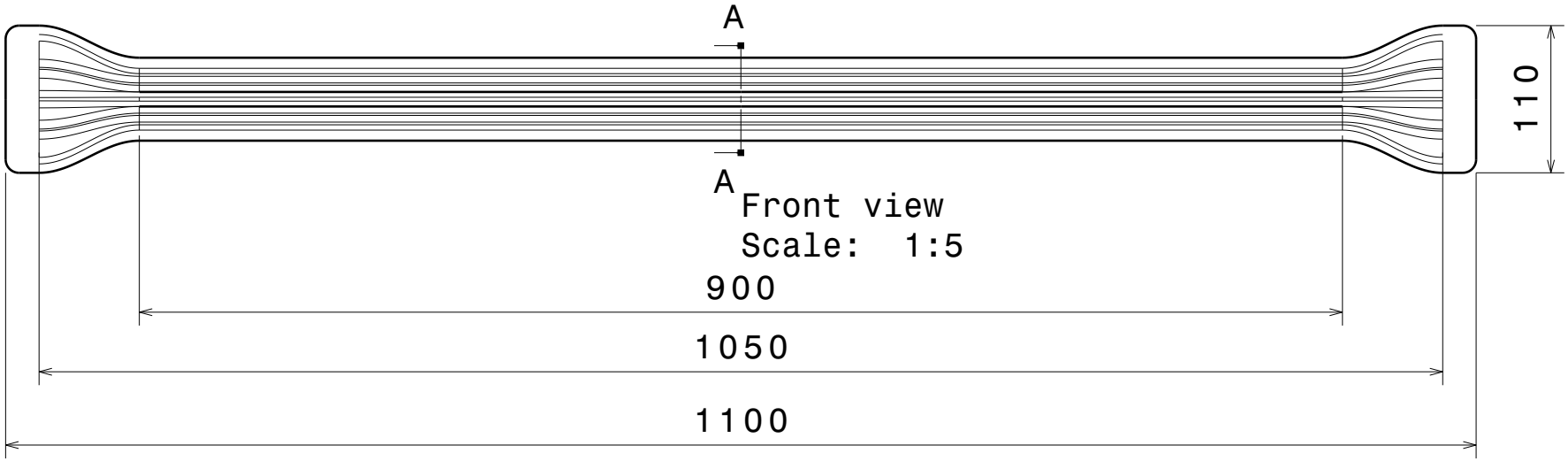
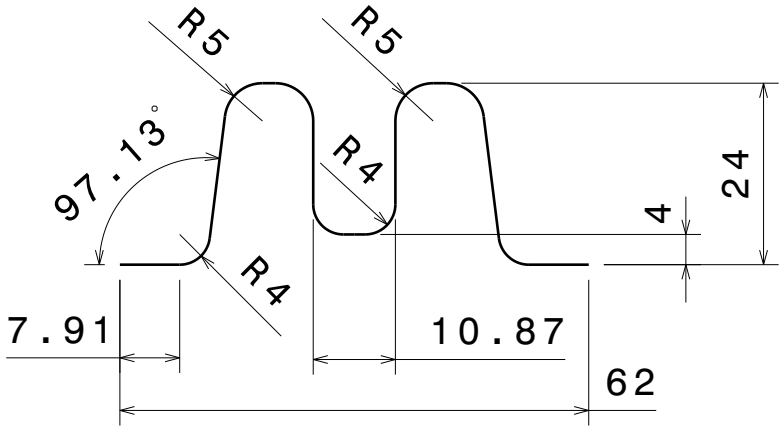
Anexo 1.

Planos.

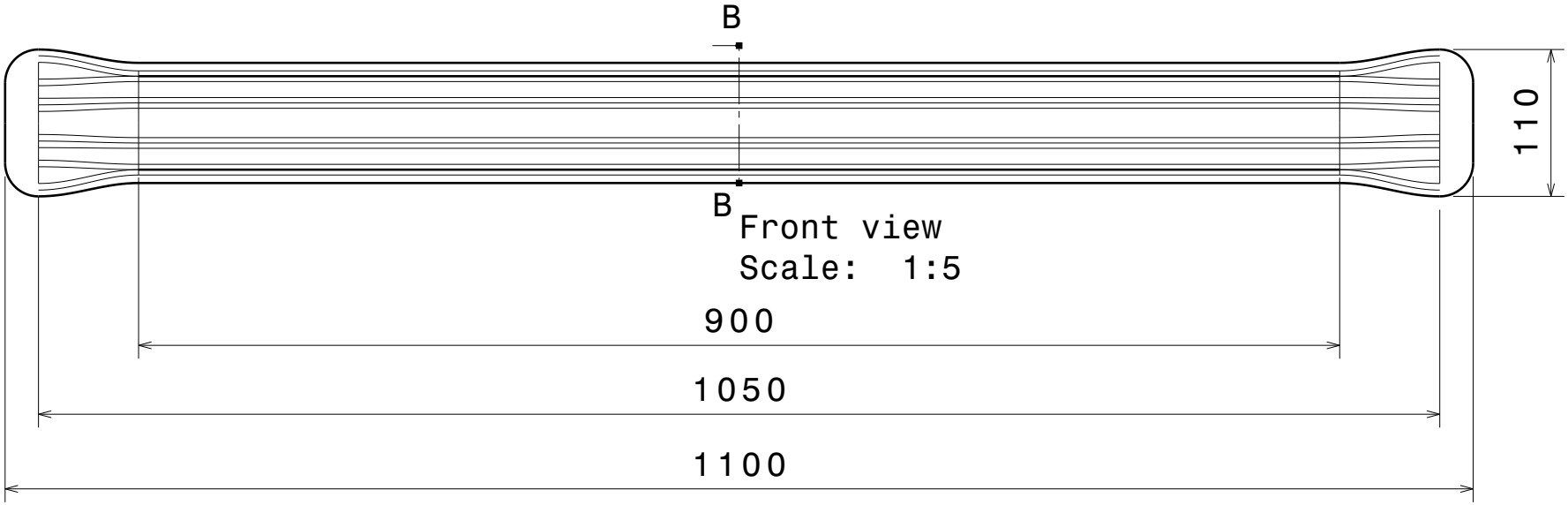
Barra de protección contra impactos laterales 1.
Dimensiones en mm.



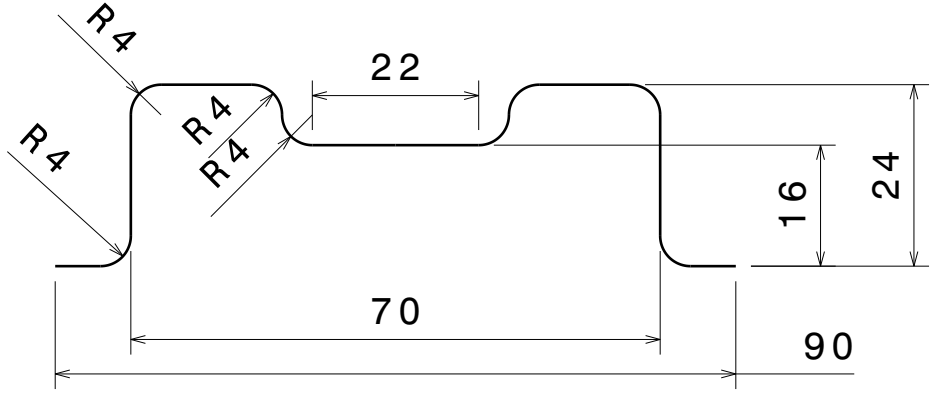


Section cut A-A
Scale: 1:1

Barra de protección contra impactos laterales 2.
Dimensiones en mm.

