Buderus | Edelstahl

DEĞİŞİM ÇELİK
ISIL İŞLEM LTD. ŞTİ.

PRESENTATION & OUR PRODUCTS

WHO ARE WE ?

As DÇ Değişim Çelik; Since 2000, we have been serving the steel industry with our European origin guaranteed, first class, certified products and our expert engineer staff and we are pleased to share our knowledge, experience and service with our customers.

We provide the steel needs of sectors such as Automotive, White Goods, Plastic, Machinery, Injection, Extrusion, Mold with the highest service and engineering knowledge by cutting the Qualified Steels that we import from European Countries such as Germany, Italy, France, Belgium with precise measurements.

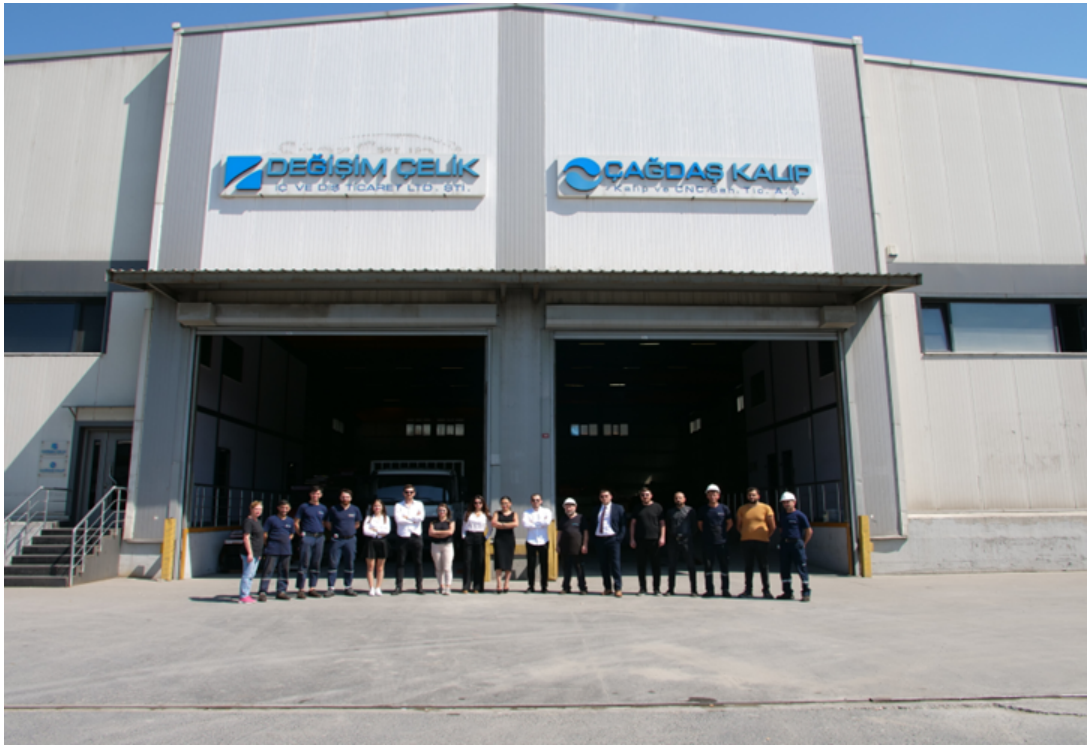
Apart from the brands under the Voestalpine High Performance Group and of course Buderus

Our goal is to ensure steady growth by reflecting our world-class superior service understanding and ethics to our local and international trade and production. We are proud to be a brand in our sector with our strong financial structure, a wide range and volume of stock, and many customers with whom we have long-standing partnerships.

We are taking very serious steps to ensure our position as the pioneer and leader of our sector in our country; also another step and target on a global scale. Our great strength based on years in areas such as financial, infrastructure, stocks, customer network; to grow professionally in an institutionalized and systematic way; in this sense, in our steps we take to realize our goal of becoming a global brand; we also receive support from expert and leading consultancy firms.

With our very strong and long-term experienced, hardworking, young and dynamic staff, we are always in the supply chain of our valued customers with our solution partnership, technical support and superior service understanding.

