

BHEL, Tiruchirappalli – 620014.	Quality Assurance	Technical Delivery Conditions
Product: ALLOY STEEL FORGINGS TO SPEC.AISI 4140 FOR USE IN HIGH PRESSURE VALVES		
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1.0 SCOPE

This Technical Delivery Condition specifies the additional requirements for the delivery of alloy steel to specification AISI 4140 for use in high pressure valves components such as Gland flanges, Support ring, Split ring etc.

This TDC is supplementary to the mandatory requirements covered in the specification.

The size and quantity shall be as specified in the purchase order.

2.0 CHEMICAL COMPOSITION AND PROCESS

The steel shall be manufactured by electric furnace or any other approved process.

The chemical composition of the steel shall be tested for each melt and shall conform to the requirements given below in weight percentage:

Element	Percentage
C	0.38 - 0.43
Mn	0.75 - 1.00
Si	0.20 - 0.35
P	0.04 max.
S	0.04 max.
Cr	0.80 - 1.10
Mo	0.15 - 0.25

Forging practice: Open die forging.

The rough forgings must be as close as possible to the final shape and size.

Minimum forging reduction in area shall be 1:4 from ingot to finished forging.

The flow lines shall be parallel to the axial length of the part.

3.0 DIMENSIONAL TOLERANCES

The forgings shall conform to the dimensional tolerances as specified in the drawing.

4.0 HEAT TREATMENT

The forgings shall be supplied in quenched and tempered condition as given below to get the required mechanical properties:

Heat to 855 +/- 15 degC and quench in oil.

Temper at 540 degC minimum with a soaking of 1 hour per inch of thickness.

5.0 MECHANICAL TESTING

The testing for mechanical properties shall be conducted as per ASTM A370 at room temperature from finished heat treated material or identical specimen which has undergone the same amount of working, for each size/melt/Heat treatment batch. Test specimen shall be taken from a location which represents the midwall of the heaviest section. The test results shall meet the requirements as given below:

Tensile strength : 97 Kg/sq.mm min.

Yield strength : 85 Kg/sq.mm min.

% Elongation : 18 min.

Hardness : 285 - 320 BHN (minimum 3 values)

Charpy impact test } Average of 3 values 8 Kgm/sq.cm minimum
(on 2 mm "U" notch) } and single minimum value 6 Kgm/sq.cm.

6.0 NON DESTRUCTIVE TESTING

Ultrasonic test shall be conducted on all forgings according to SA 388 and the acceptance standard shall be as per AM 203.2 of ASME Section VIII Division 2.

7.0 WORKMANSHIP AND FINISH

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The forgings shall be supplied in proof machined or shot blasted condition, if specified in the drawing/PO.

The forgings shall be examined visually and shall be free from scales, laps, seams, folds, cracks or other injurious defects and shall have a workman like finish.

All forgings shall be coated with a protective layer of transparent rust preventive before despatch.

8.0 **REPAIR**

Repairs involving fusion welding are prohibited.

Surface defects can be removed by mechanical means and the defective areas shall be smoothly dressed up with the adjacent surface. The minimum thickness after repair shall meet the drawing requirements.

9.0 **MARKING AND PACKING**

The following details shall be legibly marked on each forging by hard stamping with low stress stamps.

1. Specification and grade
2. Part identification
3. Melt number
4. Maker's emblem
5. Inspecting authority's seal

The forgings shall be properly packed and despatched to avoid any damage during transit.

10.0 **INSPECTION AND CERTIFICATION**

All the tests specified here shall be carried out at works and the test results shall be furnished in the test certificates.

The test certificate shall contain the following details in English language only.

1. Purchase Order Number.
2. Test Certificate Number.
3. TDC Number.
4. Quantity and Size.
5. Steel making process.
6. Specification, Grade and Melt Number.
7. Chemistry - Meltwise.
8. Heat treatment details like Temperature, soaking time, cooling medium etc.
9. Mechanical test results - Tensile, Hardness and Impact.
10. NDT results with reference and acceptance standards.

In addition, mill test certificate for raw material shall be enclosed.

- 11.0 **END USE** These forgings are intended for use in high pressure valves for components like gland flanges.

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