

**MOLDING & TOOLING ALUMINUM
WELDURAL & HOKOTOL**

Aleris





WELDURAL

FIELDS OF APPLICATION

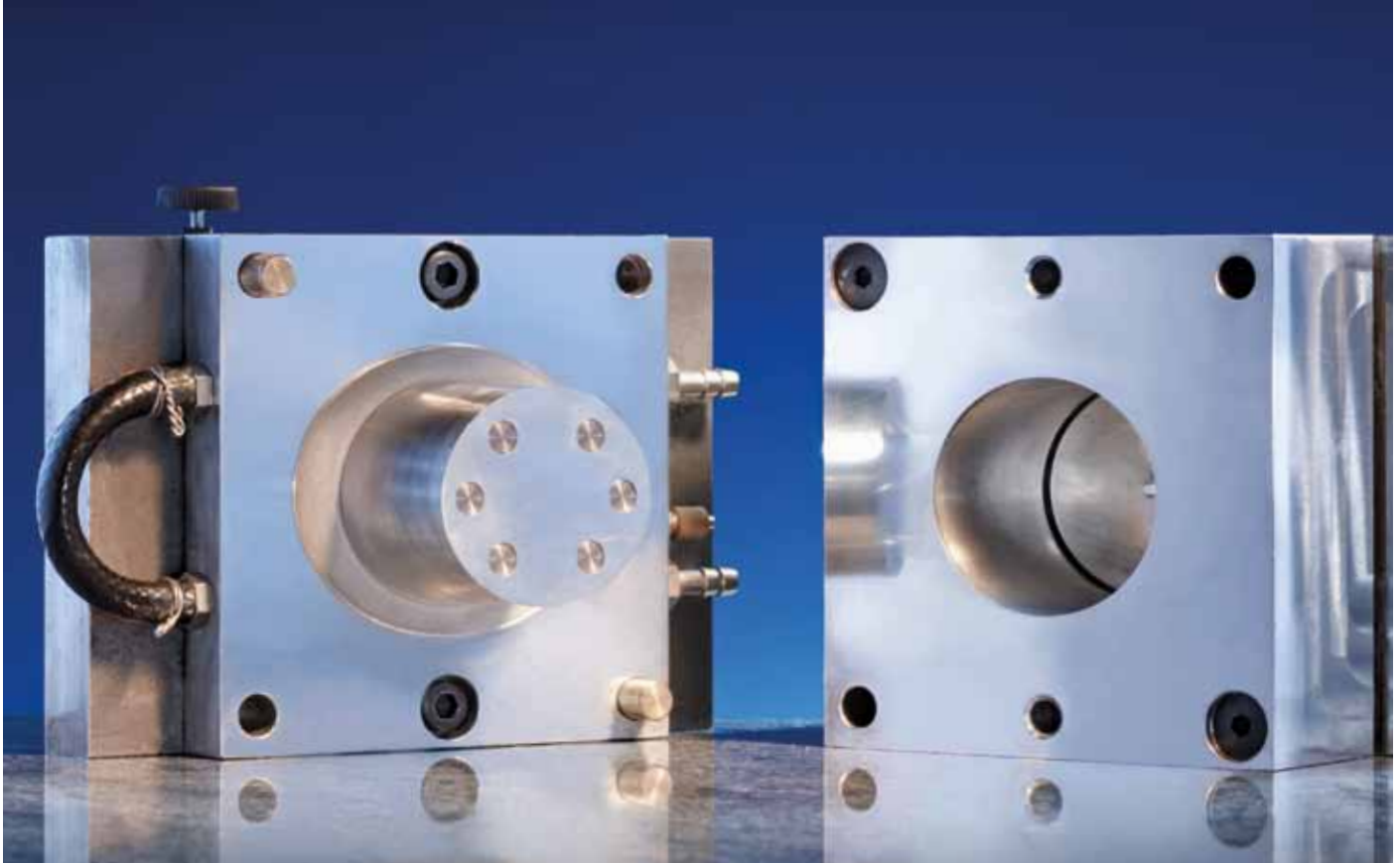
- molds for blow forming and injection molding for the plastic processing industry
- molds and each type of high-temperature-stressed parts, e. g. molds for elastomer plastics
- highly precise mechanical parts (which require high dimensional stability)
- molds with welded constructions
- refrigeration engineering