OUR FACILITY



Our company and factory operates in a closed area of 4.500 m2 and is located in Hadımköy/ISTANBUL and provides 24/7 service with our expert engineer staff. In addition to all these, we purchased an industrial land where we will build a 10.000 m2 closed factory area. Our factory construction has started on this land and we expect to complete it within 2 years.

Our 17-machines machine park in our factory; cutting can be made in accordance with every size and dimension, especially our 1100x2200 saw.

OUR STOCK

Our steel stock is approximately 5.000 tons includes the following steel groups;

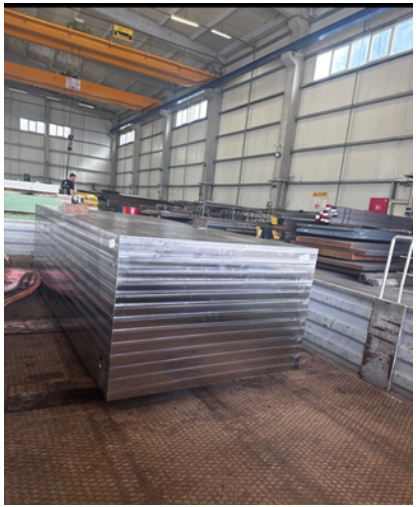
TOOL STEELS
- **Hot Work Tool Steels**
- **Cold Work Tool Steels**

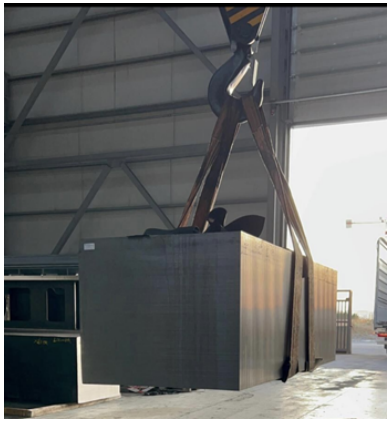
PLASTIC MOLD STEELS
HIGH SPEED STEELS
CARBON STEELS
RECLEMENTATION STEELS
CEMENTATION STEELS
NITRIDING STEELS

OUR PRODUCTS

U-cutted and milled steel for
TOGG / Sedan Project
970x1300x2700 1.2738 HH

Plastic mold steel for
TOFAS/STELLANTIS
project
850x1250x2750 1.2738

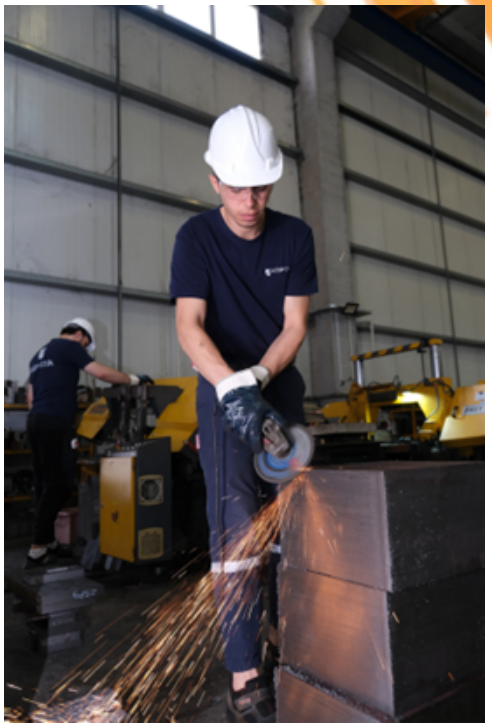




Plastic mold steel for our
customer producing white
goods
960x1100x3300 1.2312

OUR SERVICES

Some of the services we provide to our customers includes;
Cutting
Hardening
Heat Treatment
Cementation
Borwerk



OUR CUSTOMERS

We serve almost all industrial sectors. Our customers mainly operate in Automotive, White Goods, Plastic, Machinery, Injection, Extrusion, Mold sectors.

There are 2 highlights that we would like to share about our customers.

The first one; most of our customers are the largest and leading companies in their sectors which they operate.
Secondly, we have a long-term business relationship with most of our customers.

The services we provide, our competent staff, the good relationships we have established based on mutual trust, our professional approach, our ability to keep our promises, our strength in all areas; has enabled our customers to trust us and to establish long-term commercial cooperation with them.