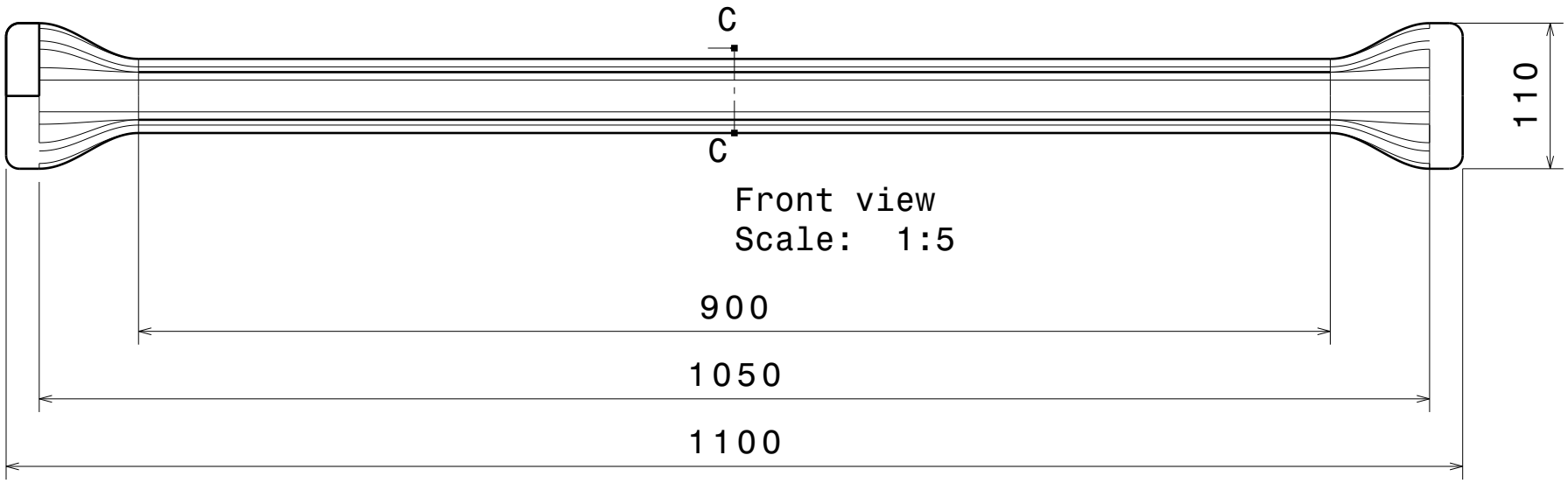


Front view
Scale: 1:5

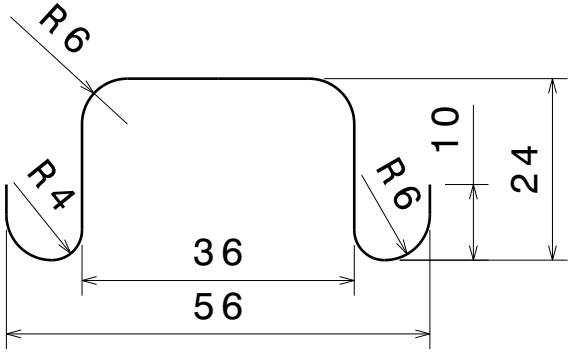


Section cut B-B
Scale: 1:1

Barra de protección contra impactos laterales 3.
Dimensiones en mm.

