

# Dual phase steels

## Data sheet

### Grade availability

ArcelorMittal offers a full spectrum of dual phase (DP) steels with tensile strength levels ranging from 500 to 1270 MPa.

	HR	Uncoated	EG	GI	GA
DP500		I	I	U	E/U
DP590/600	U	U	U	U	U
DP690/700		U	U		
DP780		U	U	U	U
DP980		U	U	U	U
DP1180		U	U	I	U
DP1270		I	I		

E – Exposed, commercially available

U – Unexposed, commercially available

I – In development

### Product characteristics

Dual phase steels are one of the important new advanced high strength steels (AHSS) developed for the automotive industry. Their microstructure typically consists of a soft ferrite phase with dispersed islands of martensite. The martensite phase is substantially stronger than the ferrite phase.

ArcelorMittal produces two types of DP steels: conventional dual phase grades and higher yield strength grades. Conventional dual phase grades exhibit low yield-to-tensile strength ratios, high initial work hardening (n-value), no yield point elongation (YPE) and significant bake hardening. The higher yield strength grades exhibit high yield-to-tensile strength ratios, some YPE and lower bake hardening than the conventional dual phase grades.

With careful schedule selection, the DP steels are joinable by all current welding processes, including resistance spot, resistance seam, arc and laser methods.

Computer Aided Engineering (CAE) structural engineers should be cautioned, however, that the unique high work hardening and bake hardening characteristics of DP steels require special treatment in finite element analysis crash models. Generally, accounting for high strain rate behavior and forming effects (thinning/thickening, work hardening, bake hardening) will yield more accurate crash simulation results. CAE engineers should contact ArcelorMittal for product specific mechanical property information to use in these situations.

### Applications

Dual Phase 500 MPa tensile strength is intended primarily for exposed body panels (doors, hoods and fenders). Its excellent formability, high work hardening and bake hardening behaviors permit designers to reduce outer panel gauge and weight substantially, while maintaining or improving dent resistance. It offers designers the opportunity to substantially reduce closure weight, and possibly avoid substitution of more costly, lower density materials.

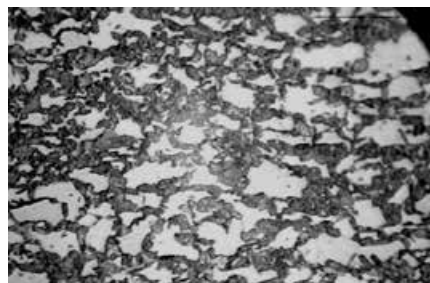
The low and intermediate tensile strength, low yield ratio grades (590 to 980 MPa tensile strength) are frequently used in body structure applications requiring high energy absorption (i.e. the crumple zones – front and rear longitudinal rails and supporting structure). The low yield strength helps keep the initial deceleration pulse low, yet the high work hardening rate and excellent ductility absorb greater deformation energy than conventional steels. Good formability permits the use of these products in complicated shapes, and good weldability permits using these steels in tailored blank and hydroformed tube applications.

The intermediate to highest strength grades, including the high yield ratio dual phase steels, are typically used in applications requiring extremely high yield strength and adequate formability, such as passenger safety cage components, limited by axial or transverse bending. These components (rockers, pillars, pillar reinforcements, roof rails and cross members) rely on high yield strength to prevent intrusion into the passenger compartment during a collision. Dual phase steels enable designers to apply high yield strength steels to safety cage components that are too complex to form with higher strength MartINsite® steels.

### Metallography - Dual Phase 980

Magnification 1000X

Approximately 60 percent martensite/40 percent ferrite



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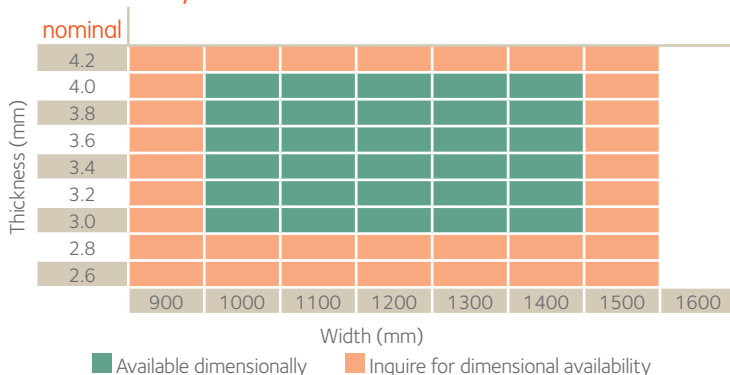
## Chemistry - Typical