We would like to proudly add that due to our power and capacity to export to all over the world; our export volume is increasing exponentially ever day.

OUR ACTIVITIES

As Değişim Çelik, we participated in many sectorel fairs both in Turkey and abroad as « exhibitors» for years.

A few examples of fairs in Turkey are ‘Metal Expo', which is organize in September/ every year that is the largest in the sector and ‘Kast Expo’ ,which is organize in December, which we have been participating in every year since they were organized.

Another examples of fair abroad such as the UK Metal NEC, Made in Steel Milan, Tube Dusseldorf which we already participated last year.

We planned for 2024 being exhebitor at UK Metal NEC 2024 , Tube 2024 Dusseldorf abroad and Metal Expo 2024 in Turkey and more. On this occasion, we both closely follow innovations , developments and expand our international customer network

OUR TEAM

We currently have more than 50 employees in total in our factory.
Our Sales team, consisting entirely of engineers, is currently 5 people in total.
In addition to this, we also have a Quality and Business Development Manager, who is a competent and expert engineer in his field, and is a solution partner to all our customers by supporting them in efficiency, the most suitable products and processes.

DEĞİŞİM ÇELİK / BUDERUS EDELSTAHL

We would like to proudly share that we are the sole authorized distributor of BUDERUS in Turkey as of 2024.

When the corporate identity of the Buderus brand, the efficiency of its unique branded products in tool steels and our strength, commercial capacity, wide customer network and well-equipped staff come together as Değişim Çelik, a tremendous synergy has been created.

This cooperation and the synergy it creates provides added value and efficiency to the Turkish industry and all sectors that use tool steels. Below, general information about Buderus Edelstahl and technical information and examples about one of the most important, well-known and unrivaled product groups of the brand, are shared.