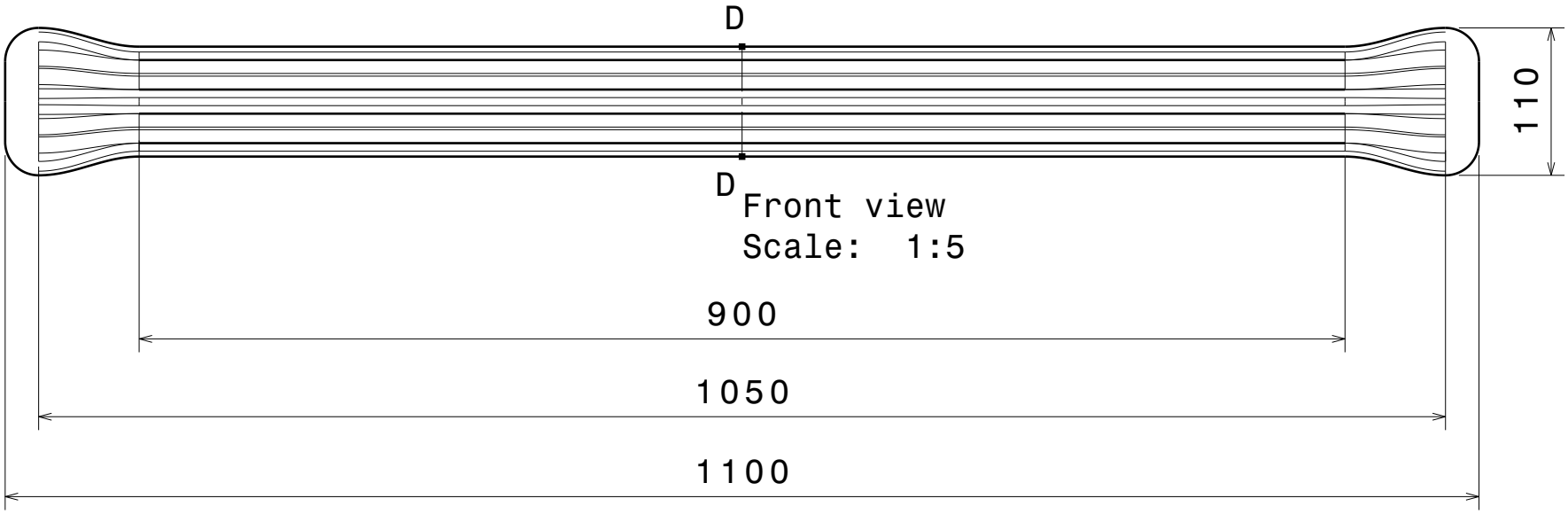


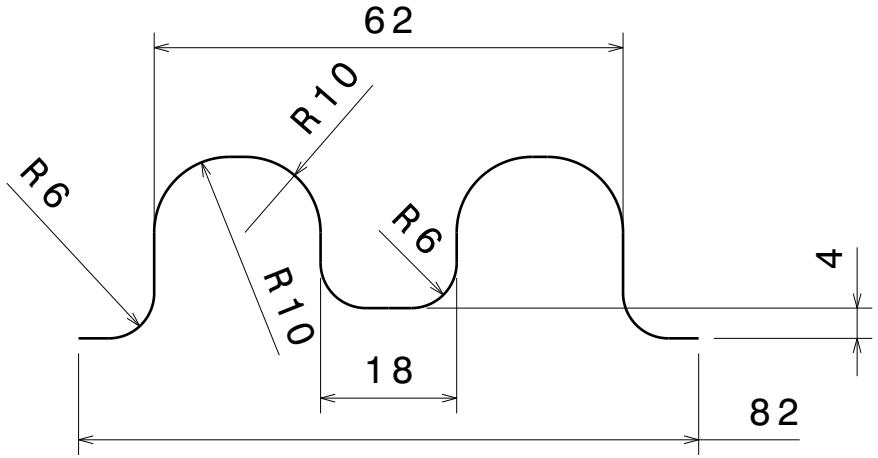
Front view
Scale: 1:5



Section cut C-C
Scale: 1:1

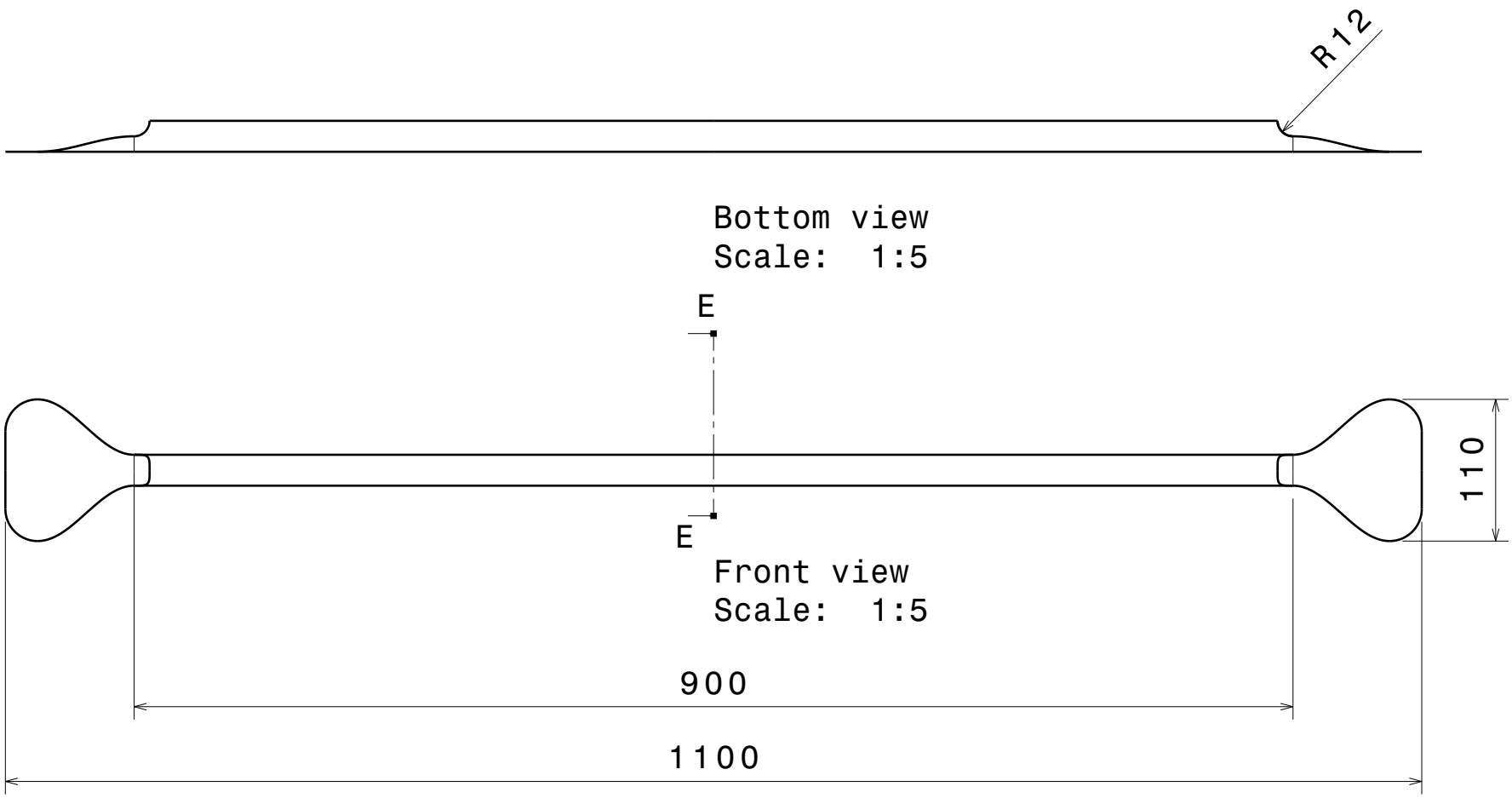
Barra de protección contra impactos laterales 4.
Dimensiones en mm.

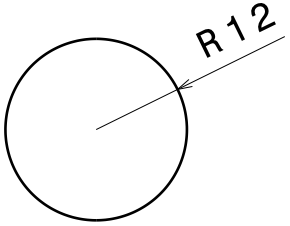




Section cut D-D
Scale: 1:1

Barra de protección contra impactos laterales 5.
Dimensiones en mm.

