EN-19 LOW ALLOY STEEL FORGED OR WROUGHT MINIMUM *YIELD* TOR HIGH PRESSURE HAMMER UNION (STANDARD SERVICE)

1.0 SCOPE

1.1 FN - 19 low alloy stool forgings anti wrought shapes heat-treated to 75.000 PSI minimum yield strength for standard service.

1.2 Product forms covered by this specification arc closed die. Open die and ring forgings, bar and mill shapes.

2.0 REQUIREMENTS

2.1 The requirements of specification C.E.S. 26-128 shall apply in addition to the following specific requirements.

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

ELEMENT	COMPOSITION	ELEMENT	COMPOSITION
CARBON (C)	0.35-0.45	SILICON (Si)	0.10-0.35
MAGANESE (Mn)	0.50-0.80	CHROMIUM	0.90-1.50
PHOSPHORUS	0.050 MAX	MOLYBDENUM	0.20-0.40
SULPHUR (S)	0.050 MAX		

2.1.b) Mechanical Properties: Mechanical property requirements are listed below. Bach heal shall he tested and the listed mechanical properties shall be reported.

MECHANICAL PROPERTIES	RANGE
TENSILE STRENGTH	95,000 PSI (655 Mpa) Min
YIELD STRENGTH	75,000 PSI (517 Mpa) Min

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2.1.e) Melt practice; The steel shall be made by the electric furnace process with subsequent vacuum treatment (EFVD). Steel made by vacuum induction melting (VM) or vacuum are remelting (VAC), or electroslag remelting (ESR) or electric are furnace (EAF) shall also be acceptable.

2.1d) Condition: All product shall be normalized (N) then quenched (QJ and tempered (T) (N-Q&T). except that normalizing shall not be required for the following:

2.1.d.1 Forgings with a forging reduction of 4;1 or greater.

2.1.d.2 Rolled tubing or extruded tubing with a wall thickness of v* or less;

2.1.d.3 Bar stock with a diameter of 8" or less;

2.1 .c) Heat Treatment:

PROCESS	ATMOSPHERE/MEDIA	TEMPERATURE	TIME AT TEMPERATURE
Normalized	Air or Nitrogen	1600°F (871°C) Minimum	½ hour per inch of maximum through thickness. One hour minimum.

Still air cool to below 400°F (204°C) before further processing.

Austenitize (see note 2.1.e.1)	Air or Nitrogen	1575°F (857°C) minimum	½ hour per inch of maximum through thickness. One hour minimum.

Quench	Water	100°F (38°C) maximum before quenching. 120°F (49°C) maximum after quenching
	Polymer	50°F (10°C) minimum before quenching (see note 2.1.f.2)
	Oil	----------

Tempering- Air or Nitrogen

HARDNESS		ELONGATION	TEMP.	SOAKING
BHN	HRC			
207-237	16-22	22	650°C	¾ hour per inch of maximum through thickness. One hour minimum.
235-285	22-30	18	630°C	
302-345	30-35	15	540°C Min	
375-415	40-45	10	315°C-330°C	

Note 2.I.C.1: The Austenitizing temperature shall be less then the normalizing temperature.

Note 2.e.2: The minimum start temperature of 50 °F (10 °C) for oil and polymer Quenchant shall be followed except when a lower minimum start temperature is permitted for a specific quenchant by the quenchant manufacturer. The start temperature shall he documented for all products.

2.1.f) Continuous Furnace Heat Treatment: Continuous furnace heat treatment shall be an acceptable alternative to conventional batch-type heat treatment for bars with diameters of 8 inches (203mm) or less. The following parameters shall be followed and reported in accordance with CES-26-128.

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Minimum bar temperature exiling final zone of austenitizing furnace 1525 °F (829°C) Minimum time in austenitizing furnace 5 minutes (see note 2.1.g.1)
Minimum bar temperature exiting final zone of temperature furnace 1 150 °*V* (621 T) Minimum time in tempering furnace 5 minutes (see note 2.i.g.1)
Minimum temperature of quench water 120 °K (40 T)

Note 2.1X1: Continuous furnaces consist of several different temperature zones through which the bar travels. The zone temperatures in the austenitizing furnace are chosen so as to heat the bar to a completely austenitic in a relatively short lime. The bar is then spray quenched before entering the tempering. Zone temperatures in the tempering furnace are chosen to produce the desired tempering effect, again in a relatively short time. The time spent in the austenitizing and tempering furnaces depends primarily upon the length of the furnace and the travel speed. Travel speed varies according to the diameter of the bar. The time in each furnace shall be sufficient to attain the desired mechanical properties and to produce a microstructure to that obtained in a conventional quench-und-temper heat treatment.