



## MATERIALS THAT PERFORM UNDER PRESSURE

### HIGH TEMPERATURE LOW-DENSITY POLYETHYLENE TUBING

When the pressure is on for high-yield production and optimal performance, customers look to Metallus' high-strength alloy steel bar and seamless tubing for high-pressure service in low-density polyethylene (LDPE) production and other petrochemical industries.

#### THE BENEFITS OF EXPERIENCE

As a global supplier of high-strength alloy steel bar and seamless tubing for more than 50 years, Metallus dedication to engineering and manufacturing excellence assures a product that meets industry standards and customer design specifications for your current and next generation LDPE plant production. We provide equivalent or superior products as compared to our historically provided 433M4 and 433M6 materials.

Our air-melted, high-strength alloy steel bar and seamless tubing is:

- ASTM A723 Grades 1, 2 and 3 compliant – Our controlled refining and inclusion engineering practices optimize strength and toughness in both the longitudinal and transverse directions of the final product, while our non-destructive testing assures we meet the highest quality specifications.
- Fit-for-purpose and tailored for you – We supply high-strength alloy steel bar and seamless tubing in the sizes and tolerances you need, made from steel optimized for superior mechanical properties and machined to exacting surface finishes.
- Delivered fast and reliably – With our centrally located steel mills in Canton, Ohio, and machining/NDT inspection capabilities via our established supply chain in Houston, Texas, we're here to serve you efficiently with industry-leading delivery.
- Driven by a streamlined supply chain that provides higher value for you – Because we control the process from raw materials to finished machined inspection, we can provide product in a wider range of quantities and offer inventory programs that save you time, money and resources.



OD Size Range	2.000 in. (54.0 mm) to 10.5 in. (266.7 mm)
OD Tolerance	+/- 0.030 in (0.762 mm)
OD Surface Finish	125 µin (3.2 µm) Ra
ID Size Range	0.75 in. (19.1 mm) to 8.0 in. (203.2 mm)
ID Tolerance	+/- 0.015 in. (0.381 mm)
ID Surface Finish	16 µin (0.4 µm) Ra
Wall Variation	+/- 5% of the NOM wall thickness
Straightness	0.060" (1.52mm) in any 3' (915mm) length
Length Range	Up to 49.2' (15 m)

## HIGH-STRENGTH ALLOY STEEL BAR AND SEAMLESS TUBING CAPABILITIES AND CHEMISTRIES

From small volume replacement projects to full plant production support, we can supply:

TYPICAL CHEMISTRIES (COMPOSITION %)					
Element	A723 Grade 1*	A723 Grade 2**	A723 Grade 3**	HS220-27 (current offering Grade 1)	4333M4 (historical offering Grade 1)
Carbon	0.35 MAX	0.40 MAX	0.40 MAX	0.28 to 0.33	0.30 to 0.38
Manganese	1.00 MAX	0.90 MAX	0.90 MAX	0.75 to 1.00	0.70 to 1.00
Phosphorus	0.015 MAX	0.015 MAX	0.015 MAX	-	0.015 MAX
Sulfur	0.015 MAX	0.015 MAX	0.015 MAX	0.005 MAX	0.015 MAX
Silicon	0.35 MAX	0.35 MAX	0.35 MAX	-	0.15 to 0.35
Nickel	1.5 to 2.25	2.3 to 3.3	3.3 to 4.5	1.65 to 2.00	1.65 to 2.00
Chromium	0.80 to 2.00	0.80 to 2.00	0.80 to 2.00	0.75 to 1.00	0.70 to 0.90
Molybdenum	0.20 to 0.50	0.30 to 0.60	0.40 to 0.80	0.35 to 0.50	0.35 to 0.45
Vanadium	0.20 MAX	0.20 MAX	0.20 MAX	0.050 to 0.100	-

\* Internal pressure fatigue tested ASTM A723 Grade 1 tube in 5.500" OD x 2.375" ID and 8.250" OD x 2.492" ID finish sizes. Results compliant with ASME Boiler & Pressure Vessel Code Section VIII, Division 3, Article KD-3. Results available upon request.

\*\* Internal pressure fatigue tested ASTM A723 Grade 2 and Grade 3 tube in 4.355" OD x 2.000" ID and 6.255" OD x 2.000" ID finish sizes. Results compliant with ASME Boiler & Pressure Vessel Code Section VIII, Division 3, Article KD-3. Results available upon request.

TYPICAL TENSILE AND CVN IMPACT MECHANICAL PROPERTY REQUIREMENTS						
Class	1	2	2a	3	4	5
Tensile Strength, Min, ksi [MPa]	115 [795]	135 [930]	145 [1000]	155 [1070]	175 [1205]	190 [1340]
Yield Strength, 0.2 % offset, min, ksi [MPa]	100 [690]	120 [825]	130 [185]	140 [965]	160 [1105]	180 [1240]
Elongation in 2 in. or 50 mm, min, %	16	14	13.5	13	21	10
Reduction of area, min, %	50	45	43	40	35	30
Minimum average value of set of three specimens, ft-lb [J]	35 [47]	30 [41]	28 [38]	25 [34]	20 [27]	12 [16]
Minimum value of one specimen, ft-lb [J]	30 [41]	25 [34]	23 [31]	20 [27]	15 [20]	10 [14]

Proven capability to meet ASTM A723 Class 1, 2, 2a and 3, inquire for Class 4 and 5."

## NDT INSPECTION AND REJECTION CRITERIA

Metallus product is 100% OD/ID surface inspected via Eddy Current in accordance with ASTM E309, and 100% volumetric inspection via Ultrasonic in accordance with ASTM A388.

Notch Type	Depth: +/- 0.002 in. (0.051 mm)	Length: +/- 10%	Width: +/- 0.002 in. (0.051 mm)	Orientation
OD Transverse	3% of Wall	0.250 in. (6.35mm)	35° "V"	90°
OD Longitudinal	3% of Wall	0.250 in. (6.35mm)	35° "V"	90°
ID Longitudinal	0.010 in. (0.254 mm)	0.250 in. (6.35mm)	35° "V"	180°
ID Transverse	0.010 in. (0.254 mm)	0.250 in. (6.35mm)	35° "V"	180°
Reference Type	Size	Orientation		
Flat Bottom Hole	2.0 mm	Radial		

## WE'LL TAILOR A HIGH-STRENGTH PRESSURE SOLUTION FOR YOU.

Whatever your application, Metallus will partner with you to understand and identify the best solution for your requirements. We leverage our operational capabilities and technical expertise to create high-quality, reliable solutions and new sources of value. Combining materials science, application engineering and processing capabilities, we are dedicated to helping our customers enhance performance.

Visit [METALLUS.COM](https://www.metallus.com) or call us at 866.284.6536 (USA), or email [quotes@metallus.com](mailto:quotes@metallus.com).