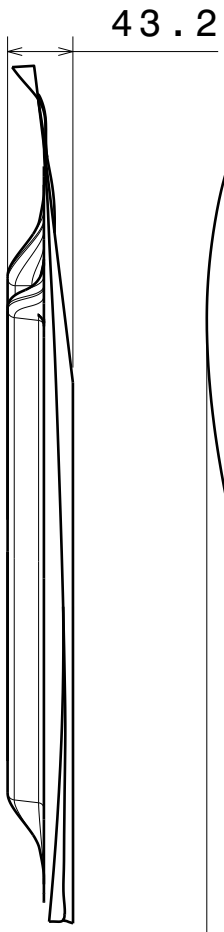


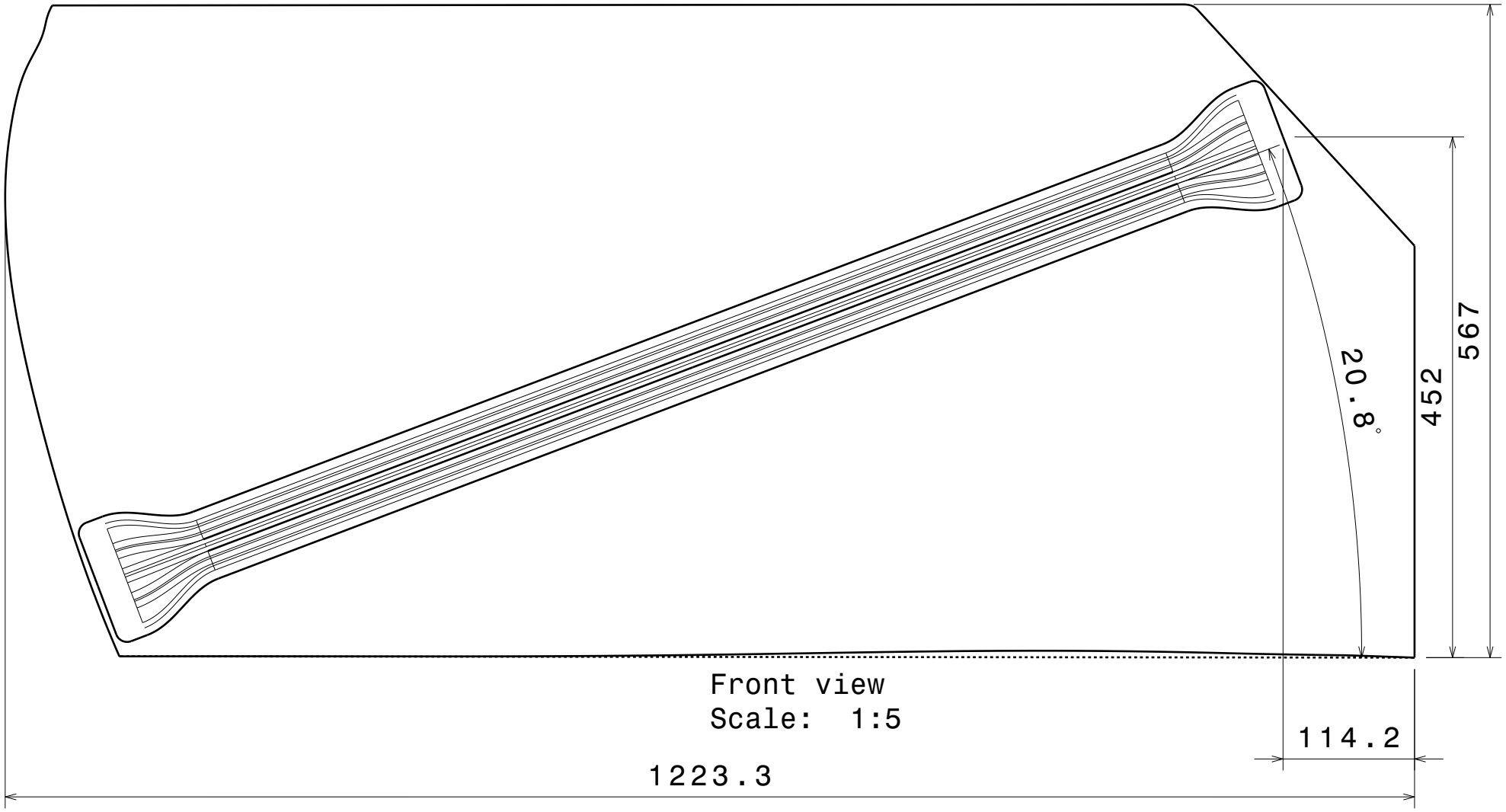


Section cut E-E
Scale: 1:1

Ensamblaje de panel exterior de puerta con barra.
Se muestra la barra 1 como referencia.
Dimensiones en mm.

Right view
Scale: 1:5





Front view
Scale: 1:5

Anexo 2.

FMVSS214: Normativa ensayo S6.

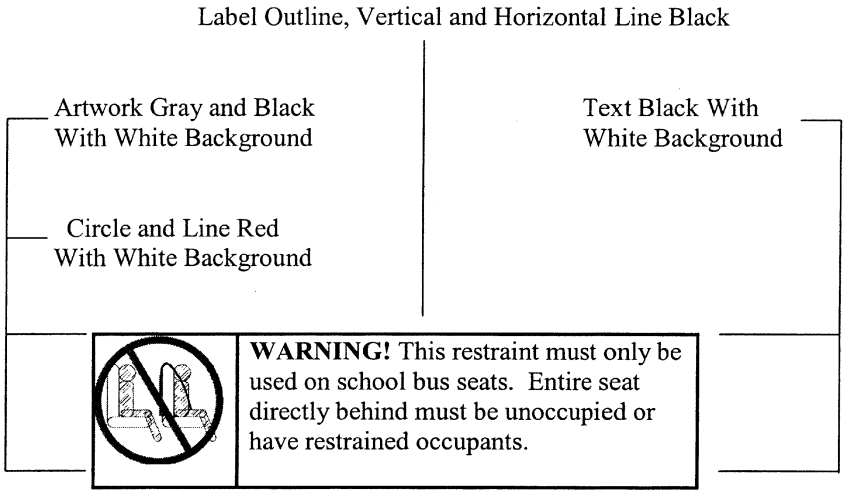


Figure 12. Label on Harness Component That Attaches to School Bus Seat Back.

[44 FR 72147, Dec. 13, 1979]

EDITORIAL NOTE: For FEDERAL REGISTER citations affecting §571.213, see the List of CFR Sections Affected in the Finding Aids section of this volume.

§571.214 Standard No. 214; Side impact protection.

S1 *Scope and purpose.*

(a) *Scope.* This standard specifies performance requirements for protection of occupants in side impacts.

(b) *Purpose.* The purpose of this standard is to reduce the risk of serious and fatal injury to occupants of passenger cars, multipurpose passenger vehicles, trucks and buses in side impacts by specifying strength requirements for side doors, limiting the forces, deflections and accelerations measured on anthropomorphic dummies in test crashes, and by other means.

S2 *Applicability.* This standard applies to passenger cars, and to multipurpose passenger vehicles, trucks and buses with a gross vehicle weight rating (GVWR) of 4,536 kilograms (kg) (10,000 pounds (lb)) or less, except for walk-in vans, or otherwise specified.

S3 *Definitions.*

Contoured means, with respect to a door, that the lower portion of its front or rear edge is curved upward, typically to conform to a wheel well.

Double side doors means a pair of hinged doors with the lock and latch mechanisms located where the door lips overlap.

Limited line manufacturer means a manufacturer that sells three or fewer carlines, as that term is defined in 49 CFR 583.4, in the United States during a production year.

Lowered floor means the replacement floor on a motor vehicle whose original floor has been removed, in part or in total, and replaced by a floor that is lower than the original floor.

Modified roof means the replacement roof on a motor vehicle whose original roof has been removed, in part or in total.

Raised roof is used as defined in paragraph S4 of 49 CFR 571.216.

Walk-in van means a special cargo/mail delivery vehicle that has only one designated seating position. That designated seating position must be forward facing and for use only by the driver. The vehicle usually has a thin and light sliding (or folding) side door for easy operation and a high roof clearance that a person of medium

stature can enter the passenger compartment area in an up-right position.

S4 *Requirements.* Subject to the exceptions of S5—

(a) *Passenger cars.* Passenger cars must meet the requirements set forth in S6 (door crush resistance), S7 (moving deformable barrier test), and S9 (vehicle-to-pole test), subject to the phased-in application of S7 and S9.

(b) *Multipurpose passenger vehicles, trucks and buses with a GVWR of 2,722 kg or less (6,000 lb or less).* Multipurpose passenger vehicles, trucks and buses with a GVWR of 2,722 kg or less (6,000 lb or less) must meet the requirements set forth in S6 (door crush resistance), S7 (moving deformable barrier test), and S9 (vehicle-to-pole test), subject to the phased-in application of S7 and S9.

(c) *Multipurpose passenger vehicles, trucks and buses with a GVWR greater than 2,722 kg (6,000 lb).* Multipurpose passenger vehicles, trucks and buses with a GVWR greater than 2,722 kg (6,000 lb) must meet the requirements set forth in S6 (door crush resistance) and S9 (vehicle-to-pole test), subject to the phased-in application of S9.

S5 *General exclusions.*

(a) *Exclusions from S6 (door crush resistance).* A vehicle need not meet the requirements of S6 (door crush resistance) for—

(1) Any side door located so that no point on a ten-inch horizontal longitudinal line passing through and bisected by the H–point of a manikin placed in any seat, with the seat adjusted to any position and the seat back adjusted as specified in S8.4, falls within the transverse, horizontal projection of the door's opening,

(2) Any side door located so that no point on a ten-inch horizontal longitudinal line passing through and bisected by the H–point of a manikin placed in any seat recommended by the manufacturer for installation in a location for which seat anchorage hardware is provided, with the seat adjusted to any position and the seat back adjusted as specified in S8.3, falls within the transverse, horizontal projection of the door's opening,

(3) Any side door located so that a portion of a seat, with the seat adjusted to any position and the seat back adjusted as specified in S8.3, falls within the transverse, horizontal projection of the door's opening, but a longitudinal vertical plane tangent to the outboard side of the seat cushion is more than 254 mm (10 inches) from the innermost point on the inside surface of the door at a height between the H–point and shoulder reference point (as shown in Figure 1 of Federal Motor Vehicle Safety Standard No. 210 (49 CFR 571.210)) and longitudinally between the front edge of the cushion with the seat adjusted to its forwardmost position and the rear edge of the cushion with the seat adjusted to its rearmost position.