CHARACTERISTICS

- low weight (approx. three times lighter in comparison to steel)
- very good machinability (approx. four times better in comparison to steel)
- extremely uniform mechanical properties across the total thickness
- excellent dimensional stability by stress relieving stretching or cold compression
- very good thermal conductivity (approx. three times higher in comparison to steel)
- excellent electrical conductivity (double higher speeds during electric discharge machining/EDM) is possible



Aluminum mold swingarm



HOKOTOL

FIELDS OF APPLICATION

- molds for blow forming and injection molding for the plastic processing industry
- bolsters and force plates (punching technique)
- machine parts for high strength requirements at a low weight
- mechanical components with elevated mechanical properties

CHARACTERISTICS

- low weight (approx. three times lighter in comparison to steel)
- excellent machinability (approx. five times better in comparison to steel)
- extremely uniform mechanical properties across the total thickness
- excellent mechanical properties in the centre of the plate
- excellent dimensional stability by stress relieving stretching or cold compression
- excellent thermal conductivity (approx. four times higher in comparison to steel)
- excellent electrical conductivity (double higher speeds during electric discharge machining/EDM) is possible

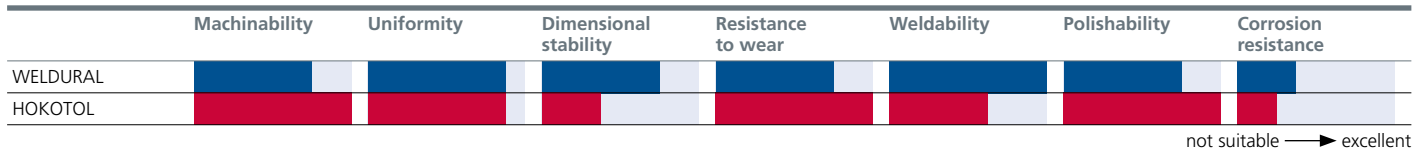


Aluminum mold flowerstand



ALLOY COMPARISON

Characteristics



Chemical composition (all data wt.-%)

Chemical elements		Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Zr	Other Individual	Other Total
WELDURAL	Min.	0,00	0,00	5,8	0,2	0,00	0,00	0,00	0,02	0,10	0,00	0,00
	Max.	0,30	0,4	6,8	0,4	0,1	0,05	0,1	0,10	0,25	0,05	0,15
HOKOTOL	Min.	0,00	0,00	1,5	0,00	1,8	0,00	5,7	0,00	0,08	0,00	0,00
	Max.	0,30	0,35	2,6	0,1	2,6	0,05	7,6	0,06	0,25	0,05	0,15

Physical properties in comparison to steel

Property	Hardness		Density		E-Modulus		Coeff. of thermal expansion 20–100 °C (68–212 °F) 10 ⁻⁶ · K ⁻¹	Thermal conductivity at room temperature W/(m · K) BTU · in/ft ² · h · °F		Electrical conductivity at room temperature m/Ω · mm ² %IACS	
	HB		g/cm ³	lbs/in ³	MPa	ksi					
WELDURAL	130		2,84	0,10	73.800	10.700	22,5	130	901,4	17,4	30,0
Steel 1.2312 (40CrMnMoS86)	300		7,85	0,28	215.000	31.200	12,5	35	242,7	10,3	17,8
Relation Al : St	1:2,3		1:2,8	1:2,8	1:2,9	1:2,9	1,9:1	3,7:1	3,7:1	1,7:1	1,7:1
HOKOTOL	180		2,83	0,10	70.300	10.200	23,5	154	1.067,8	23,0	39,7
Steel 1.2312 (40CrMnMoS86)	300		7,85	0,28	215.000	31.200	12,5	35	242,7	10,3	17,8
Relation Al : St	1:1,7		1:2,8	1:2,8	1:3,1	1:1,3	1,9:1	4,4:1	4,4:1	2,2:1	2,2:1

* IACS = Int. Annealed Copper Standard; BTU = British Thermal Unit

Comparison of various mold alloys dependent on the used type of plastic and the typical number of closures

