SSAB SWEDISH STEEL

DOCOL®

08-05-22 US8225Docol

Docol M
Cold reduced martensitic steels intended for US market

Product

Docol M are cold reduced fully martensitic steels with designations based on US unit ksi. These steels are manufactured using special heat treatment in a continuous annealing line. The ultra high strength is produced by extremely fast water quenching from an elevated austenitic temperature range.

Docol M grades are char-acterized by good formability at these high strength levels combined with good weldability. All conventional welding methods can be used due to the lean chemical composition.

Some of the advantages of using Docol M are:

- Weight reduction
- Very high strength levels
- Simplified manufacturing
- Increased safety
- Improved environment
- Longer lifecycle
- Increased payload
- Reduced total cost

Applications

Typical applications for Docol M are

- Safety components in cars
- door beams
- bumper reinforcements.
- Safety shoe toe-caps and soles
- Cutting tools
- Clutch discs

Dimension range

Thickness: 0.5 - 2.10 mm (0,020 - 0,083 inch)
Width: 800 - 1500 mm (31,5 - 59,0 inch), depending on steel grade and thickness

Tolerances

Docol M are supplied to tolerances in accordance with EN 10131.

Chemical composition

(typical values)

Steel grade	C %	Si %	Mn %	P %	S %	Al_{tot} %	Nb %	Ti %
Docol 130M	0,05	0,20	2,00	0,010	0,002	0,040	-	-
Docol 160M	0,09	0,20	1,70	0,010	0,002	0,040	0,015	0,025
Docol 175M	0,11	0,20	1,60	0,010	0,002	0,040	0,015	0,025
Docol 190M	0,14	0,20	1,50	0,010	0,002	0,040	0,015	0,025
Docol 205M	0,18	0,20	1,20	0,010	0,002	0,040	0,015	0,025
Docol 220M	0,20	0,20	1,00	0,010	0,002	0,040	0,015	0,025

Forming

Docol M is designed for conventional cold forming techniques such as stamping, roll forming and tube making.

Bending

The bendability of M steels is good. At tight bend radii it is important if possible to do the bending transverse to the rolling direction where the bendability is somewhat better than in the longitudinal direction.

Mechanical properties

Steel grade	Yield strength R_{eL} (ksi) min	Yield strength R_{eL} (ksi) max	Tensile strength R_m (ksi) min	Tensile strength R_m (ksi) max	Min Elongation A_{50} %	Min bending radius 90° bend
Docol 130M	100	-	130	-	3	3xt
Docol 160M	130	-	160	-	3	3xt
Docol 175M	138	-	175	-	3	3xt
Docol 190M	150	-	190	-	3	3xt
Docol 205M	167	-	205	-	3	3xt
Docol 220M	180	-	220	-	3	3-xt

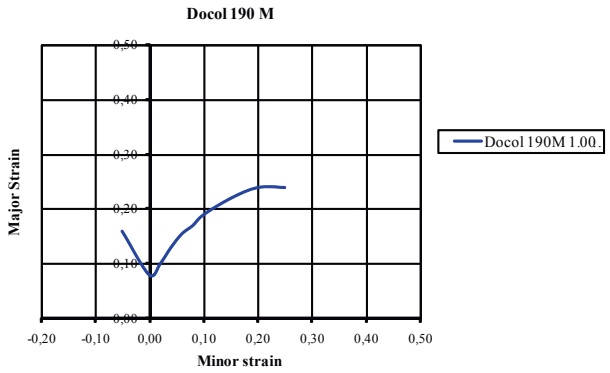
t = thickness

Roll forming

Roll forming is widely used for M steels and this also permits smaller radii compared to those achieved when bending.

Pressing

The high work hardening of M steels results in good strechability and drawability. Usual consideration when designing details in Docol is to make the radii slightly larger and optimize the blank shape to help the material ”flow” in the tool. The forming limit curves below, for Docol 1400 M in thickness 1,50 mm, show a material that can withstand at least 14% deformation at forming.



Shearing and punching

When shearing and punching Docol M steels it is particularly important to use the right cutting clearances. Factors ruling this are sheet thickness, strength and the demand on the cut surface appearance. We rec-ommed a cutting clearance of 10-12% of the sheet thickness for Docol M steels.

Welding

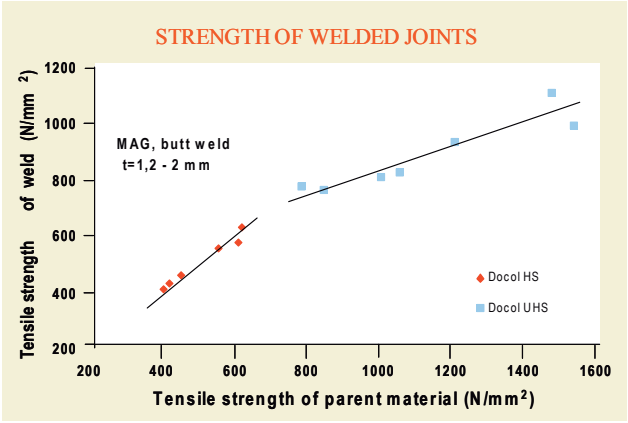
The weldability of Docol M is very good. The reason for this is that Docol M steels have very low contents of alloying elements in relation to the high strength of the steels.

When Docol M is fusion welded all the common welding methods can be used as e.g. gas metal arc welding (GMAW), manual metal arc welding (MMA), TIG-welding, plasma welding and laser welding. The recommended filler metals for Docol M are shown in table 1. If the weldments can be placed in areas of low stresses, then filler metals of lower strength than in table 1 can be used.

GMAW (MAG) Gas metal arc welding	MMA Manual metal arc welding
AWS: A5.28 ER 10XS-X AWS: A5.28 ER 11XS-X AWS: A5.28 ER 12XS-X	AWS: A5.5 E10X18 AWS: A5.5 E11X18 AWS: A5.5 E12X18

Tabell 1: Rekommenderade tillsatsmaterial

The strength of welded joints with Docol M is higher than when conventional high strength steels are welded.



Another welding method, which can be used for Docol M, is electrical resistance welding. Spot welding is the most common welding method for Docol M. When Docol M is spot welded to another soft steel it is recommended that the electrode force is increased by 20-30%. To ensure good welding results when Docol M is spot welded to itself it is rec-ommended that the electrode force is increased by 40-50% and that the welding time is slightly increased.

Teknisk service och information

Knowledge Service Center will be pleased to assist with additional information concerning this product from SSAB Tunnplåt.

SSAB SWEDISH STEEL

USA
SSAB Swedish Steel Inc
4700 Grand Avenue
Pittsburgh, PA 15225
Tel +1 412-269 21 20
Fax + 1 412 269 21 24
swedishsteel.us