(4) Any side door that is designed to be easily attached to or removed (e.g., using simple hand tools such as pliers and/or a screwdriver) from a motor vehicle manufactured for operation without doors.

(b) *Exclusions from S7 (moving deformable barrier test).* The following vehicles are excluded from S7 (moving deformable barrier test):

(1) Motor homes, ambulances and other emergency rescue/medical vehicles (including vehicles with fire-fighting equipment), vehicles equipped with wheelchair lifts, and vehicles which have no doors or exclusively have doors that are designed to be easily attached or removed so the vehicle can be operated without doors.

(2) Passenger cars with a wheelbase greater than 130 inches need not meet the requirements of S7 as applied to the rear seat.

(3) Passenger cars, multipurpose passenger vehicles, trucks and buses need not meet the requirements of S7 (moving deformable barrier test) as applied to the rear seat for side-facing rear seats and for rear seating areas that are so small that a Part 572 Subpart V dummy representing a 5th percentile adult female cannot be accommodated according to the positioning procedure specified in S12.3.4 of this standard.

(4) Multipurpose passenger vehicles, trucks and buses with a GVWR of more than 2,722 kg (6,000 lb) need not meet the requirements of S7 (moving deformable barrier test).

(c) *Exclusions from S9 (vehicle-to-pole test).* The following vehicles are excluded from S9 (vehicle-to-pole test)

(wholly or in limited part, as set forth below):

(1) Motor homes;

(2) Ambulances and other emergency rescue/medical vehicles (including vehicles with fire-fighting equipment) except police cars;

(3) Vehicles with a lowered floor or raised or modified roof and vehicles that have had the original roof rails removed and not replaced;

(4) Vehicles in which the seat for the driver or right front passenger has been removed and wheelchair restraints installed in place of the seat are excluded from meeting the vehicle-to-pole test at that position; and

(5) Vehicles that have no doors, or exclusively have doors that are designed to be easily attached or removed so that the vehicle can be operated without doors.

S6 *Door Crush Resistance Requirements.* Except as provided in section S5, each vehicle shall be able to meet the requirements of either, at the manufacturer's option, S6.1 or S6.2, when any of its side doors that can be used for occupant egress is tested according to procedures described in S6.3 of this standard (49 CFR 571.214).

S6.1 With any seats that may affect load upon or deflection of the side of the vehicle removed from the vehicle, each vehicle must be able to meet the requirements of S6.1.1 through S6.1.3.

S6.1.1 Initial crush resistance. The initial crush resistance shall not be less than 10,000 N (2,250 lb).

S6.1.2 Intermediate crush resistance. The intermediate crush resistance shall not be less than 1,557 N (3,500 lb).

S6.1.3 Peak crush resistance. The peak crush resistance shall not be less than two times the curb weight of the vehicle or 3,114 N (7,000 lb), whichever is less.

S6.2 With seats installed in the vehicle, and located in any horizontal or vertical position to which they can be adjusted and at any seat back angle to which they can be adjusted, each vehicle must be able to meet the requirements of S6.2.1 through S6.2.3.

S6.2.1 Initial crush resistance. The initial crush resistance shall not be less than 10,000 N (2,250 lb).

S6.2.2 Intermediate crush resistance. The intermediate crush resistance shall not be less than 1,946 N (4,375 lb).

S6.2.3 Peak crush resistance. The peak crush resistance shall not be less than three and one half times the curb weight of the vehicle or 5,338 N (12,000 lb), whichever is less.

S6.3 *Test procedures for door crush resistance.* The following procedures apply to determining compliance with S6.1 and S6.2 of S6, *Door crush resistance requirements.*

(a) Place side windows in their uppermost position and all doors in locked position. Place the sill of the side of the vehicle opposite to the side being tested against a rigid unyielding vertical surface. Fix the vehicle rigidly in position by means of tiedown attachments located at or forward of the front wheel centerline and at or rearward of the rear wheel centerline.

(b) Prepare a loading device consisting of a rigid steel cylinder or semicylinder 305 mm (12 inches) in diameter with an edge radius of 13 mm (½ inch). The length of the loading device shall be such that—

(1) For doors with windows, the top surface of the loading device is at least 13 mm (½ inch) above the bottom edge of the door window opening but not of a length that will cause contact with any structure above the bottom edge of the door window opening during the test.

(2) For doors without windows, the top surface of the loading device is at the same height above the ground as when the loading device is positioned in accordance with paragraph (b)(1) of this section for purposes of testing a front door with windows on the same vehicle.

(c) Locate the loading device as shown in Figure 1 (side view) of this section so that—

(1) Its longitudinal axis is vertical.

(2) Except as provided in paragraphs (c)(2)(i) and (ii) of this section, its longitudinal axis is laterally opposite the midpoint of a horizontal line drawn across the outer surface of the door 127 mm (5 inches) above the lowest point of the door, exclusive of any decorative or protective molding that is not permanently affixed to the door panel.

(i) For contoured doors on trucks, buses, and multipurpose passenger vehicles with a GVWR of 4,536 kg (10,000 lb) or less, if the length of the horizontal line specified in this paragraph (c)(2) is not equal to or greater than 559 mm (22 inches), the line is moved vertically up the side of the door to the point at which the line is 559 mm (22 inches) long. The longitudinal axis of the loading device is then located laterally opposite the midpoint of that line.

(ii) For double side doors on trucks, buses, and multipurpose passenger vehicles with a GVWR of 4,536 kg (10,000 lb) or less, its longitudinal axis is laterally opposite the midpoint of a horizontal line drawn across the outer surface of the double door span, 127 mm (5 inches) above the lowest point on the doors, exclusive of any decorative or protective molding that is not permanently affixed to the door panel.

(3) Except as provided in paragraphs (c)(3)(i) and (ii) of this section, its bottom surface is in the same horizontal plane as the horizontal line drawn across the outer surface of the door 127 mm (5 inches) above the lowest point of the door, exclusive of any decorative or protective molding that is not permanently affixed to the door panel.

(i) For contoured doors on trucks, buses, and multipurpose passenger vehicles with a GVWR of 4,536 kg (10,000 lb) or less, its bottom surface is in the lowest horizontal plane such that every point on the lateral projection of the bottom surface of the device on the door is at least 127 mm (5 inches), horizontally and vertically, from any edge of the door panel, exclusive of any decorative or protective molding that is not permanently affixed to the door panel.

(ii) For double side doors, its bottom surface is in the same horizontal plane as a horizontal line drawn across the outer surface of the double door span, 127 mm (5 inches) above the lowest point of the doors, exclusive of any decorative or protective molding that is not permanently affixed to the door panel.

