

Revision Record: Rev:01: 27.06.95: Modified based on feed back. Rev:02: re-written, matl.spec. added, High temp.tensile removed. Impact added.

1.0 MATERIAL SPECIFICATION

ASME:(Latest): Carbon steel(CS): SA 515 Gr.60, 70, SA 516 Gr.55, 60, 65, 70
SA299, SA 537 Cl.1, SA 285 Gr.C,
Alloy Steel(AS): SA 387 Gr.5, 11, 12, 21, 22, SA 204 Gr.A,B,C
Nickel Steel(NS): SA 203 Gr.D, E
Martensitic Stainless Steel(MS): SA 240 TP 410,410S
Stainless Steel(SS): SA 240 TP 304,304L,316,316L,316Ti, 321,347,347L
Additional Requirement: As listed below (supplementary to Specification)
Size,Class and Qty.: As per Purchase order(PO)

2.0 CHEMICAL COMPOSITION & PROCESS

Fully killed steel, Final rolling: lengthwise. Vacuum treatment(S1 of SA 20) for thick. ≥ 50 mm.
Hot rolling for SS: >7 mm. thick.
Ladle analysis: min.1 sample per cast, Product analysis: min.1 sample per plate as rolled.
Max. Carbon: CS,NS&AS: lesser of Specification. or 0.23%, MS: 0.08%.
Carbon Equivalent: CS: $C + Mn/6 + (Cr+Mo+V)/5 + (Cu+Ni)/15 \leq 0.43\%$.

3.0 HEAT TREATMENT (HT)

CS: Normalise at 900-950 deg.C, NS: Normalise at 840-880 deg.C, AS & MS: Normalise at 955-980 deg.C and Temper at 705-750 deg.C, 1 hr. per inch thick(t), Air cool.
SS 321,347,347L: Additionally to be Stabilisation Heat treated.

4.0 SIMULATION HEAT TREATMENT for test coupons in addition to Cl.:3.

CS:Normalise:900-950deg.C,1hr./ inch t, SR:610 $\pm$ 10deg.C,3 hr./inch t,furnace cool to 400deg.C
NS:Normalise:840-880deg.C,1hr./ inch t, SR:610 $\pm$ 10deg.C,3 hr./inch t,furnace cool to 400deg.C
AS & MS:Normalise:955-980deg.C,1hr./inch t, Temper:705-750deg.C,1hr./inch t,Air cool,
SR:690 $\pm$ 10deg.C,3 hr./inch t, furnace cool to 400 deg.C
ROH/ROC for SR: $< 220/t$ deg.C/hr. (t in inch), but need not be slower than 55 deg.C/hr.

5.0 MECHANICAL TESTS on simulation Heat Treated coupon:

Extent of test: For each plate as rolled. Orientation of Specimen: Transverse to rolling direction.
Hardness(max.): CS & NS: 175 BHN, AS: 190 BHN.
Impact test: CS: S5 of SA 20. Test temperature, Acceptance: Table A 2.15 of SA 20. Values for SA 516 to be used for SA 515. AS: SA 370: Test temperature: (-)18 deg.C.(SA 387Gr.5: 0 deg.C.) Acceptance(min.): $t \leq 50$ mm.: Avg: 25 J, Single min.:17 J; $t > 50$ mm.:Avg: 34 J, Single min.: 27 J.
Bend test: Non IBR items with $t > 50$ mm. & all IBR items: S14 of SA 20.
IGCT: SS: Items for PV: ASTM A262 practice B. Acceptance: Corrosion rate ≤ 48 mils/Year.
Items for HE : ASTM A262 practice E. Specimen to be sensitised, bent & inspected at 50 & 200x
Acceptance: free of cracks and grain dropping, Photo micro graph to be provided.

6.0 NON DESTRUCTIVE TEST AFTER HT

Ultrasonic test: SA578. Acceptance: Level B. Monitoring:III party inspector.

7.0 DIMENSIONAL TEST

Tolerance on thickness of plates shall be positive only.

8.0 FINISH AND REPAIRS

Plates to be free from loose mill scales, edge cracks & other injurious defects. Repairs by fusion welding prohibited. Mechanical removal of defect permitted subject to min. thick. & smooth surface SS plates to be surface treated as per ASTM A380 with No.1 finish as per SA 480.

9.0 MARKING

Specification, grade, Melt number, Plate number, Maker's emblem/code, Inspecting Authority's seal to be stamped with low stress stamp on each plate along rolling direction & bordered by white paint. PO No., "BHEL - Tiruchirappalli" & weight to be painted on the product.

10.0 INSPECTION AND CERTIFICATION

Products to be inspected at works & test certificates countersigned by Inspecting Authority as below:

Imported: Inspecting Authority approved by IBR for country of origin.(to be concurred by BHEL)

Indigenously supplied IBR items: Boiler Inspectorate/Directorate of Boilers of respective State

Indigenously supplied non IBR items: a reputed inspection agency like M/s EIL/PDIL/TUV/
Lloyds Register - as indicated in PO

Supplier certified TC sufficient for IBR items from 'IBR approved - well known Steel maker'.

Test certificate in English for each product with following details shall accompany the product
(in format approved by Boiler Inspectorate for IBR items):

1. Purchase Order No.(BHEL),TDC No., Test certificate number & Quantity.
2. Specification and Grade with applicable year of code, Heat Number, Plate number.
3. Steel making process, Chemistry including incidental elements - Ladle and Product analysis.
4. HT details of material and test coupons like temperature, soaking time, cooling medium etc.
5. Mechanical, NDE & other test results with reference, acceptance standards.
6. Surface treatment details for SS.
7. Print of the stamp of Inspecting Officer, which is used on the plate.

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