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HOT-ROLLED STEEL STRIP FOR THE AUTOMOTIVE INDUSTRY

A wide range of high-strength hot-rolled steels developed for complex component geometries with demanding forming operations

Hot-rolled steel grades developed for applications in the automotive industry have been combined in the "hot-rolled drive" steel product family. The family includes complex-phase, micro-alloyed and ferritic-bainitic steels. In order to meet the requirements of lightweight automotive design, "hot-rolled drive" grades feature above-average processing properties in addition to the properties specified in VDA 239-100.

Microalloyed steels are characterized by a very fine-grained and largely single-phase microstructure. The steels of the LAS series are especially suitable for the most demanding forming of punched edges.

The complex-phase steels and ferritic-bainitic steels feature a more pronounced transformation-hardened microstructure with a higher proportion of secondary phases. This leads to an optimized balance between total elongation and hole expansion, thus allowing complex forming steps.

Convincing advantages

- » Excellent combination of strength and cold formability
- » Achievement of demanding component geometries based on excellent suitability for bending and deep drawing
- » Best cutting and punching properties
- » Excellent formability of punched edges and high resistance to edge cracking
- » Excellent weldability resulting from low C equivalent
- » Available as hot-rolled strip in uncoated and hot-dip galvanized condition

Chemical composition

Heat analysis in mass %

Steel grade	Standard	C max.	Si max.	Mn max.	P max.	S max.	Al min.	Nb max.	Ti max.	Cu max.
Hot-rolled micro-alloyed steels										
HR300LA	VDA239-100	0.12	0.50	1.30	0.030	0.025	0.015	0.10	0.15	0.20
HR340LA	VDA239-100	0.12	0.50	1.50	0.030	0.025	0.015	0.10	0.15	0.20
HR380LA	VDA239-100	0.12	0.50	1.50	0.030	0.025	0.015	0.10	0.15	0.20
HR420LA	VDA239-100	0.12	0.50	1.60	0.030	0.025	0.015	0.10	0.15	0.20
HR460LA	VDA239-100	0.12	0.50	1.65	0.030	0.025	0.015	0.10	0.15	0.20
HR500LA	VDA239-100	0.12	0.50	1.70	0.030	0.025	0.015	0.10	0.15	0.20
HR550LA	VDA239-100	0.12	0.60	1.80	0.030	0.025	0.015	0.10	0.15	0.20
HR700LA	VDA239-100	0.12	0.60	2.10	0.030	0.025	0.015	0.10	0.20	0.20

Hot-rolled and micro-alloyed steels with improved formability of punched edges

LAS stands for hot-rolled, micro-alloyed steels with adapted hot-rolling parameters and a significantly reduced sulfur content as compared to standard grades.

HR300LAS	VDA239-100	0.12	0.50	1.30	0.030	0.010	0.015	0.10	0.15	0.20
HR340LAS	VDA239-100	0.12	0.50	1.50	0.030	0.010	0.015	0.10	0.15	0.20
HR380LAS	VDA239-100	0.12	0.50	1.50	0.030	0.010	0.015	0.10	0.15	0.20
HR420LAS	VDA239-100	0.12	0.50	1.60	0.030	0.010	0.015	0.10	0.15	0.20
HR460LAS	VDA239-100	0.12	0.50	1.65	0.030	0.008	0.015	0.10	0.15	0.20
HR500LAS	VDA239-100	0.12	0.50	1.70	0.030	0.005	0.015	0.10	0.15	0.20
HR550LAS	VDA239-100	0.12	0.60	1.80	0.030	0.005	0.015	0.10	0.15	0.20
HR700LAS	VDA239-100	0.12	0.60	2.10	0.030	0.005	0.015	0.10	0.20	0.20

Steel grade	Standard	C max.	Si max.	Mn max.	P max.	S max.	Al	Ti+Nb max.	Cr+Mo max.	B max.	Cu max.
Hot-rolled complex-phase steels											
HR660Y760T-CP	VDA239-100	0.18	1.00	2.20	0.050	0.010	0.015 - 1.2	0.25	1.00	0.005	0.20
Hot-rolled ferritic-bainitic steels											
HR440Y580T-FB	VDA239-100	0.18	0.50	2.00	0.050	0.010	0.015 - 2.0	0.15	1.00	0.010	0.20