(d) Using the loading device, apply a load to the outer surface of the door in an inboard direction normal to a vertical plane along the vehicle's longitudinal centerline. Apply the load continuously such that the loading device travel rate does not exceed 12.7 mm (0.5 inch) per second until the loading device travels 457 mm (18 inches). Guide the loading device to prevent it from being rotated or displaced from its direction of travel. The test is completed within 120 seconds.

(e) Record applied load versus displacement of the loading device, either continuously or in increments of not more than 25.4 mm (1 inch) or 91 kg (200 pounds) for the entire crush distance of 457 mm (18 inches).

(f) Determine the initial crush resistance, intermediate crush resistance, and peak crush resistance as follows:

(1) From the results recorded in paragraph (e) of this section, plot a curve of load versus displacement and obtain the integral of the applied load with respect to the crush distances specified in paragraphs (f)(2) and (3) of this section. These quantities, expressed in mm-kN (inch-pounds) and divided by the specified crush distances, represent the average forces in kN (pounds) required to deflect the door those distances.

(2) The initial crush resistance is the average force required to deform the door over the initial 152 mm (6 inches) of crush.

(3) The intermediate crush resistance is the average force required to deform the door over the initial 305 mm (12 inches) of crush.

(4) The peak crush resistance is the largest force recorded over the entire 457 mm (18-inch) crush distance.

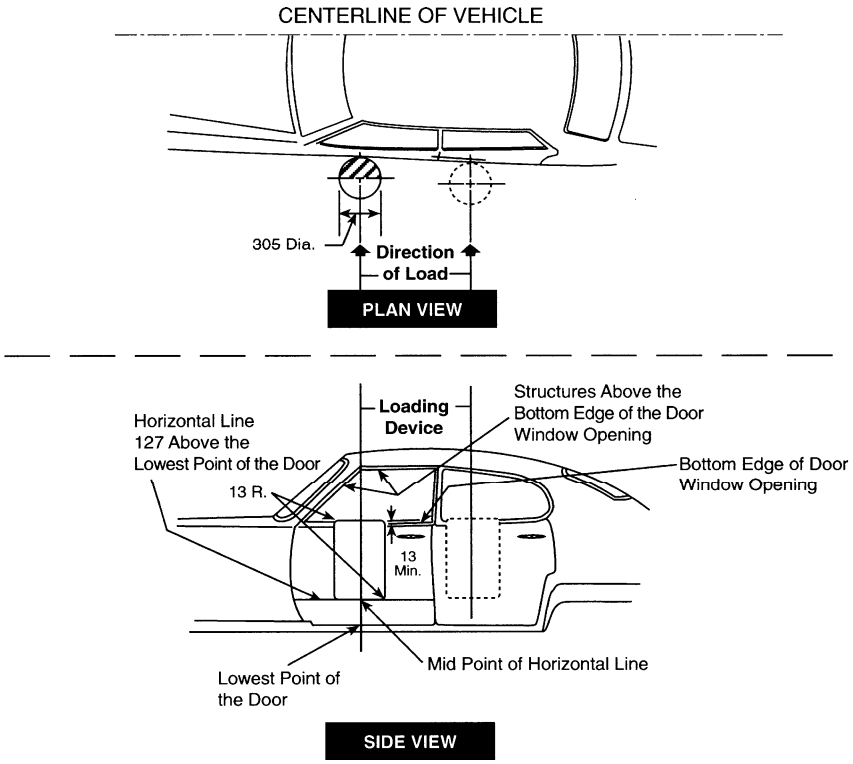


Figure 1—LOADING DEVICE LOCATION AND APPLICATION TO THE DOOR
All dimensions in millimeters (mm)

S7 *Moving Deformable Barrier (MDB) Requirements.* Except as provided in section S5, when tested under the conditions of S8 each vehicle shall meet S7.3 and the following requirements in a 53 ± 1.0 km/h (33.5 mph) impact in which the vehicle is struck on either side by a moving deformable barrier.

S7.1 *MDB test with SID.* For vehicles manufactured before September 1, 2010, the following requirements must be met. The following requirements also apply to vehicles manufactured on or after September 1, 2010 that are not part of the percentage of a manufacturer's production meeting the MDB test with advanced test dummies (S7.2 of this section) or are otherwise excluded from the phase-in requirements of S7.2. (Vehicles manufactured before September 1, 2010 may meet S7.2, at the manufacturer's option.)

S7.1.1 The test dummy specified in 49 CFR Part 572 Subpart F (SID) is placed in the front and rear outboard seating positions on the struck side of the vehicle, as specified in S11 and S12 of this standard (49 CFR 571.214).

S7.1.2 When using the Part 572 Subpart F dummy (SID), the following performance requirements must be met.

(a) *Thorax.* The Thoracic Trauma Index (TTI(d)) shall not exceed:

(1) 85 g for a passenger car with four side doors, and for any multipurpose passenger vehicle, truck, or bus; and,

(2) 90 g for a passenger car with two side doors, when calculated in accordance with the following formula:

$TI(d) = \frac{1}{2}(G_R + G_{L,S})$

Anexo 3.

Hojas de especificaciones de materiales.

DOCOL®
HIGH STRENGTH STEEL

Docol DP/DL
Cold reduced dual phase steels

PRODUCT
Docol DP and Docol DL are cold reduced dual phase steels. 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
Width: 800 - 1500 mm, depending on steel grade and thickness.

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

MECHANICAL PROPERTIES

Steel grade	Yield Strength $R_{p,02}$ (N/mm²)		Yield Strength after bake hardening[1)]	Tensile strength R_m (Nmm²)		Elongation A_{80}%	Min. bending radius for 90°
	min	max	min	min	max	min	
Docol 500 DP	290	370	400	500	600	20	0xt
Docol 500 DL	230	300	350	500	600	24	0xt
Docol 600 DP	350	450	500	600	700	16	0xt
Docol 600 DL	280	360	450	600	700	20	0xt
Docol 800 DP	500	650	600	800	95	10	1,0xt
Docol 800 DL	390	540	550	800	950	13	1,0xt
Docol 1000 DP	700	950	850	1000	1200	7	2,0xt

The mechanical properties are valid in transverse direction of rolling.
t = Sheet thickness
1) BH = bake hardening after 2 % plastic deformation and heated to 170 °C

SSAB

DATASHEET: 09-05-20 GB8201 DOCOL

Docol DP/DL

Cold reduced dual phase steels

CHEMICAL COMPOSITION

(typical value)

Steel grade	C %	Si %	Mn %	P %	S %	Al_{tot} %	Nb %
Docol 500 DP	0,08	0,30	0,65	0,010	0,010	0,040	-
Docol 500 DL	0,05	0,20	1,50	0,010	0,002	0,040	-
Docol 600 DP	0,10	0,20	0,80	0,010	0,002	0,040	0,015
Docol 600 DL	0,10	0,40	1,50	0,010	0,002	0,040	-
Docol 800 DP	0,13	0,20	1,50	0,010	0,002	0,040	0,015
Docol 800 DL	0,14	0,20	1,50	0,010	0,002	0,040	0,015
Docol 1000 DP	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

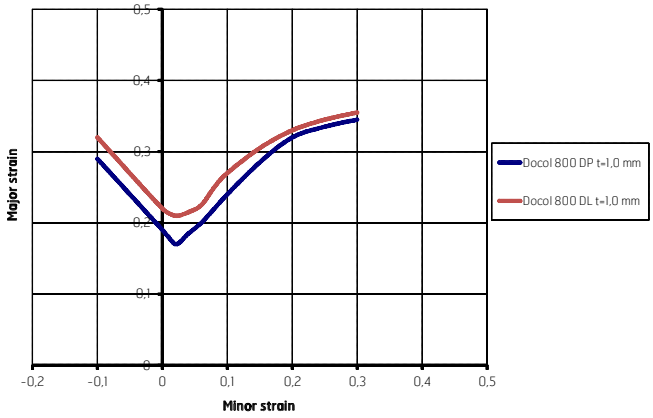
The bendability of DP/DL steels is good even at higher strength levels. At advanced bending it is important if possible to bend transverse to the rolling direction, where the bendability is somewhat better than in the longitudinal direction.