	C	Mn	Si	Other
<b>Hot roll</b>				
DP590/600	0.05	1.2	0.6	Cr
<b>Cold roll/EG</b>				
DP590/600	0.10	1.0	0.3	
DP690	0.15	1.4	0.3	
DP780	0.10	1.6	0.3	
DP980 – mid C	0.15	1.4	0.3	
DP980 – low C	0.09	2.1	0.65	
DP980 – high YS	0.09	2.1	0.65	Mo
DP1180 – RF	0.16	1.8	0.4	Nb, Ti
DP1180 – CS	.015	2.2	0.6	Nb, Ti, Al
<b>Galvanize/galvanneal</b>				
DP500	0.05	1.45	0.125	Cr, Mo
DP590/600	0.09	1.6 – 1.9	0.2 – 0.3	Cr, Mo
DP780	0.09	2.1	0.3	Cr, Mo, Nb
DP980	0.09	2.2	0.3	Cr, Mo, Nb, Ti, B
DP1180	0.14	2.7	0.7	Cr, Mo, Nb, Ti, B

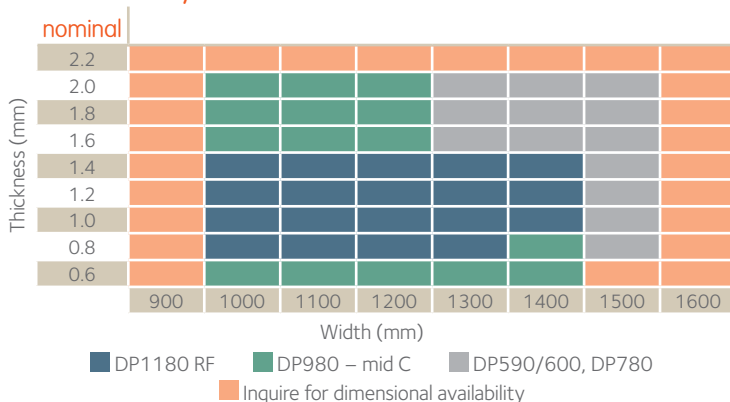
## Mechanical properties - Typical

	Test – Direction	Yield strength (MPa)	Ultimate tensile strength (MPa)	Total elongation (percent)
<b>Hot roll</b>				
DP590/600	JIS-T	400	630	27
<b>Cold roll/EG</b>				
DP590/600	ASTM – L	370	635	24.5
DP690	ASTM – L	600	760	16.6
DP780	ASTM – L	480	830	18.2
DP980 – mid C	ASTM – L	600	1030	13.8
DP980 – low C	JIS – T	650	1030	14.7
DP980 – high YS	ASTM – L	800	1050	11.9
DP1180 – RF	ASTM – L	960	1270	10.1
DP1180 – CS	JIS – T	940	1250	11
<b>Galvanize/galvanneal</b>				
DP500 – GA	JIS – T	355	583	28
DP590/600	ASTM – L	365	620	27
DP780	ASTM – L	490	830	19
DP980	ASTM – L	660	1000	13
	JIS – T	645	1030	14
DP1180	JIS – T	855	1220	9.9

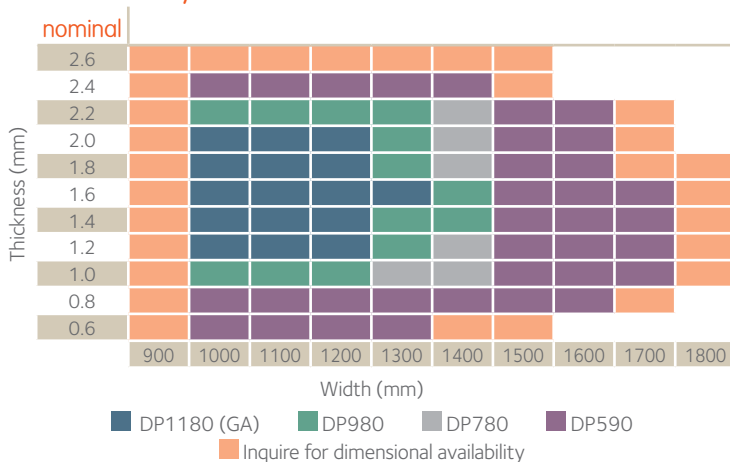
## Size availability – Hot roll – DP590/DP600



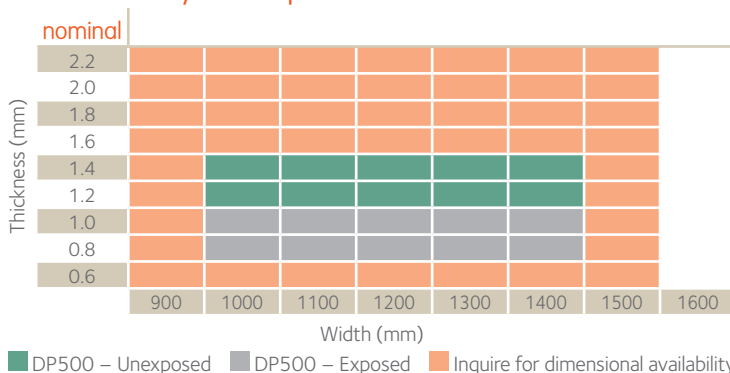
## Size availability – Cold roll/EG



## Size availability – GA/GI



## Size availability – Dual phase 500



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March 2019