BUDERUS EDELSTAHL GMBH
Company Key Figures
Fiscal Year 2021/2022

RAW STEEL PRODUCTION
242,000 t

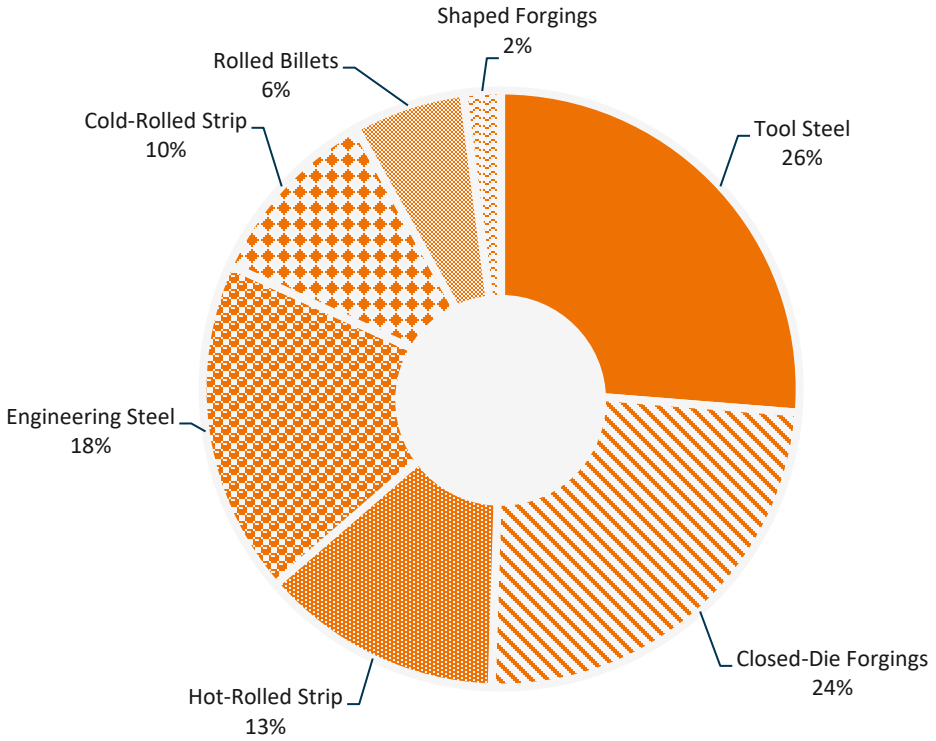
DELIVERIES
186,000 t

TURNOVER
382 Mio. €

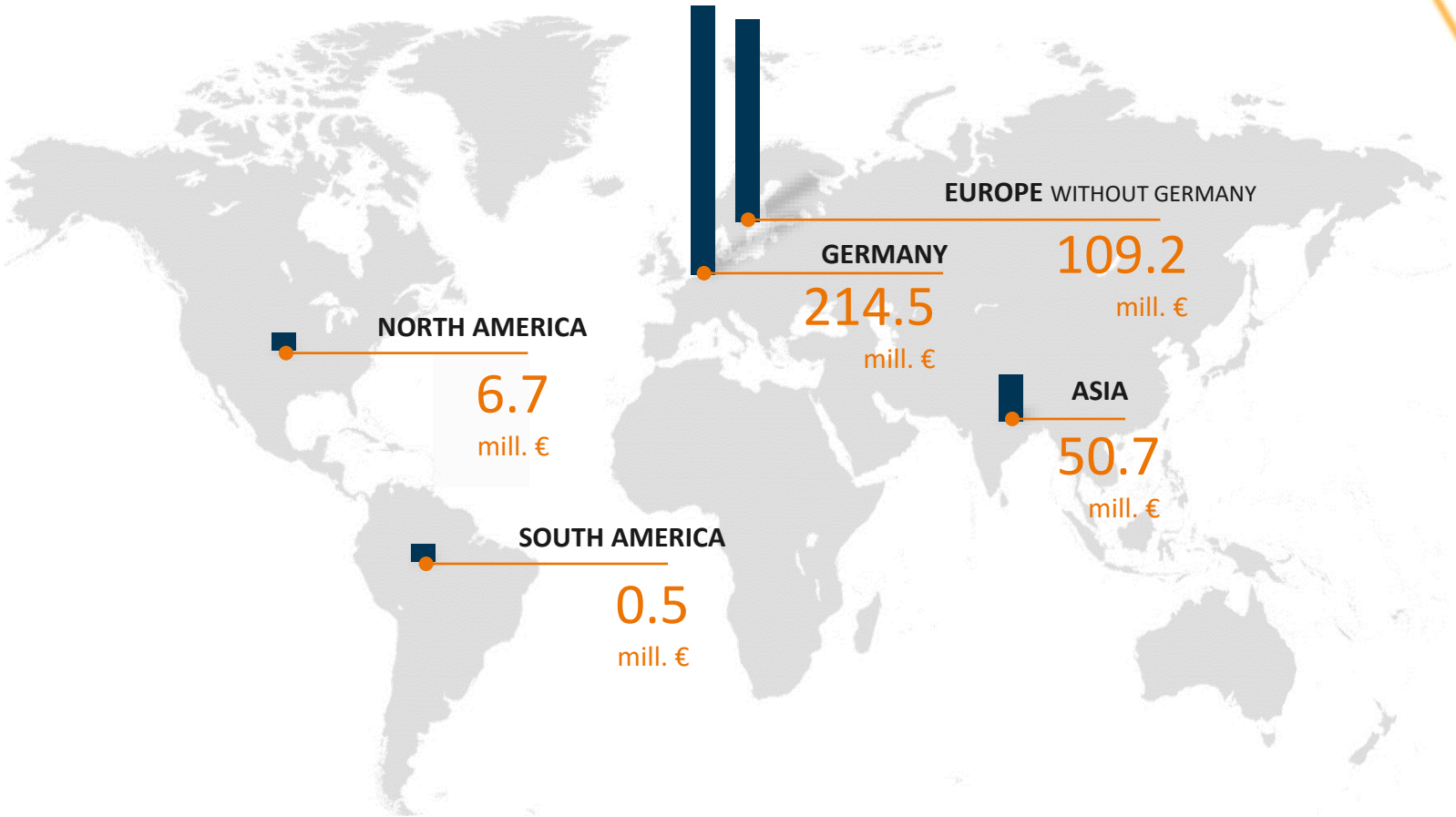
EMPLOYEES
1,263

APPRENTICES
55

BUDERUS EDELSTAHL GMBH
Company Key Figures
Fiscal Year 2021/2022



Buderus Edelstahl - Turnover by Region (FY 2021/2022)