Mechanical properties: Tensile test

Lengthwise test direction

$A_{80\text{ mm}}$ for thicknesses < 3 mm

A_5 for thicknesses \geq 3 mm

Steel grade	Standard	0.2 % yield strength	Tensile strength	Total elongation min.		n value min.
		$R_{p0.2}$ [MPa]	R_m [MPa]	$A_{80\text{ mm}}$ [%]	A_5 [%]	n_{10-20/A_g}
Hot-rolled micro-alloyed steels						
HR300LA	VDA239-100	300 – 380	380 – 500	24	28	0.14
HR340LA	VDA239-100	340 – 440	420 – 540	22	26	0.13
HR380LA	VDA239-100	380 – 480	450 – 570	20	24	-
HR420LA	VDA239-100	420 – 520	480 – 600	18	22	-
HR460LA	VDA239-100	460 – 560	520 – 640	16	20	-
HR500LA	VDA239-100	500 – 620	560 – 700	14	17	-
HR550LA	VDA239-100	550 – 670	610 – 750	12	16	-
HR700LA	VDA239-100	700 – 850	750 – 950	10	13	-

Hot-rolled and micro-alloyed steels with improved formability of punched edges

The hot-rolled microalloyed steels of the LAS series are characterized by enhanced formability, especially with respect to the formability of punched edges.

HR300LAS	VDA239-100	300 – 380	380 – 500	24	28	0.14
HR340LAS	VDA239-100	340 – 440	420 – 540	22	26	0.13
HR380LAS	VDA239-100	380 – 480	450 – 570	20	24	-
HR420LAS	VDA239-100	420 – 520	480 – 600	18	22	-
HR460LAS	VDA239-100	460 – 560	520 – 640	16	20	-
HR500LAS	VDA239-100	500 – 620	560 – 700	14	17	-
HR550LAS	VDA239-100	550 – 670	610 – 750	12	16	-
HR700LAS	VDA239-100	700 – 850	750 – 950	10	13	-

Steel grade	Standard	0.2 % yield strength	Tensile strength	Total elongation min.		BH ₂ value min.
		$R_{p0.2}$ [MPa]	R_m [MPa]	$A_{80\text{ mm}}$ [%]	A_5 [%]	[MPa]
Hot-rolled complex-phase steels						
HR660Y760T-CP	VDA239-100	660 – 820	760 – 960	10	13	30
Hot-rolled ferritic-bainitic steels						
HR440Y580T-FB	VDA239-100	440 – 600	580 – 700	15	17	30

Coatings and available dimensions

Available thicknesses [mm] based on coating

Steel grade	UC (uncoated)	GI (hot-dip galvanized)
Hot-rolled micro-alloyed steels		
HR300LA	2.0 – 6.0 ¹⁾	-
HR340LA	2.0 – 6.0	-
HR380LA	2.0 – 6.0 ¹⁾	2.0 – 3.0
HR420LA	2.0 – 6.0	2.0 – 3.0
HR460LA	2.0 – 6.0 ¹⁾	2.0 – 3.0
HR500LA	2.0 – 6.0	2.0 – 3.0 ¹⁾
HR550LA	2.0 – 6.0	2.0 – 3.0 ¹⁾
HR700LA	2.0 – 6.0	2.0 – 3.0
Thermomechanically rolled and micro-alloyed steels with improved formability		
HR300LAS	2.0 – 6.0 ¹⁾	-
HR340LAS	2.0 – 6.0 ¹⁾	-
HR380LAS	2.0 – 6.0 ¹⁾	2.0 – 3.0 ¹⁾
HR420LAS	2.0 – 6.0 ¹⁾	2.0 – 3.0 ¹⁾
HR460LAS	2.0 – 6.0 ¹⁾	2.0 – 3.0 ¹⁾
HR500LAS	2.0 – 6.0 ¹⁾	2.0 – 3.0 ¹⁾
HR550LAS	2.0 – 6.0 ¹⁾	2.0 – 3.0 ¹⁾
HR700LAS	2.0 – 6.0	2.0 – 3.0 ¹⁾
Hot-rolled complex-phase steels		
HR660Y760T-CP	2.0 – 5.0 ¹⁾	2.0 – 3.0
Hot-rolled ferritic-bainitic steels		
HR440Y580T-FB	2.0 – 5.0	2.0 – 3.0 ¹⁾

¹⁾After consultation with quality control

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