RECORD OF AMENDMENTS

Sl. No.	Amendment Sl. No.	Date	Details of Amendments	Amendment carried out by & Date

TECHNICAL REQUIREMENTS OF T.A. BOLT

The technical requirements are to be read in conjunction with Drg No OFM 32840 & 32841

1. T.A. BOLT M20 x 1.5 – DRG. NO. **OFM-32840**
   T.A. BOLT M27 x 1.5 – DRG. NO. **OFM-32841**

2. **METHOD OF MANUFACTURE:**

   i) The steel shall be manufactured from fully Aluminium killed steel melted through basic lined Electric arc furnace and L.F. route. The stock will be manufactured by hot rolling.

   ii) Sufficient discard shall be made from each ingot to secure freedom from piping and undue segregation.

   iii) The rolled bar will be checked for Macro examination as per IS: 11371 & 13015-91 confirming to R1, C1 & S1 from plate1. It shall be free from external and internal cracks, flakes, laps and other injurious imperfections.

   iv) The basic raw material for the forging has to be purchased by the supplier only from prime manufacturer of Steels and not from any traders.

   v) Each rolled bars will be legibly marked on the ends with grade of steel and heat number.

   vi) The forgings shall be made by close die forging method, followed by machining, heat treatment, cadmium coating and chromate treatment.

3. **MATERIAL:**

   3.1. **Grade of Steel**
   38 XC to GOST 4543 – 71

   3.2. **Chemical Composition:**

C%	Si%	Mn%	Cr%	S%	P%
0.34 – 0.42	1.00 – 1.40	0.30 – 0.60	1.30 – 1.60	0.035 Max	0.035 Max

   Residual mass fraction of copper & nickel should not be more than 0.30% each.

4. **MATERIAL CLEARANCE:**

   Before commencing manufacturing of forging from Rolled stock, the firm shall offer the Test certificate of material from NABL accredited laboratory for chemical composition, macrostructure, non-metallic inclusion & physical properties from the steel manufacturer for the approval of material clearance from OFM.

5. **CONDITION OF SUPPLY:**

   The T.A. Bolts are to be supplied in Isothermally hardened, Cadmium coated and Chromate treated condition.

6. **SURFACE CONDITION:**

i) The Bolts should be properly cadmium coated after heat treatment. Cadmium plating 12 microns thick coating followed by chromate treatment. Lumps of coating on the bolts should be avoided.

ii) Before cadmium coating surface of bolts is to be made clean and it should be without rust, scales and oil spots.

iii) Coating should be golden – yellow with rainbow hue. 100% bolts are to be checked for colour of coating.

7. **METALLURGICAL PROPERTIES:**

7.1. **Macrostructure:** (IS: 13015-1991)

i) 01 no. each Bolt is to be taken from the production batch of 500 nos. forging for Macro examination.

ii) The forgings should be free from shrinkage cavity, porosity, blisters, slag inclusions, harmful dendrites, segregations, cracks and laminations.

iii) The flow lines of the Macro etched section should follow the contour of the forging. Flow lines should not cut the contour anywhere.

7.2. **Microstructure:**

i) Two longitudinal samples to be taken from middle of heat-treated forgings for checking of microstructure.

ii) Samples for microstructure test are cut by methods, not causing the heating of metal by cutting with continuous supply of coolant. The microstructure should be having minimum 90% Bainite with section of upper Bainite. (In cross sections more than 15 mm during satisfactory hardness and impact Strength).

7.3. **Non-metallic inclusion content:** (IS: 4163-1982)

Oxide, Sulphide, Alumina and Silicate inclusions not to exceed 2 in thin series and 1 in thick series. Steels having coarse alumina or slag streaks shall not be acceptable.

7.4. **Grain Size:**

Austenitic grain size 5 to 8 as per IS: 2853-1964.

7.5. **Decarburised Layer:**

Thickness of decarburised layer shall be 0.30 mm max. (Pure Ferrite 0.05 mm, Partial Decarburisation 0.25 mm).