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.

DATASHEET: 09-05-20 GB8201 DOCOL

Docol DP/DL

Cold reduced dual phase 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.

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.

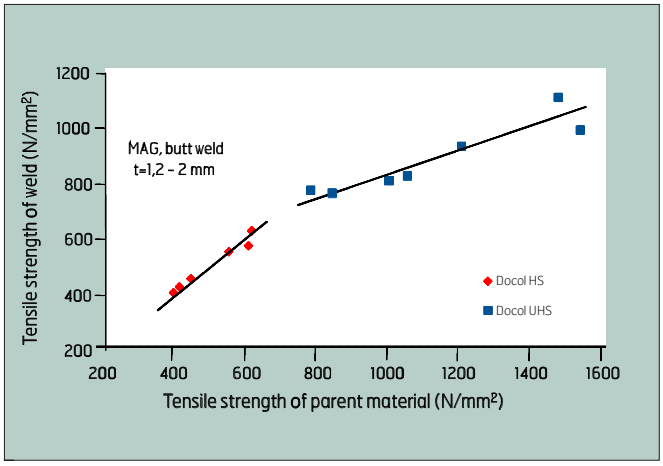
TECHNICAL SERVICE AND INFORMATION

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

TABLE 1: RECOMMENDED FILLER METALS FOR DOCOL UHS

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

STRENGTH OF WELDED JOINTS



SSAB

DOCOL®
HIGH STRENGTH STEEL

Docol DP/DL

Cold reduced dual phase steels

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www.ssab.com

SSAB

DOCOL®
HIGH STRENGTH STEEL

DATA SHEET: 09-03-18 GB8207 DOCOL

Docol M
Cold reduced martensitic steels

PRODUCT
Docol M are cold reduced fully martensitic steels. 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
Width: 800-1500 mm, depending on steel grade and thickness.

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

MECHANICAL PROPERTIES

Steel grade	Yield strength R_{el} (N/mm²)		Yield strength after bake hardening[1]	Tensile strength R_m (Nmm²)		Elongation A_{80} %	Min bending radius 90° bend
	min	max	min	min	max	min	
Docol 900M	700	-	900	900	1100	3	3.0 xt
Docol 1200M	950	-	1150	1200	1400	3	3.0 xt
Docol 1400M	1150	-	1350	1400	1600	3	3.0 xt
Docol 1500M[2]	1200	-	-	1500	1700	3	3.0 xt

The mechanical properties are valid in transverse direction of rolling
t = Sheet thickness
1) BH = bake hardening after 2 % plastic deformation and heated to 170 °C
2) Can be achieved at request

CHEMICAL COMPOSITIONS
(Typical values)

Steel grade	C %	Si %	Mn %	P %	S %	Al_{tot} %	Nb %	Ti %
Docol 900M	0,05	0,20	2,00	0,010	0,002	0,040	-	-
Docol 1200M	0,11	0,20	1,70	0,010	0,002	0,040	0,015	0,025
Docol 1400M	0,17	0,20	1,40	0,010	0,002	0,040	0,015	0,025
Docol 1500M	0,21	0,20	1,10	0,010	0,002	0,040	0,015	0,025

SSAB

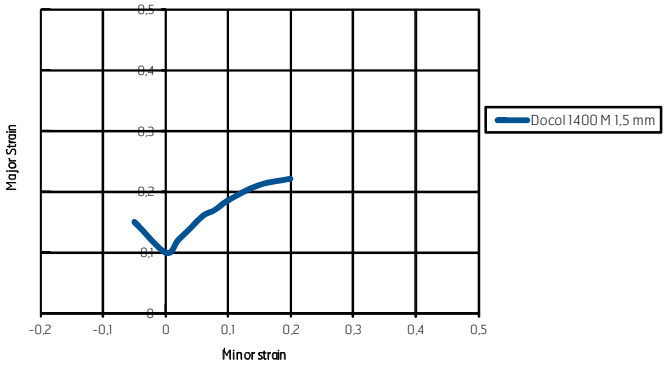
Docol M
Cold reduced martensitic steels

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.

Rollforming
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.

Docol M
Cold reduced martensitic 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.

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.

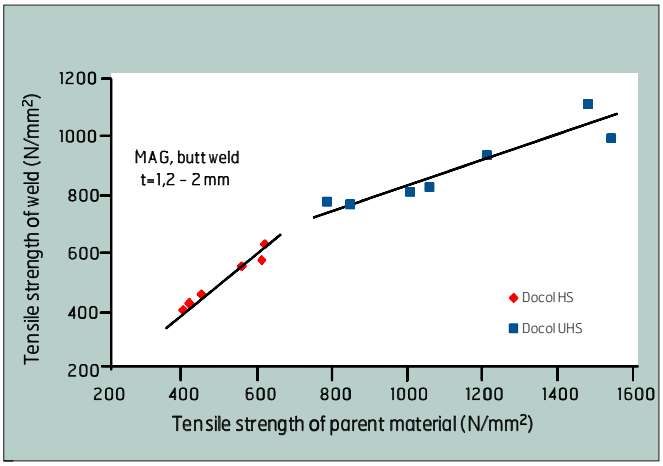
TECHNICAL SERVICE AND INFORMATION

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

TABLE 1: RECOMMENDED FILLER METALS

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

STRENGTH OF WELDED JOINTS



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Docol M

Cold reduced martensitic steels

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SSAB

Galvatite high-strength steel

Galvatite high-strength steel allows the user to increase the strength of the finished component or reduce the steel thickness, or both. It also offers corrosion resistance and good forming properties.

Typical applications

- automotive components
- cold-formed tubes
- building frames
- floor decking
- racking and shelving
- building components

Standard

Galvatite high-strength steel complies with EN 10292 : 2000 and is available in the grades and coatings shown in table 49 (right).

Mechanical properties

The values shown for the mechanical properties in table 50 below are for temper-rolled material and are for test pieces taken either transverse to or in the rolling direction (see test direction in table).

Chemical composition

Galvatite high-strength steel meets the requirements of the cast analysis in the standard, as shown in table 51 on page 68.

Dimensions

The width and thickness limits are shown in table 52 on page 68. The minimum width for all products is 900mm. Widths below this may be available after consultation.

