.2	c) Rolled / Forged bars – Diameter limitation details for SA 105 / SA 193 B7 rods received from various steel manufacturers viz., SAIL, Facor and Vikrant were taken into account and accordingly separate table for rolled bars and forged bars were introduced in this revision. d) For Rolled bars the reduction ratio changed to 6:1 min., in place of 4:1.	02.04.2012
	5.0	The dimensional tolerance for rolled bars as per IS:3739 is also included along with IS: 11185	02.04.2012
	9.0	Clause no. 9 Inspection & Certification has been renamed as Inspection Check List with more clarity for inspection purpose.	02.04.2012
	10.0	New clause added as <u>"Documentation"</u> taking care of new requirements as per this revision 03.	02.04.2012

1.0 SCOPE :

1.1 This Technical Delivery Conditions (TDC) specifies the requirement for supply of rolled / forged bars to various specifications mentioned below, as applicable to each of the products of BAP – Ranipet Viz., Air Pre Heater (APH), Utility Heavy Duty Fans (FAN), Electrostatic Precipitator (ESP or EP) and Guillotine Gates and Isolation Dampers (GAD).

- 1.2
- a) IS: 2062 Gr. A or Gr. B
 - b) SA 105
 - c) SA 193 B7
 - d) SA 479 Type 304
 - e) SA 276 Gr.420 / X20 Cr13 to EN 10088-3 (Matl. No.1.4021)

1.5 The rounds / rods raw material specification, sizes, diameter, length and Qty will be as per Purchase Order.

2.0 CHEMICAL COMPOSITION AND PROCESS:

2.1 The Steel shall be manufactured by open hearth basic oxygen or electric arc furnace followed by vacuum degassing process and shall be fully killed.



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- 2.2 The Billets / Blooms / Ingots supplied by the following manufacturers only acceptable to Quality and no deviation on this account is acceptable to Quality.
- 2.2.1 BHEL – Haridwar
 - 2.2.2 SAIL / Alloy Steel Plant - Durgapur
 - 2.2.3 SAIL / VISL - Bhadravathi
 - 2.2.4 RINL – Vizag
 - 2.2.5 Kalyani Steel – Pune
 - 2.2.6 Starwire - Ballabagh
 - 2.2.7 Mahindra UGINE Steel Co. Ltd - Khopoli
 - 2.2.8 Midhani - Hyderabad
 - 2.2.9 Arcvac - Kolkatta
 - 2.2.10 Facor – Nagpur
 - 2.2.11 Mukund Ltd
 - 2.2.12 Jindal Steel & Power Ltd., - Raigarh
 - 2.2.13 Noble Tech Industries Ltd – Chennai
 - 2.2.14 OPG Metal Industries - Mayawaram
- 2.3 The Chemical and Mechanical properties of the material shall be as per the respective specifications mentioned in clause no. 1.2 above.

3.0 HEAT TREATMENT & SUPPLY CONDITION FOR ROLLED / FORGED BARS :-

- 3.1 Following materials shall be supplied as either ROLLED or FORGED BARS with the Heat Treatment condition mentioned against each specification (Refer Notes given below) :-**

SL NO	MATERIAL	HEAT TREATMENT & SUPPLY CONDITION
1	a) IS : 2062 Less than 40 mm dia	As Rolled / Forged bars and without any Heat Treatment
	b) IS: 2062 Dia 40mm and above	As Rolled / Forged bars with Controlled Furnace Normalized condition (880°C to 920° C)
2	SA 105 – Up to and less than Dia 125mm	As Rolled / Forged Bars with controlled Furnace Normalized condition ((880°C to 920° C)
3	SA 193 B7 - Up to and less than Dia 125mm	As Rolled / Forged Bars with Quenched & Tempered Condition.
4	SA 479 Type 304 - Up to and less than Dia 125mm	As Rolled / Forged Bars with Solution Annealed Condition
5	SA 276 Gr.420 / X 20 Cr 13 to EN 10088-3 (Matl. No.1.4021) - Up to and less than Dia 125mm	As Rolled / Forged Bars with Quenched & Tempered Condition

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3.2 Following materials shall be supplied as **FORGED BARS ONLY** with the Heat Treatment condition mentioned against each specification (Refer Notes given below):-

SL NO	MATERIAL	HEAT TREATMENT & SUPPLY CONDITION
1	SA 105 - Dia more than 125mm	As Forged Bars with controlled Furnace Normalized condition (880°C to 920° C)
2	SA 193 B7 - Dia more than 125mm	As Forged Bars with Quenched & Tempered Condition.
4	SA 479 Type 304 more than 125mm	As Forged Bars with Solution Annealed Condition
5	SA 276 Gr.420 / X 20 Cr 13 to EN 10088-3 (Matl. No.1.4021) more than 125mm	As Forged Bars with Quenched & Tempered Condition

Note: 1. Rolled bars made through bottom poured vacuum degassed quality ingots/billets/ blooms will have minimum reduction ratio 6:1 from start to final piece.

