phs-directform® 1500

The pioneer in galvanized, press-hardened components produced using direct hot forming

phs-directform®, the innovation developed by voestalpine, is directly hot-formed, hot-dip galvanized steel strip to be used in corrosion-resistant light-weight components for the automotive industry. phs-directform® is a conversion-delayed boron steel with a galvannealed coating ZF180. Hot forming can be performed in existing hot-forming lines with a minimum of adaptation.
phs-directform® is the simple and economical solution for press-hardened components that are subject to heavy corrosion. With its excellent properties in joining, paintability and crash performance, phs-directform is recommended for roof frames, cross members, stiffeners, rocker panels, bumpers and B pillars.

Convincing advantages:

- Excellent cathodic corrosion protection
- Economical manufacturing, even when processing small lots
- Excellent processability and paintability
- 1500 MPa tensile strength

The blanks are heated to roughly 900 °C. The subsequent precooling prevents microcracking during subsequent forming. The blanks are then formed into their final geometry and hardened prior to final cutting. When requested by the customer, component surfaces are conditioned and transport corrosion protection is applied.

Chemical composition:

Heat analysis in mass %

Steel grade	C	Si max.	Mn max.	P max.	S max.	Al	Cr max.	Mo max.	Ti + Nb max.	B
phs-directform 1500	0.17 – 0.23	0.5	2.5	0.02	0.005	0.02 – 0.3	0.05	0.2	0.1	0.002 – 0.005

Mechanical properties: Tensile test/Bending test

Test direction: transverse to rolling direction

TENSILE TEST IN IN NON-HARDENED DELIVERY CONDITION

Steel grade	0.2 % yield strength $R_{p0.2}$ [MPa]	Tensile strength R_m [MPa]	Total elongation [%] min. A_{80}	A_{50}
phs-directform 1500	300 – 600	600 – 900	12	-

TENSILE AND BENDING TESTS IN HARDENED CONDITION

Steel grade	0,2 % yield strength [1] $R_{p0.2}$ [MPa]	Tensile strength [1] R_m [MPa]	Total elongation [1] [%] min. A_{80}	A_{50}	Bending angle [1] [2] α_{1mm} [°] min.
phs-directform 1500	950 – 1250	1300 – 1650	-	5	50

[1] Mechanical parameters and coating properties in hardened condition are standard values achieved in professional processing of flat sheets. The indicated values are not guaranteed by voestalpine Stahl GmbH.
- Austenitization conditions 45 s annealing time after achieving component temperature of 870 °C
- Transfer time 1: < 10 s (transfer time = time between opening the furnace and beginning of precooling)
- Precooling with a cooling rate of > 20 K/s bis 500 °C
- Transfer time 2: < 7 s (transfer time = time between end of precooling and closing the press)
- Cooling conditions in the press tool: Cooling rate > 40 K/s during cooling between water-cooled plates

[2] Instrument measurement of bending angle during bend test according to VDA 238-100, $\alpha 1mm = \alpha \times thickness^{0.35}$

Coating

UNHARDENED AS-DELIVERED CONDITION PURSUANT TO EN 10346

Coating class	Coating thickness [µm]	Fe content in coating [mass %]	Al content in coating [mass %]	Admixtures in coating [mass %] max.
ZF180	11 – 18	8 – 14	< 1	1

HARDENED CONDITION

Coating class	Coating thickness [1] [µm]	Gamma phase [1] [2]
ZF180	15 – 35	Yes/no (dependent on heat treatment)

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[2] Estimate from a galvanostatic resolution, corresponding to a resolution time of > 200 s and a current density of 10 mA/cm²

The parts should be shot-blast-cleaned for good weldability and corrosion resistance.

Available dimensions:

Maximum width [mm] per thickness, minimum width of 900 mm for wide strip

Steel grade	Thickness [mm] 1.0	2.0
phs-directform 1500	1580	1580

Additional dimensions upon request.

Please find further information and downloadable files at
www.voestalpine.com/phs-directform

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voestalpine
ONE STEP AHEAD.