MATERIAL SPECIFICATION ASTM A-181 CARBON STEEL FOR LOW PRESSURE HAMMER UNION

1.0 PURPOSE

1.1 It is the purpose of this material specification to list in concise form of the material requirement for ASTM A-181 Class 60 carbon steel forging for use in Hammer Union.

1.2 Product forms covered by this specification are Closed die, Open die and Ring forgings for Hammer Unions.

1.3 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 REQUIREMENTS

2.1 The requirements of specification SES 26-590, SES 26-740 & SES 26-744 shall apply in addition to the following specific requirements.

2.2 It is the responsibility of raw material/metal supplier/machined parts supplier of carbon, low alloy and martensitic stainless steel to have practices and procedures in place to assure that raw materials/parts delivered do not have excessive amounts of residual magnetism. Excessive residual magnetism is defined as greater than 3 gauss. Residual magnetism can occur due to factors such as lifting with magnets, magnetic particle inspection or stray welding current. The supplier's procedures/testing methods will be subject to verification during supplier audits.

2.3 The raw material supplier shall assure that material does not receive with greater than background level of radioactivity

3.0 Chemical composition: Chemical composition limits are listed below. An analysis of each heat of steel is made by the manufacturer, preferably from a ladle sample taken at or near the time of pouring. The listed elements shall be reported in weight percent. Reporting of residual elements is not required, but total residuals must not exceed 1%.

ELEMENTS	COMPOSITION RANGE (%)
Carbon (C)	0.35 (max.)
Manganese (Mn)	1.10 (max.)
Silicon (Si)	0.35 (max.)
Sulphur (S)	0.05 (max.)
Phosphorus (P)	0.05 (max.)

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3.1 Elements that are not included in the application material specification but that may have been intentionally added by the mill are limited as follows:

ELEMENTS	COMPOSITION RANGE (%)
Vanadium (V)	0.08 (max.)
Aluminum (Al)	0.055 (max.)
Nitrogen (N)	0.010 (max.)
Hydrogen (H)	0.010 (max.)
Niobium(Columbium)+Titanium +Vanadium	0.12 (max.)
Boron	0.0005 (max.)

4.0 Mechanical Properties: Mechanical property requirements are listed below. Each heat shall be tested and the listed mechanical properties shall be reported.

MECHANICAL PROPERTIES	RANGE
TENSILE STRENGTH	60,000 PSI (415 MPa) Min.
YIELD STRENGTH	30,000 PSI (205 MPa) Min.
ELONGATION	22% Min.
HARDNESS	212 BHN (16 HRC) Max.

5.0 HEAT TREATMENT: - Heat treatment is neither required nor prohibited, but when applied heat treatment shall consist of tempering, annealing, normalizing or normalizing and tempering.

PROCESS	ATMOSPHERE/MEDIA	TEMPERATURE	TIME AT TEMPERATURE
Normalizing	Air	1600 °F (870 °C)	1/2 hour per inch of maximum through Thickness. One hour minimum.
Note: Maximum holding time shall not exceed Five times (5X) the minimum holding time. In all case, holding time shall not start until parts or materials have reached specified heat treatment temperature. The 5X rule does not apply to the separate QTC (e.g. ER 5")			

Slow cool to room temperature

6.0 DOCUMENTATION REQUIRED:-

6.1 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.

6.2 Mechanical properties certification as per section 4.0.

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

6.4 Calibration certificate of furnace.

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