SSAB SWEDISH STEEL

DOCOL®

08-05-23 US8224Docol

Docol DP/DL
Cold reduced dual phase steels intended for US market

Product

Docol DP and Docol DL are cold reduced dual phase steels with designestions based on US unit ksi. The steels are subjected to special heat treatment in the continuous annealing line, which produces a two-phase structure in which the ferrite that imparts unique forming properties is one of the phases, and martensite that accounts for the strength is the other. The strength increases with increasing proportion of the hard martensite phase.

Docol DP/DL are characterized by a very good formability compared to the strength and also good weldability. All conventional welding methods can be used because of a very lean chemical composition.

Some of the advantages of using Docol DP/DL are:

- Weight reduction
- Simplified manufacturing
- Increased safety
- Improved environment
- Longer lifecycle
- Increased payload
- Increased load capacity
- Reduced total cost

Applications

Typical applications for Docol DP/DL are

- Safety components in cars - door beams, bumper reinforcement, seat tracks
- Tube applications - baby rams, furnitures, bicycles

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 DP/DL are supplied to tolerances in accordance with EN 10131.

Chemical Composition

(typical values)

Steel grade	C %	Si %	Mn %	P %	S %	Al_{tot} %	Nb %
Docol 85DP	0,10	0,20	0,80	0,010	0,002	0,040	0,015
Docol 85DL*	0,10	0,40	1,50	0,010	0,002	0,040	-
Docol 100DP	0,13	0,20	1,50	0,010	0,002	0,040	0,015
Docol 115DP	0,13	0,20	1,50	0,010	0,002	0,040	0,015
Docol 115DL	0,14	0,20	1,50	0,010	0,002	0,040	0,015
Docol 140DP	0,15	0,50	1,50	0,010	0,002	0,040	0,015
Docol 145DP	0,15	0,50	1,50	0,010	0,002	0,040	0,015

Forming

Docol DP/DL are meant for cold forming, and even the ultra high strength qualities can be formed in a traditional way.

Bending

The bendability of DP/DL steels is good even at higher strength levels. At advanced bending it is important if possible to bend transverse to the rolling direction, where the bendability is somewhat better than in the longitudinal direction.

Mechanical properties

Steel grade	Yield strength R_{eL} min	Yield strength R_{eL} max	Tensile strength R_m (ksi) min	Tensile strength R_m (ksi) max	Min Elongation A_{50} %	Min bending radius 90° bend
Docol 85DP	50	65	85	101	16	0xt
Docol 85DL	40	52	85	101	20	0xt
Docol 100DP	80	95	100	130	12	0xt
Docol 115DP	72	95	115	138	10	1,0xt
Docol 115DL	56	78	115	138	13	1,0 xt
Docol 140DP	80	115	140	171	8	2,0 xt
Docol 145DP	100	138	145	174	7	2,0 xt

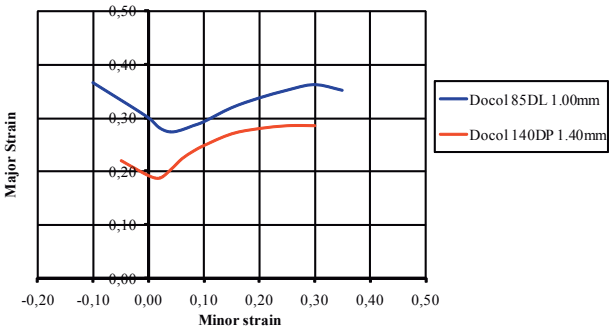
t = thickness

Rollforming

Roll forming is very suitable for DP/DL steels and this also permits smaller radii compared to bending.

Pressing

The high work hardening of DP/DL steels results in good stretchability and drawability. To consider when designing details in Docol DP/DL is to make the radii be a bit larger and optimize the blank shape to help the material ”flow” in the tool. Below some formability limit curves (true strain) are shown as example of the formability of two DP/DL grades.



Shearing and punching

When shearing and punching Docol DP/DL 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 shape. A cutting clearance of 10-12% of sheet thickness is recommended for Docol DP/DL steels.

Welding

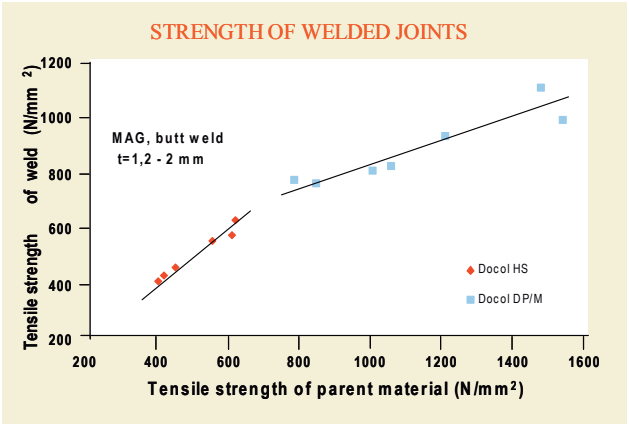
The weldability of Docol DP/DL is very good. The reason to this is that Docol DP/DL steels have very low contents of alloying elements in relation to the high strength of the steels.

When Docol DP/DL 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 DP/DL are shown in table 1. If the welds can be placed in areas with low stresses also 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

Table 1: Recommended filler metals for Docol UHS.

The strength of welded joints for Docol DP/DL is higher than the corresponding strength of conventional high strength steels.



Other welding methods which can be used for Docol DP/DL are electrical resistance welding and high frequency welding. Spot welding is the most common welding method for Docol DP/DL. When Docol DP/DL 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 DP/DL is spot welded to itself it is recommended that the electrode force is increased by 40-50% and that the welding time is slightly increased.

Technical service and information

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

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