TuffDOM® Tubing

transformingtomorrow

ArcelorMittal

One Tough Tube

Tubular Products Division of ArcelorMittals' TuffDOM® tubing proves itself in test after test for fluid power and other mechanical applications.

Performance requirements for DOM tubing are more demanding than ever. Today's customers insist that the mechanical properties of their tubing be virtually customized. They demand greater flexibility in combining qualities such as yield and tensile strength, hardness and ductility. And they want their tubing to be tougher.

That's why we introduced our TuffDOM line of cold-drawn, stress-relieved tubing that has ideal mechanical properties for fluid power and other demanding applications.

In test after test, TuffDOM has proven itself particularly suited to high load-bearing applications and to jobs where an exceptional ability to withstand severe stress or cold temperature is important.

The TuffDOM Choice: 520 and 620 for two distinct strength levels

TuffDOM 520® is made to normal yield strength level (75 KSI min.) and has *typical* longitudinal Cv impact of 30 ft. lbs. at -20 degrees C on 10mm x 10mm specimens.* Tests confirm that its mechanical properties are similar to SAE 1026 in yield and tensile strength while exhibiting greater elongation when manufactured under similar conditions.

TuffDOM 620® is made to a higher yield strength level (90 KSI min.) and has *typical* longitudinal Cv impact of 10 ft. lbs. at -20 degrees C on 10mm x 10mm specimens.* It is designed to provide increased (approximately 20%) mechanical properties compared to TuffDOM 520 and SAE 1026. All tension tests were performed in accordance with ASTM A-370.

**Individual inquiries are required on tubing specifying minimum impact properties.*

TuffDOM: Out-toughs SAE 1026 in test after test

TuffDOM's high strength and improved toughness make it the perfect match for your most difficult mechanical applications. To prove it, a comprehensive study was undertaken to compare the characteristics of TuffDOM 520 and TuffDOM 620 to those of the current industry standard SAE 1026. Mechanical property, weldability, machinability, notch toughness, and fracture toughness tests were performed on tubes manufactured under identical production conditions. The only variable was the stress relief anneal temperature used to obtain the required mechanical properties.

The result: TuffDOM 520 and TuffDOM 620 exhibited better machinability, weldability and superior toughness when compared to SAE 1026. The toughness of TuffDOM 520 is greater than TuffDOM 620 and vastly greater than SAE 1026 with the same tensile properties.

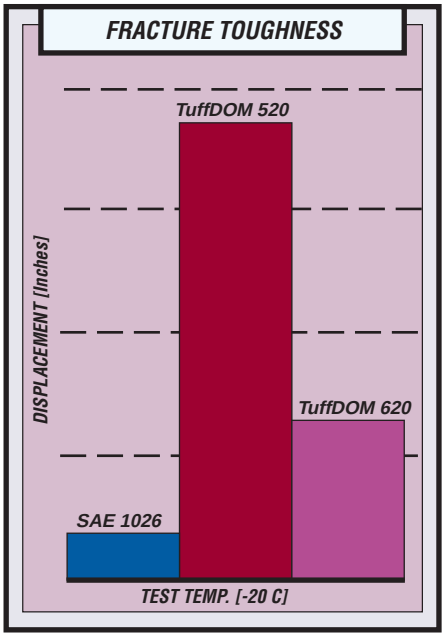
Fracture Toughness

Crack Tip Opening Displacement (CTOD) tests were performed according to ASTM E-1290 to compare the relative fracture toughness. (The greater the crack tip displacement, the tougher the material.)

TuffDOM 520 and TuffDOM 620 both exhibited superior fracture toughness compared to SAE 1026.

Notch Toughness

Charpy V-notch Impact tests were performed to compare relative notch toughness as measured by absorbed energy. (The greater the absorbed energy, the tougher the material.) All notch tests were performed in accordance with ASTM E-23.

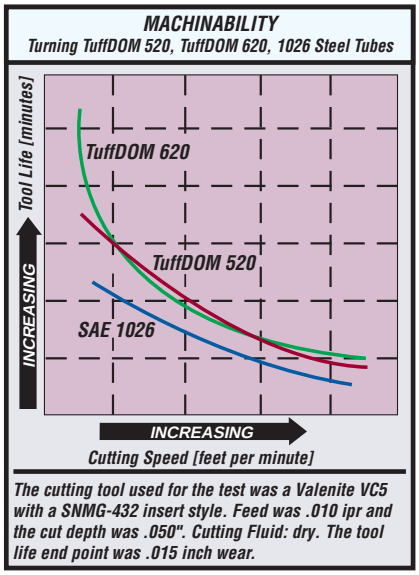


TuffDOM 520 and TuffDOM 620 exhibited superior notch toughness at all test temperatures.

