

 <b>Sara Sae</b>		<b>SARA SAE ENGINEERING SPECIFICATION</b>	
SECTION	SES 26 - 737A	Customer:	3C Metal
ISSUE	"A"	Rev.:	"1"
EFF. DATE	20.10.2011	Page	1 of 2

**MATERIAL SPECIFICATION FOR CARBON STEEL ASTM A-350 Gr LF-2 FORGING**  
**52,000 MINIMUM YIELD, IMPACT TESTED AT -29°C OR LOWER 20J/14J**

**1.0 PURPOSE**

- 1.1 It is the purpose of material specification to list in a concise form of the material requirements for ASTM A-350 Gr. LF2 carbon steel forgings for use in oil field services.
- 1.2 This material specification is intended to aid the purchasing department in procuring and the vendor in supplying a material which meets the needs of its intended use, and the quality control department in the inspection and release of incoming material.

**2.0 SCOPE**

- 2.1 This material specification covers forgings in the annealed or normalized condition other requirements are met as specified.

**3.0 Chemical composition:**

The material shall conform to the following chemical composition:-

ELEMENTS	COMPOSITION RANGE (%)
Carbon (C)	0.30 max
Manganese (Mn)	0.60 – 1.35
Silicon (Si)	0.15 – 0.30
Sulphur (S)	0.025 max
Phosphorus (P)	0.025 max
Nickel (Ni)	0.40 max *
Chromium (Cr)	0.30 max * <sup>a</sup>
Molybdenum (Mo)	0.12 max * <sup>a</sup>
Copper (Cu)	0.40 max *

\* The sum of copper, nickel, chromium, vanadium and molybdenum shall not exceed 1.00% on heat analysis

<sup>a</sup> The sum of chromium and molybdenum shall not exceed 0.32% on heat analysis



	SARA SAE ENGINEERING SPECIFICATION	
	SECTION SES 26 - 737A	Customer: 3C Metal
	ISSUE "A"	Rev.: "1"
	EFF. DATE :20.10.2011	Page 2 of 2

#### **4.0 Mechanical Properties:**

The material produced to this specification shall confirm to the following properties.

MECHANICAL PROPERTIES	RANGE
TENSILE STRENGTH	70,000 PSI (483 MPa) Min.
YIELD STRENGTH	52,000 PSI (358 MPa) Min.
ELONGATION IN 50mm Dia	19% Min.
REDUCTION IN AREA	32% Min
HARDNESS	140 BHN Min

Tensile shall be performed at room temperature. One tension test shall be made for each heat as forged components.

#### **5.0 IMPACT TESTING**

Impact testing shall be performed at -29 °C. Average 20 joules each set of three specimens with one minimum value of 14 joules.

#### **6.0 HEAT TREATMENT:-**

After hot working and before reheating for heat treatment, forging shall be allowed to cool substantially below the transformation range (less than 590° C).

**6.1** The forgings shall either be normalized.

**6.2 NORMALIZING:** heat to a temperature that produces an austenitic structure, holding sufficient time to attain uniform temperature throughout. Cool uniformly in still air.

#### **7.0 DOCUMENTATION REQUIRED**

**7.1** Each shipment shall be accompanied by material certifications for each lot of material, the certifications must be positively relatable to the lot of material represented.

a) Mill certificate of raw material.

b) Chemical certificate for each lot of forging.

**7.2** Mechanical properties certification as per section 4.0.

**7.3** Impact testing certification as per section 5.0.

**7.4** Certification of heat treatment including cycle time, temperature, cooling media, hardness and graphs.

**7.5** Calibration certificate of furnace.

**7.6** Ultrasonic test report certification of raw material.

#### **8.0 TESTING TO BE CARRIED OUT BY SARA SAE**

**8.1** At the time of lifting forgings re-verification of chemical properties.

**8.2** Recheck of tensile strength, yield strength, elongation, reduction in area, hardness, impact testing and UT testing.

**8.3** MPI testing after machining.