Buderus Edelstahl – Our Global Sales Network

Buderus Edelstahl GmbH - Factory Site Overview

1 Steel Mill
2 Open-Die Forge
3 Hot Rolling Mill
4 Cold Rolling Mill
5 Closed-Die Forge
6 Heat Treatment
7 Machine Shop
8 Bar Stockholding

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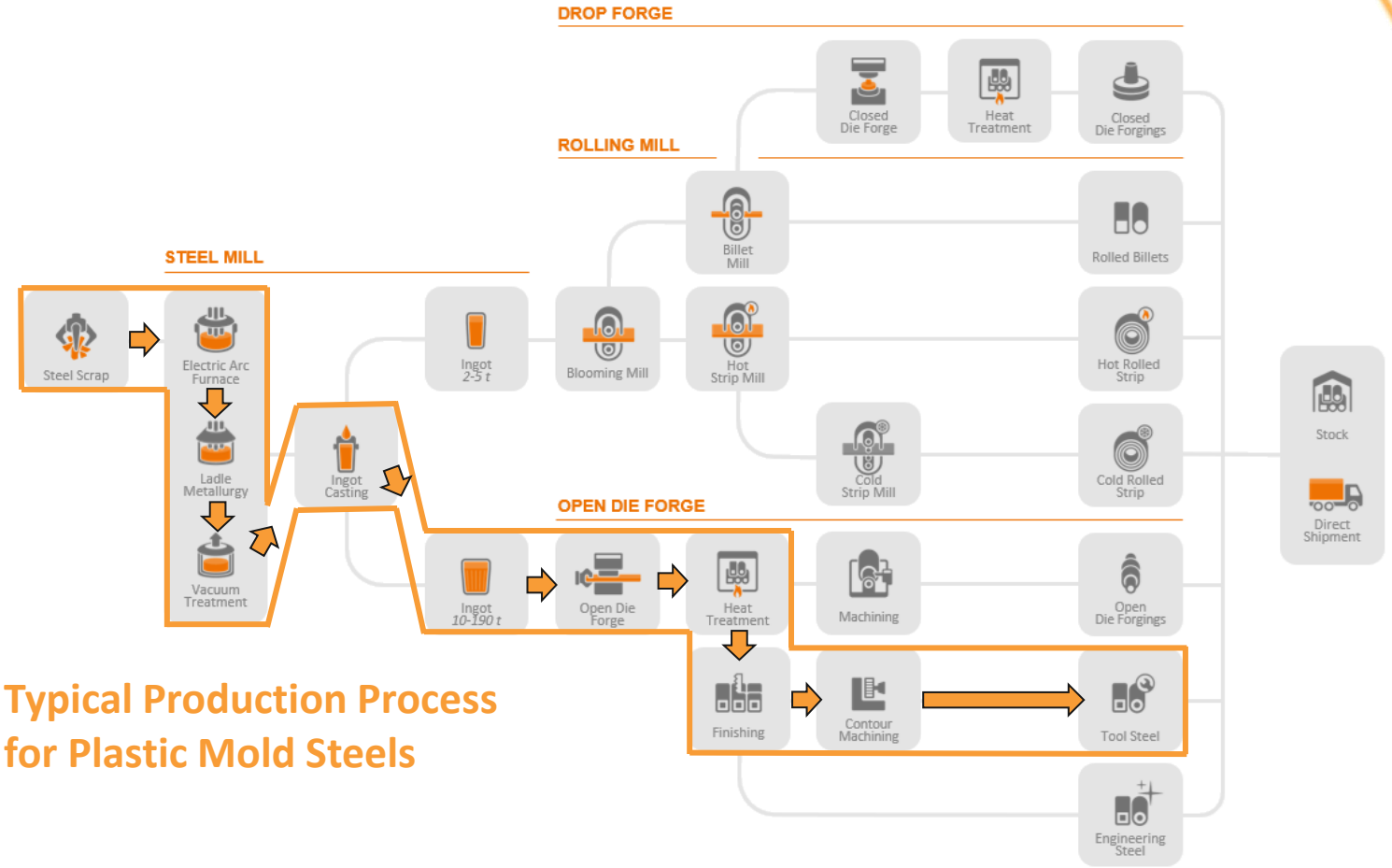
Plastic Mold Steels

