

Plates for large diameter, longitudinally welded linepipe Data Sheet

ArcelorMittal USA is a leader in the production of API quality linepipe plates used for longitudinally welded pipes for oil and gas industries. Use of high-quality slabs with low sulfur, phosphorus and nitrogen contents combined with sulfide inclusion shape control, provides excellent low temperature toughness required for extreme geographical locations. Our ArcelorMittal Burns Harbor facility employs a high temperature controlled processing combined with accelerated cooling provided by a state-of-the-art accelerated cooling unit for the production of thick linepipe plates with a predominantly acicular/lower bainitic microstructure. For thinner plates, a thermo-mechanical controlled processing is employed which creates substantial ferrite grain refinement resulting in plates with high strength and superior toughness. The alloy designs ensure low carbon equivalence and hence, excellent weldability.

Slab reheating, primary rolling, descaling, finish rolling, accelerated cooling and hot leveling are Level-II computer process-controlled. In-line isotope gauge sensors and plate surface inspection provide accurate dimensional control and superior surface quality.

The ArcelorMittal Burns Harbor plate mill is capable of producing widths up to 150" enabling the production of pipe with outer diameter of 24" - 48". Typical product dimensions for various grades are given below.

Plate Grades and Dimensions

API 5L/ ISO 3183	Thickness	Width	Length	Process
Grade B X42M/L290M	0.315 – 1.50" (8-38 mm)	74-148" (1880-3759 mm)	490" (12446 mm)	TMCP
X52M/L360M	0.315 – 1.50" (8-38 mm)	74-148"	490"	TMCP
X60M/L415M	0.315 – 1.50" (8-38 mm)	74-148"	490"	TMCP
X65M/L450M	0.315 – 1.18" (8-30 mm)	74-148"	490"	TMCP
X70M/L485M	0.315 – 0.75" (8-19 mm)	74 - 148"	490"	TMCP
	0.75 – 1.03" (19-26 mm)	74 - 148"	490"	TMCP+ACC
X80M/L555M	0.315 – 0.625" (8-16 mm)	74-148"	490"	TMCP
	0.625-1.03" (16-26 mm*)	74-148"	490"	TMCP+ACC

TMCP: Thermo-mechanical Controlled Processing; ACC: accelerated cooling

* Under development

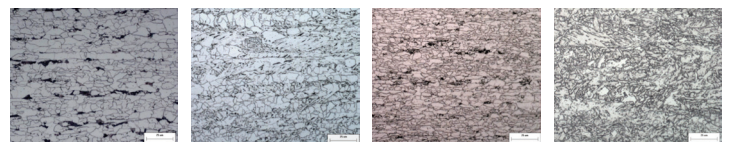
Chemical Composition – Primary alloying for Plate Grades

API 5L	Nominal percent, max			CE _{IW} (max)
	C	Mn	Others	
Grade B/X42/L290M	0.18	1.20	Nb	0.42
X52M/L360M	0.12	1.45	Nb, V	0.32
X60M/L415M	0.12	1.60	Nb, V	0.36
X65M/L450M	0.10	1.65	Nb, V, Cr, Mo	0.38
X70M/L485M	0.10	1.70	Nb, V, Cr, Mo	0.40
X80M/L555M	0.08	1.90	Nb, V, Cr, Mo	0.43

- Calcium treated, low sulfur practice
- No deliberate addition of nitrogen or boron

Plate Processing and Microstructures

X70 Thin gauge	X70 Thick Gauge	X80 Thin Gauge	X80 Thick Gauge (under development)
Controlled Processing only	Controlled Processing + Accelerated Cooling	Controlled Processing only	Controlled Processing + Accelerated Cooling



Product Characteristics:

- Fine-grained microstructures
- High strength with excellent low temperature toughness

Weldability

The microalloyed skelp has a low carbon equivalence (CE_{IW} or P_{cm}) resulting in product that has excellent weldability:

- high HAZ toughness
- resistance to cold cracking
- Suitable for electric resistance welding (ERW), submerged arc welding (SAW) and double submerged arc welding (DSAW) during pipe making and shielded metal arc welding (SMAW) during field girth welding.

See Mechanical Properties on next page.

Mechanical Properties

ISO/API Grade	YS (MPa)	YS (ksi)	TS (MPa)	TS (ksi)	Y/T (max)	CVN 32°F (ft-lbs)	CVN 0°C (J)	DWTT 0°C/32°F (%)
B	245-450	35.5-65.3	415-760	60.2-110.2	0.93	≥ 20	≥ 27	≥ 85
L290M/X42M	290-495	42.1-71.8	415-760	60.2-110.2	0.93	≥ 20	≥ 27	≥ 85
L320M/X46M	320-525	46.4-76.1	435-760	63.1-110.2	0.93	≥ 20	≥ 27	≥ 85
L360M/X52M	360-530	52.2-76.9	460-760	66.7-110.2	0.93	≥ 20	≥ 27	≥ 85
L390M/X56M	390-545	56.6-79.0	490-760	71.1-110.2	0.93	≥ 20	≥ 27	≥ 85
L415M/X60M	415-565	60.2-81.9	520-760	75.4-110.2	0.93	≥ 20	≥ 27	≥ 85
L450M/X65M	450-600	65.3-87.0	535-760	77.6-110.2	0.93	≥ 20	≥ 27	≥ 85
L485M/X70M	485-635	70.3-92.1	570-760	82.7-110.2	0.93	≥ 20	≥ 27	≥ 85
L555M/X80M	555-705	80.5-102.3	625-825	90.6-119.7	0.93	≥ 30	≥ 40	≥ 85

The mechanical properties listed above are those in the pipe.

The measured difference in yield strength between the plate and the pipe is specific for each mill and would depend on several interrelated factors, such as:

- Bauschinger effect
- Chemical composition
- Type of manufacturing line
- Microstructure
- D/t (ratio of pipe diameter to pipe wall thickness)
- Post treatment (e.g. coating, stress relieving, etc.)

Therefore, an agreement between ArcelorMittal and the pipe producer on the plate mechanical properties to be guaranteed must be reached prior to delivery of the plate.

Technical Assistance

For additional information and assistance, please contact ArcelorMittal. Our Sales representatives and Technical Service Engineers are ready to assist you.

T +1 800 422 9422

E energypipeinquiries@arcelormittal.com

API: American Petroleum Institute

CE_{iw}: Carbon equivalent, based on the International Institute of Welding equation - per API, used for steels with carbon contents over 0.12%

CVN: Charpy V Notch Energy

DWTT: % shear fracture in Drop-weight Tear Test

ft-lbs: Foot-pounds

ISO: International Organization for Standardization

J: Joules

ksi: Kilo-pounds per square inch

Mn: Manganese

MPa: Megapascals

Nb: Niobium (also referred to as Columbium, Cb)

P_{cm}: Carbon equivalent, based on the chemical portion of the Japanese (Ito-Bessyo) weldability equation - per API, used for steels with carbon contents of 0.12% or less

TS: Tensile strength (designated by R_m in API specifications)

Y/T: Yield (strength) to tensile (strength) ratio; or $R_{10.5}/R_m$

YS: Yield strength at 0.5% total elongation (designated by $R_{10.5}$ in API specifications)

ArcelorMittal USA

1 South Dearborn Street
18th Floor
Chicago, IL 60603
USA

T +1 800 422 9422

E energypipeinquiries@arcelormittal.com