Type of plastic	Typical number of closures < 1,000	< 50,000	< 150,000	< 500,000	< 2,000,000
Common plastics PP - PE - PET - PS - ABS	WELDURAL	WELDURAL	WELDURAL	WELDURAL / HOKOTOL	WELDURAL / HOKOTOL
PPO - PMMA - PC - PA - POM	WELDURAL	WELDURAL	WELDURAL / HOKOTOL	WELDURAL / HOKOTOL	Steel
Talc charged plastics	WELDURAL	WELDURAL / HOKOTOL	WELDURAL / HOKOTOL	WELDURAL / HOKOTOL	Steel
GF charged plastics	WELDURAL	WELDURAL / HOKOTOL	WELDURAL / HOKOTOL	Steel	Steel
Elastomers NR - EPDM - NDR	WELDURAL	WELDURAL	WELDURAL	Steel	Steel

■ WELDURAL

■ HOKOTOL

■ Steel



Swingarm mold with part

Minimum tensile properties for various thicknesses

Thickness		Tensile strength R _m		Yield strength R _{p0.2}		Elongation A ₅₀
mm	in	MPa	ksi	MPa	ksi	%
WELDURAL						
100	3,9	415	60,4	305	44,4	5,0
200	7,9	370	53,8	270	39,9	3,0
300	11,8	340	49,5	240	34,9	1,5
400	15,7	320	46,5	240	34,9	1,5
500	19,7	310	45,1	230	33,5	0,5
HOKOTOL						
100	3,9	550	80,0	495	72,0	4,0
200	7,9	500	72,7	430	62,5	1,0
300	11,8	460	66,9	400	58,2	1,0
325	12,8	450	65,5	390	56,7	1,0

* at room temperature; measured at S/4; test direction L-T

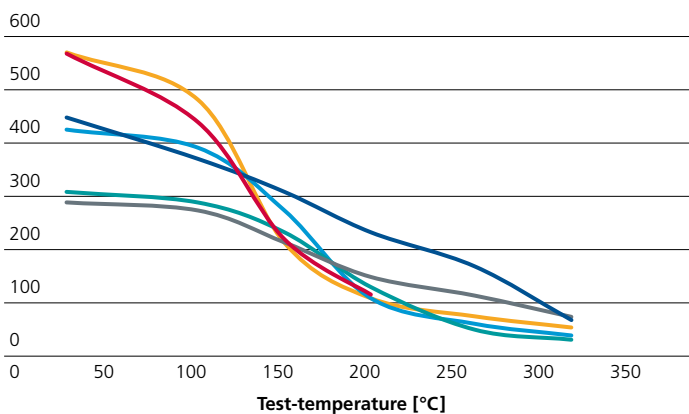
Typical tensile properties for various thicknesses

Thickness		Tensile strength R _m		Yield strength R _{p0.2}		Elongation A ₅₀
mm	in	MPa	ksi	MPa	ksi	%
WELDURAL						
100	3,9	455	66,0	350	50,8	7,5
200	7,9	440	63,8	335	48,6	6,5
300	11,8	405	58,7	320	46,4	3,5
400	15,7	365	52,9	305	44,2	2,5
500	19,7	345	50,0	295	42,8	1,5
600	23,6	395	57,3	315	45,7	3,5
700	27,6	395	57,3	315	45,7	3,5
HOKOTOL						
100	3,9	575	83,4	535	77,6	7,5
200	7,9	545	79,0	485	70,3	4,0
300	11,8	515	74,7	455	66,0	2,0
325	15,7	485	70,3	415	60,2	2,0

* at room temperature; measured at S/4; test direction L-T

Typical elevated-temperature tensile strength 10,000 h at test temperature, without load

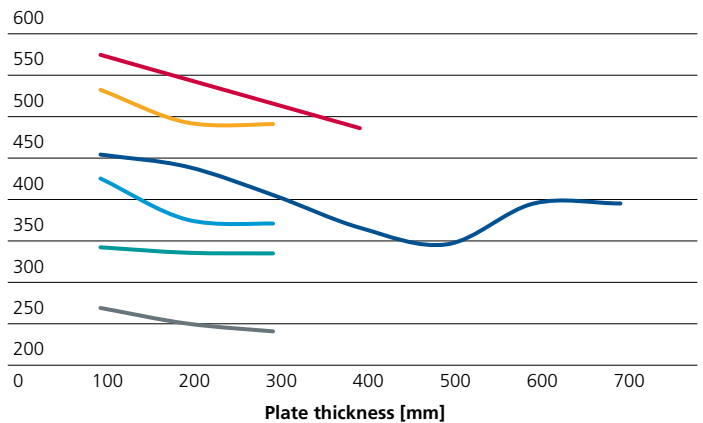
Elevated-temp. tensile strength [MPa]