2. Forged bars made through bottom poured vacuum degassed quality ingots/billets/ blooms will have minimum reduction ratio 4:1 from start to final piece.

4.0 NON DESTRUCTIVE TESTS :

4.1 The material shall be free from scales, laps, piping, cracks and any other injurious defects to raw materials.

4.2 All the bars of diameter equal to 50mm and above shall be Ultrasonic Tested (UT) by straight beam method as per ASTM A-388.

4.2.1 **ACCEPTANCE NORMS:** One or more discontinuities resulting in complete loss of back wall reflection to 10% of full scale height, not attributable to geometric configuration, when tested by back wall echo method are not acceptable.

5.0 DIMENSIONAL TOLERANCES :

5.1 The dimensional tolerances for the rolled bars shall be either as per IS: 11185 (latest) or IS: 3739 (latest) and for forged bars the same shall be as per IS: 11185 (latest).

6.0 REPAIR :

6.1 Surface defects can be removed by mechanical means. However the dimensions after repair shall be as per PO / Drawing requirement.

6.2 Repairs involving welding are fully prohibited.



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7.0 SURFACE FINISH :

7.1 All the bars of diameter equal to 50 mm and above shall have smooth surface finish providing uniform coupling of UT probe.

8 MARKING AND PACKING :


- 8.1 Bars of diameter equal to 50 mm and above sizes shall be supplied in loose and all these bars shall be hard stamped furnishing the melt number, specification and makers emblem / code and the same shall be framed with suitable painting/markings at any one end.
- 8.2 Bars of diameter below 50 mm sizes shall be packed in bundles not exceeding each bundle 1 MT weight along with metal tag, having details like melt number, specification and maker's emblem / code suitably punched on the metal tag and the same may be tagged on both ends.
- 8.3 The color code to be applied on the two faces of both ends of each bars of respective specifications shall be as per the table given below:-

SL. NO.	SPECIFICATION	COLOUR CODE
1	IS: 2062	GREY
2	SA 105	BLACK
3	SA 193 B7	RED
4	SA 479 TYPE 304	RED & WHITE (50/50)
5	SA 276 GR.420	BLACK & WHITE (50/50)

Note: No deviation on the color code is acceptable as it is applicable to our Plant standard Storage procedure.

9 INSPECTION CHECK LIST :

- 9.1 The Original Mother TC / Mill TC of the respective billet / bloom / Ingot used for the successive hot rolling / hot forging has to be shown to BHEL / BHEL's Authorized Inspection Agency (AIA) for verification and a copy of the same has to be submitted along with other TCs.
- 9.2 BHEL / BHEL's AIA will witness two samples per heat number for the finished product against the respective material specification for its chemistry / mechanical properties and the same shall be submitted along with other internal Test Certificates.
- 9.3 The respective reduction ratio for rolled bars / forged bars – as applicable shall be calculated and recorded on IR (Inspection Report) itself by BHEL / BHEL's AIA.
- 9.4 During the course of rolling / forging BHEL / BHEL's AIA shall be witnessing the process for which the rolling plan program has to be submitted to Quality Department thro' purchase within three weeks time after the acceptance of the BHEL PO.
- 9.5 All the Bars either rolled or forged shall be offered for physical verification at the place of manufacturing of works only before HT Cycle to verify the process / method of manufacture to BHEL / BHEL's Authorized Inspection Agency.
- 9.6 The source of HT and UT shall be NABL approved / BHEL approved vendors only.

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- 9.7 After the HT cycle, the bars which are to be UT tested shall be offered for BHEL / BHEL's AIA witness during the time of UT checking for which suitable advance information has to be given thro' purchase to Quality.
- 9.8 The Final Inspection of Rounds / Rods shall be carried out only at the place of manufacturing of rolling / forging at works by BHEL /BHEL's AIA .

10 DOCUMENTATION :

- 10.1 The entire test specified under respective specifications shall be carried out at works or at NABL approved Labs or BHEL Units and the test results shall be furnished in the test certificate.
- 10.2 The supplier shall send the test certificates in English only to reach BHEL before the physical receipt of materials at BHEL stores and it shall contain the following documents /information's:
- Purchase Order Number and Date
 - TDC Number with rev.no and Date
 - Material Specification and Grade
 - Size, Number, Qty and Weight
 - Chemical Composition for Billet / Bloom / Ingot – MILL TC – Each Melt wise
 - Chemical Composition for finished product – Each Melt wise
 - Mechanical Properties – Each Melt wise / Heat Treatment Batch wise
 - Ultrasonic Testing Report
 - Heat Treatment Cycle Charts in Original.

11 AUDIT CHECK AT BHEL :

- 11.1 BHEL reserves the right, at their discretion to carry out audit checks for billet / bloom/ingot raw material for its chemistry, finished product chemistry, heat treated condition, mechanical testing and NDT on the supplied bars.
- 11.2 If any bar is found to be defective during audit check test as per clause 11.1 or during subsequent processing at BHEL works, such bars supplied against the respective PO are liable for rejection at the cost of supplier.

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