8. **HEAT TREATMENT:**

All the components should be Isothermally Hardened to achieve following mechanical properties. The Heat Treatment cycle for guidance is given below.

i) Preheating at temperature 200°C-250°C, Soaking Time 15 minutes.

ii) Hardening in Salt Bath at temperature 910°C ±10°C, Soaking Time 30 ±5 minutes. Melt composition: Neutral Salt 100%.

iii) Austempering at temperature 300°C - 350°C. Soaking time 30 - 45 minutes. Melt composition: Sodium Nitrate 50% & Calcium Nitrate 50%

iv) Wash parts in hot flowing water at temp 70°C - 90°C for 10 minutes. Water flow rate minimum 100 lt/hr.

v) Passivation in water solution of Sodium Nitrate, concentration 5 - 7%. Temp. 70°C - 90°C. Passivation time 10 minutes minimum.

vi) Stress relieving at temperature 310°C - 340°C for 3hrs - 3.5 hrs.

Note: - As these components are to be heat treated after final machining operation, care should be taken during stress relieving to prevent oxidation during heating.

9 MECHANICAL PROPERTIES:

i) Hardness 341 - 444 BHN

ii) Impact strength > 7 Kgf-m/cm²

iii) Impact strength will be determined on Type I / II specimens as per GOST 9454 - 78 at room temp. Length = 55 ± 0.6mm, Width = 10 / 7.5 ± 0.10mm, Height = 10 ± 0.1mm, U type Notch of 2 x 2 mm, Radius of concentrator = 1 ± 0.07mm, Height of working section = 8 ± 0.1mm.

iv) Hardness to be tested on 100% parts on the place shown in drg. no. OFM 32840 & 32841 before Cadmium coating. For hardness-failed parts, repeated Heat Treatment is allowed twice in a separate charge.

v) Samples for mechanical tests should represent the longitudinal direction of the components.

10 FREEDOM FROM DEFECTS:

i) Bolts should not have hairline cracks, grain boundary cracks, whose absence is to be ensured by MCD Test - Bolts in which above mentioned defects are detected are to be broken and all remaining Bolts of this batch can be considered as suitable only after individual inspection.

ii) The bolts should be free from shrinkage cavity, porosity, blisters, slag inclusions, harmful dendrites, segregations, cracks and laminations.

11 BULK PRODUCTION CLEARANCE:

i) Firm shall submit dimensional inspection report, test results of metallurgical and mechanical properties from NABL accredited laboratory as per point number 6,7&9 along with 02 nos. each heat-treated Cadmium coated and Chromate treated Bolts. Clearance for commencing of Bulk Production will be given after inspection and testing at OFM.

ii) The firm will design and manufacture it's own gauge for inspection duly calibrated by NABL (Metrological) accredited laboratory.

12 IDENTIFICATION AND TRACEABILITY:

Identification and traceability of the material to be maintained at all stages of manufacture to avoid mix up of material.

13. **PACKING AND SUPPLY:**

i) Bolts are to be properly packed to protect against ingress of water, damage of threads and coating to withstand damages during transits.

ii) All packing should be properly identified and tagged with quantity supplied & challan number.

14. **TEST CERTIFICATES:**

The supplier shall furnish following certificates along with each supply:

i) Chemical analysis report from steel manufacturer.
ii) Hardness report.
iii) Mechanical properties. (Report from NABL accredited laboratory).
iv) Grain size.
v) Microstructure, Macrostructure and Inclusion rating. (Report from NABL accredited laboratory).
vi) Cadmium coating report.
vii) Cracks detection report of 100%.
viii) Dimensional reports.
ix) Source of Steel used and its batch number (Attach test certificate of steel manufacturer).
x) Number of pieces supplied.
xi) Challan number.
xii) Calibration certificate of gauges. (Report of NABL accredited laboratory).

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