■ WELDURAL
■ HOKOTOL
■ 2017 A T451
■ 7075 T651
■ 6061 T651
■ 5083 O / H111

Typical tensile strength

Tensile strength [MPa]

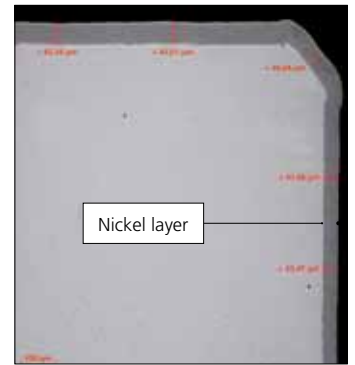
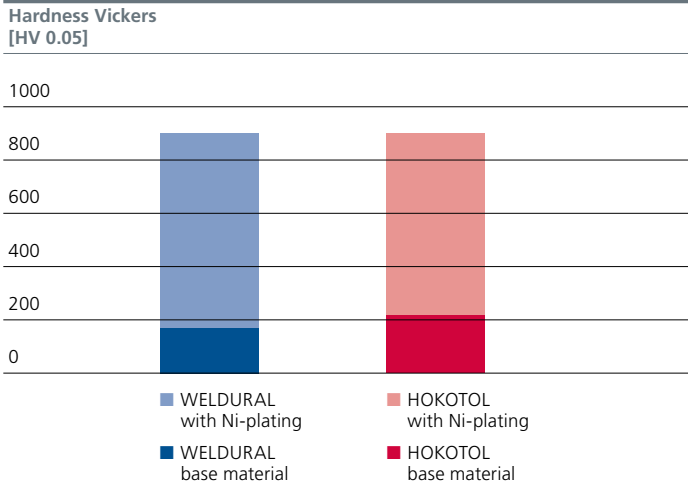


■ WELDURAL
■ HOKOTOL
■ 2017 A T451
■ 7075 T651
■ 6061 T651
■ 5083 O / H111



Inner part of a HOKOTOL mold

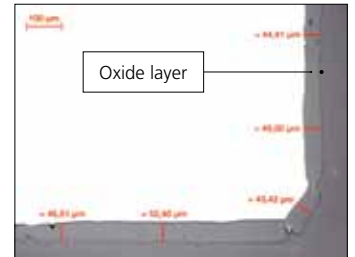
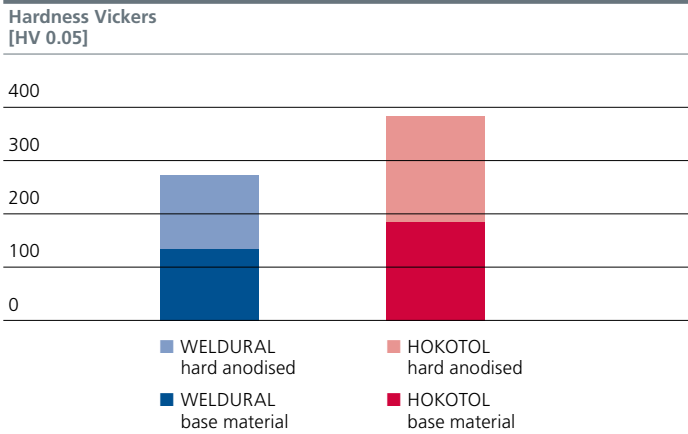
Surface treatment with hard chemical nickel plating



WELDURAL and HOKOTOL:
 900 Hardness Vickers
 ~ 52 HRC
 (Hardness Rockwell)