Table 49: Standard: EN 10292 : 2000

Grade	Symbol for coating type
H180BD	Z, ZF
H220BD	Z, ZF
H220PD	Z, ZF
H300PD	Z
H220YD	Z
H260YD	Z
H260LAD	Z, ZF
H300LAD	Z, ZF
H340LAD	Z
H380LAD	Z
H420LAD	Z

Table 50: Mechanical properties: EN 10292 : 2000

		$R_{p0.2}$ (N/mm²)	BH_2 (N/mm²)	R_m (N/mm²)	A_{80} (%)	r_{90}	n_{90}
Grade	Test	Min-Max	Min	Min-Max	Min	Min	Min
H180BD	t	180-240	35	300-360	34	1.5	0.16
H220BD	t	220-280	35	340-400	32	1.2	0.15
H220PD	t	220-280	–	340-400	32	1.3	0.15
H300PD	t	300-360	–	400-480	26	–	–
H220YD	t	220-280	–	340-410	32	1.5	0.17
H260YD	t	260-320	–	380-440	30	1.4	0.16
H260LAD	t	260-330	–	350-430	26	–	–
H300LAD	t	300-380	–	380-480	23	–	–
H340LAD	t	340-420	–	410-510	21	–	–
H380LAD	t	380-480	–	440-560	19	–	–
H420LAD	t	420-520	–	470-590	17	–	–
H260LAD	l	240-310	–	340-420	27	–	–
H300LAD	l	280-360	–	370-470	24	–	–
H340LAD	l	320-400	–	400-500	22	–	–
H380LAD	l	360-460	–	430-550	20	–	–
H420LAD	l	400-500	–	460-580	18	–	–

Note: The letters in the test column indicate test direction. The letter t indicates transverse to the rolling direction and the letter l indicates longitudinal, i.e. in the rolling direction.

Table 51: Chemical composition: EN 10292 : 2000

Grade	C	Mn	Si	Al	P	S	Ti[1]	Nb[1]
	Max	Max	Max	Min	Max	Max	Max	Max
H180BD	0.04	0.70	0.50	0.020	0.060	0.025	–	–
H220BD	0.06	0.70	0.50	0.020	0.080	0.025	–	–
H220PD	0.08	0.70	0.50	0.020	0.080	0.025	–	–
H300PD	0.10	0.70	0.50	0.020	0.080	0.025	–	–
H220YD	0.01	0.90	0.10	0.020	0.080	0.025	0.120	–
H260YD	0.01	1.60	0.10	0.020	0.100	0.025	0.120	–
H260LAD	0.10	0.60	0.50	0.015	0.025	0.025	0.150	0.090
H300LAD	0.10	1.00	0.50	0.015	0.025	0.025	0.150	0.090
H340LAD	0.10	1.00	0.50	0.015	0.025	0.025	0.150	0.090
H380LAD	0.10	1.40	0.50	0.015	0.025	0.025	0.150	0.090
H420LAD	0.10	1.40	0.50	0.015	0.025	0.025	0.150	0.090

Notes:

1. The sum of the contents of these elements should not exceed 0.22%.
2. Values are in weight percentages.

Table 52: Dimensions: EN 10292 : 2000

Thickness		Width							
		Max							
>	≤	H180BD	H220BD	H220YD	H260YD	H220PD H260LAD	H300PD H300LAD	H340LAD	H380LAD H420LAD
0.38	0.40	–	–	–	–	970	–	–	–
0.40	0.43	–	–	–	–	1220	–	–	–
0.43	0.45	1070	–	–	–	1220	–	–	–
0.45	0.50	1250	–	–	–	1520	–	–	–
0.50	0.56	1520	–	–	–	1520	1300	–	–
0.56	0.60	1520	1520	1320	1320	1520	1300	–	–
0.60	0.63	1520	1520	1580	1580	1520	1500	1450	–
0.63	0.68	1520	1520	1605	1605	1520	1500	1450	–
0.68	0.70	1605	1605	1605	1605	1605	1500	1450	–
0.70	0.75	1605	1605	1620	1620	1605	1500	1450	1500
0.75	0.90	1620	1620	1620	1620	1620	1600	1550	1500
0.90	0.98	1620	1620	1620	1620	1620	1600	1600	1500
0.98	1.10	1620	1620	1620	1620	1620	1600	1600	1550
1.10	1.20	1620	1620	1620	1620	1620	1620	1620	1550

Note: Dimensions are in millimetres.

1.5.2 Typical mechanical properties of rolled products for automotive applications[1]

See also:

- AAM – Materials – 3 Designation system > Wrought alloys > H-Tempers for strain-hardening wrought alloys (EN 515)

Literature:

- Ostermann, F., Anwendungstechnologie Aluminium, Berlin, Heidelberg, London, New York, Tokyo: Springer-Verlag, 1998, ISBN 3-540-62706-5 — The majority of data were taken from this reference, p. 664-668.

Int. Reg. Record	Designations according to DIN EN 573-3 numerical	chemical symbol	Temper (DIN EN 515)	$R_{p0.2}$ [MPa]	R_m [MPa]	A_{50mm} [%]
1050A	EN AW-1050A	EN AW-Al99,5	O	35	80	38
			H12 / H22	85	100	12 [2]
			H14 / H24	105	115	9
1200	EN AW-1200	EN AW-Al99,0	O	40	90	35
			H12 / H22	90	110	11 [2]
			H14 / H24	115	125	8
3003	EN AW-3003	EN AW-AlMn1Cu	O	50	110	25
			H12 / H22	120	140	11
			H14 / H24	145	160	9
3103	EN AW-3103	EN AW-AlMn1	O	45	105	25
			H12 / H22	115	135	11
			H14 / H24	140	155	9
5005	EN AW-5005	EN AW-AlMg1(B)	O	45	120	26
			H12 / H22	125	140	13
			H14 / H24	145	160	11
5005A	EN AW-5005A	EN AW-AlMg1(C)	O	45	120	27 [2]
			H12 / H22	125	145	13
			H14 / H24	145	165	11
5052	EN AW-5052	EN AW-AlMg2,5	O	90	195	24
			H12 / H22	175	225	14
			H14 / H24	200	250	12
5083	EN AW-5083	EN AW-AlMg4,5Mn0,7	O	145	300	22
			H12 / H22	240	330	16
			H14 / H24	275	360	14
5086	EN AW-5086	EN AW-AlMg4	O	130	275	23
			H12 / H22	220	305	15
			H14 / H24	250	330	13
5154A	EN AW-5154A	EN AW-AlMg3,5(A)	O	110	235	23
			H12 / H22	205	265	13
			H14 / H24	235	290	12
5182	EN AW-5182	EN AW-AlMg4,5Mn0,4	O	140	280	25 [3]
5251	EN AW-5251	EN AW-AlMg2	O	80	180	25
			H12 / H22	165	210	14
			H14 / H24	190	230	12
5454	EN AW-5454	EN AW-AlMg3Mn	O	110	235	24
			H12 / H22	205	265	14
			H14 / H24	235	290	12
5754	EN AW-5754	EN AW-AlMg3	O	100	215	24
			H12 / H22	185	245	14
			H14 / H24	215	270	12
6009	-	-	T4	125	230	27 [2]
6016	-	-	T4	120	240	28 [2]
			T6	205	255	-
6022	-	-	T4	129	248	28
6061	EN AW-6061	EN AW-AlMg1SiCu	O	55	125	26
			T4	140	235	21
			T6	270	310	12
6082	EN AW-6082	EN AW-AlSi1MgMn	O	60	130	26
			T4	170	260	19
			T6	310	340	11
6181A	-	-	T4	125	235	24
			T6	225	290	16 [3]

[1]) F. Ostermann, in "Anwendungstechnologie Aluminium", Springer 1998, p664

[2]) A_5

[3]) A_{80mm}