Production and Applications

Buderus Production Process



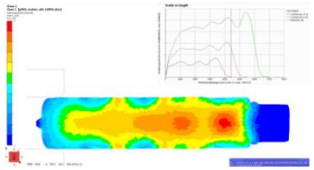
Typical Production Process for Plastic Mold Steels

Melting and Open-Die Forging

Melting

- melting in our own Electric Arc Furnace
- heat lots of up to 110 metric tons of liquid steel
- refining in ladle furnace incl. automated alloying
- Vacuum Degassing (VD) & melting to fine-grain practice of all our Tool Steels
- Vacuum Oxygen Decarburization (VOD) for low-Carbon Stainless Steel Grades (Super13%-Cr, F6NM, 16-5-1, etc.)
- ISO-B inclusion shape modification process (controlled calcium treatment) for enhanced transverse ductility & toughness
- extremely low content of non-metallic inclusions
- sulphur contents of less than 0.002% as well as tight control of residuals and impurities (Sn, Sb, etc.) are standard at Buderus
- internal laboratory for precise fine tuning of the chemical composition
- bottom poured ingots in a weight range of 2.8 to 190 metric tons
- argon shielding of pouring stream
- **semi-automatic advanced teeming system for ingots up to 10 metric tons**

Advanced Teeming System:



Open Die Forging

- forging presses with 20MN, 50MN and 80/100 MN press force
- hollow forging, stretching, upsetting, disc forgings up to a maximum diameter of approximately 4000mm (158”)
- flame cutting up to a diameter of 2000mm (79”)
- 20x forging furnaces with a maximum width of 4000mm (158”)
- Finite Element Method calculation of forging processes to ensure closure of all internal voids caused by shrinkage during solidification of the ingot

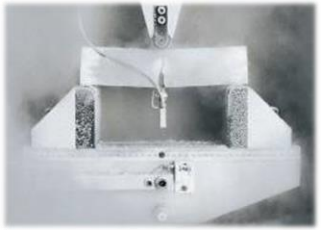
Heat Treatment, Machining and Quality Assurance

Heat Treatment

- 6x vertical furnaces, max. length: 11400mm (37 ft.), max. weight: 56 metric tons
- 1x vertical water quenching tank
- 34x horizontal batch-type furnaces, max. length: 16200mm (53 ft.)
- 3x horizontal water quenching tanks, 1x oil-/ polymer quenching tank each max. length: 15000mm (49 ft.)
- 5 continuous furnaces with 2x water quenching tanks (optional: polymer quenching for special Applications)
- separate fully automated heat treatment shop for closed-die forgings with 5x low- and 5x high-temperature furnaces with attached polymer quenching tank
- furnaces with calibration and pyrometry acc. AMS 2750E / API 6A Annex M for special applications

Machining

- machining of forgings with weights up to 120 metric tons
- as-deliverd weights up to 100 metric tons after final-machining
- numerically controlled horizontal turning lathes, max. Ø 2100mm (Ø 82”), max. length: 15000mm (49 ft.)
- deep-hole drilling up to a max. length of 13000mm (42 ft.)
- horizontal bore- and cylinder honing machine
- boring and milling operations (including core trepanning)
- saw cutting of cross-sections up to 2000 x 2000mm (79” x 79”)



Quality Assurance

- certified according to ISO 9001, ISO 14001, ISO 50001, ISO TS 16949 by LRQA
- health and safety management system acc. OHSAS 18001
- chemical analysis in laboratory fully certified acc. ISO / IEC 17025
- mechanical- and metallographic laboratories fully certified acc. ISO / IEC 17025
- level III and level II NDT-inspectors qualified acc. EN 473, ISO 971 and SNT-TC-1A
- manual-, mechanized- and automated ultrasonic inspection
- dye penetrant testing / magnetic particle testing
- 3.1-/ 3.2-inspections/ approved by: LRS, DNV, ABS, TÜV, GL, BV, etc.
- Approvals for the production of pressure equipment acc. PED 97/23/EC

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Typical Composition of Buderus Plastic Mold Steels