Alloy: WELDURAL
 Plated by Novoplan, Aalen, Germany

Surface treatment with hard anodising



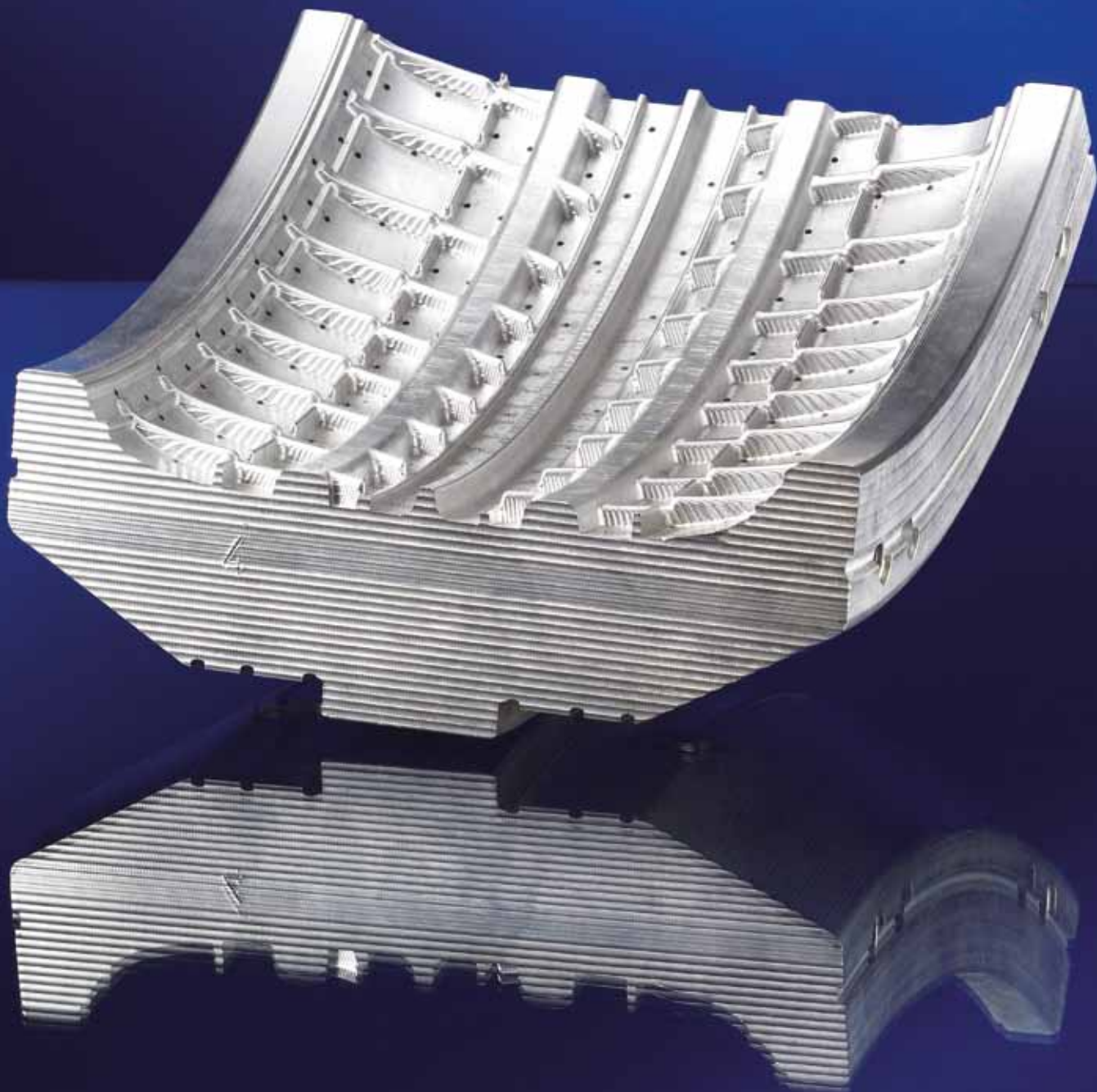
WELDURAL:
 270 Hardness Vickers
 ~ 25 HRC
 (Hardness Rockwell)

HOKOTOL:
 385 Hardness Vickers
 ~ 40 HRC
 (Hardness Rockwell)

Alloy: WELDURAL
 Anodised by AHC Oberflächentechnik, Kerpen, Germany



Weighing module



**Aleris
Global Rolled & Extruded Products**

Aleris Switzerland GmbH
Balz Zimmermann-Straße 7
8058 Zurich Airport · Switzerland
T +41 (0)44 828 1400

Molding Department

Aleris Aluminum Koblenz GmbH
Carl-Spaeter-Straße 10
56070 Koblenz · Germany
T +49 (0) 261 891 7974

www.aleris.com



Download any QR reader and scan.
Charges may apply.

© 2012, Aleris Switzerland GmbH

Care has been taken to ensure that this information is accurate, but Aleris, including its subsidiaries, does not accept responsibility or liability for errors or information which is found to be misleading.

Issue 7/12 · 1st release