Ductile-to-Brittle transition curves were also developed for all three grades. TuffDOM 520 and TuffDOM 620 clearly exhibited superior transition characteristics compared to SAE 1026. TuffDOM 520 exhibited a nominal transition temperature of -25 degrees C; TuffDOM 620 exhibited a nominal transition temperature of -5 degrees C; SAE 1026 had a transition temperature of +20 degrees C (room temperature).

Machinability

TuffDOM 520 and TuffDOM 620 both exhibited better relative machinability than SAE 1026 as demonstrated by a single-point turning test. The relative machinability was measured by either longer tool-life or higher cutting speeds; the effect of both is reduced machining costs and increased productivity.



Weldability

TuffDOM 520 and TuffDOM 620 demonstrated equal or superior qualities in the weldability tests compared to SAE 1026. No special requirements for pre-weld or post-weld thermal treatments were indicated.

Bend tests, tensile tests, notch toughness tests and hardness profiles were used to evaluate the relative weldability. To enable this comparison, sample tubes of each chemistry were welded to SAE 1026 tubes of the same size using a multiple pass, single arc MIG welding process.

Bend tests were used to demonstrate soundness and ductility of welds by the ability to resist cracking during bending. All combinations of test samples passed this test. The bend tests were performed in accordance with ASTM E-190.

The tensile test specimens included the weld and the Heat-Affected Zones (HAZ) along with the parent material. These tests showed TuffDOM 520 and TuffDOM 620 exhibited higher tensile strengths than SAE 1026. In each test performed, the tensile specimen broke on the SAE 1026 side of the weld zone.

TuffDOM 520 and TuffDOM 620 exhibited superior notch toughness in the HAZ compared to SAE 1026. Charpy V-notch tests were performed in both the weld area and HAZ near the weld in each sample.

Hardness profiles were generated from one parent metal, through the weld zone, to the other parent metal. The changes in hardness across the profile are a good indication of the changes in tensile strength across the same profile. TuffDOM 620 exhibited the highest and most uniform hardness across the entire profile. SAE 1026 revealed the lowest hardness level and the greatest variation across the profile.

Spec the Tough Tube That Thrives on Hard Times

Modern Steelmaking Assurances

TuffDOM 520 and 620 tubing are fully killed and made with exacting control of their steel chemistries. These tight controls, combined with "clean steelmaking" practices, ensure consistent elemental control while minimizing the frequency and severity of non-metallic inclusions. This is extremely important for optimal-quality precision DOM tubing, which may encounter subsequent machining, centerless grinding, honing, skiving and burnishing, and chrome plating.

Chemical Composition

STEEL GRADE	C	Mn	P	S	Si	Microalloying Elements*	Al	Near Equivalent DIN Grade	C	Mn	P	S	Si	V	Al
TuffDOM 520	.13/.18	1.20/1.50	.020m	.015m	.35m	—	.02min.	ST52.3	.22m	1.60m	.04m	.04m	.55m	—	.02 min.
TuffDOM 620	.13/.18	1.20/1.50	.020m	.015m	.35m	.15m	.02min.	STE460 *(STE 47)*	.18	1.50			.35	.09	

m=maximum *V and/or Cb Addition

Minimum Tensile Properties

Stress-Relief Annealed

STEEL GRADE	Near Equivalent DIN Grade	Yield Strength N/mm2	Yield Strength KSI	Tensile Strength N/mm2	Tensile Strength KSI	%Elong. in 2"	Hardness Rb
TuffDOM 520	ST52.3	520	75	590	85	18	85
TuffDOM 620	STE 460 *(STE 47)*	620	90	690	100	15	92
			Normalized				
TuffDOM 520	ST52.3	310	45	470	68	25	70
TuffDOM 620	STE 460 *(STE 47)*	345	50	500	72	25	75

Typical Cv Impact Properties*

(All Material in Stress-Relief Annealed Condition)

STEEL GRADE	Tensile Properties	Cv Impact Test Temperature	Cv Impact Foot-Pounds
SAE 1026	75 KSI Yield Strength	Room Temperature	10
	85 KSI Ultimate Tensile Strength	-20 degrees C	2
TuffDOM 520	75 KSI Yield Strength	Room Temperature	80
	85 KSI Ultimate Tensile Strength	-20 degrees C	30
TuffDOM 620	90 KSI Yield Strength	Room Temperature	60
	100 KSI Ultimate Tensile Strength	-20 degrees C	10

*Individual inquiries are required on tubing specifying minimum impact properties. The above data is used for illustration purposes and should not be taken as minimum values with regard to Cv Impact at the specific strength levels. (Impact testing done in accordance with ASTM A-370. Longitudinal specimens with notch orientation OD to ID.)

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