Buderus | Edelstahl

Typical Chemical Composition (wt-%)

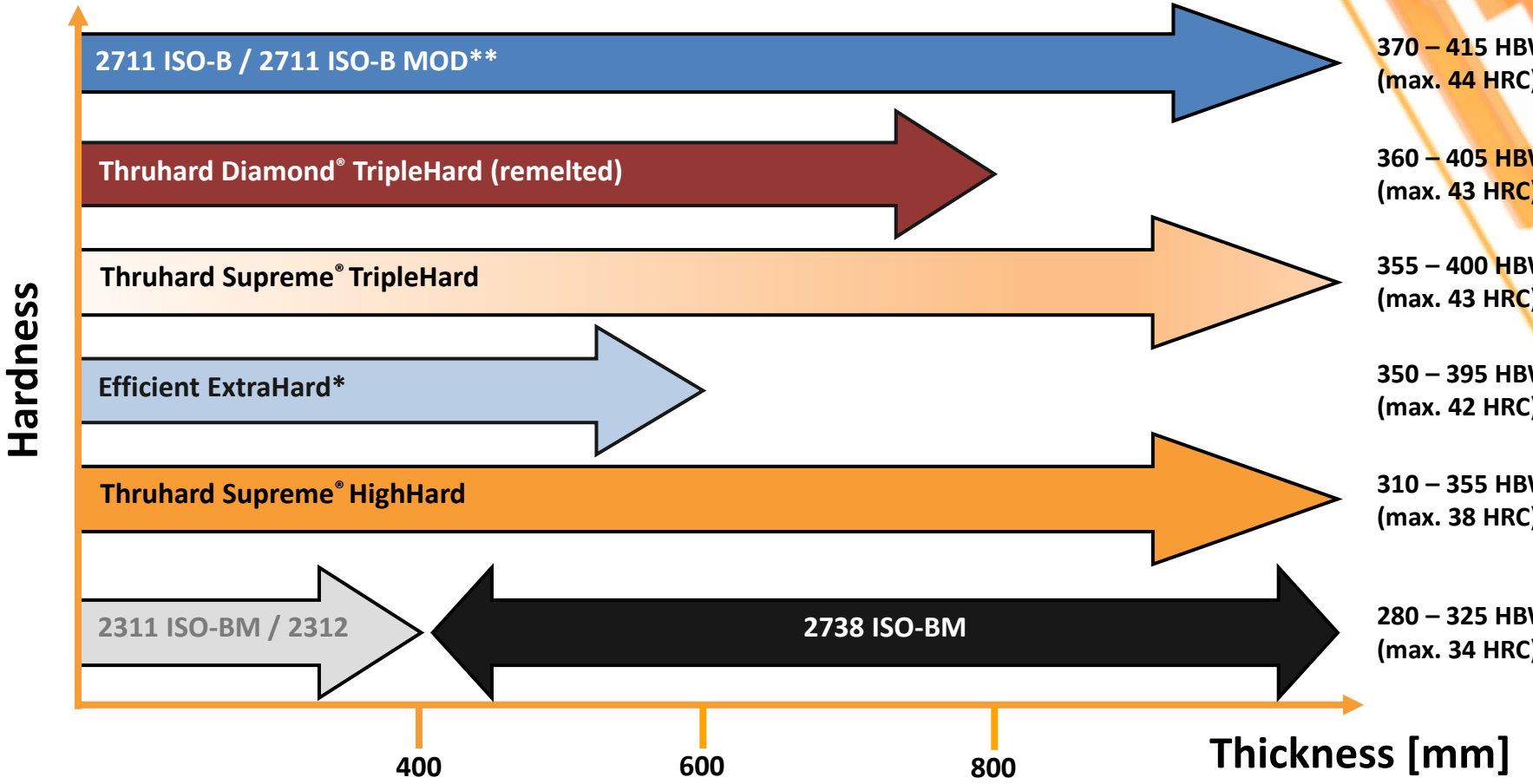
Steel Grade	DIN / EN / ISO	C	Si	Mn	S	Cr	Ni	Mo	V
Carbon Steel									
1203	C55E	0.53	0.20	0.80	< 0.003	-	-	-	-
1730	C45U	0.45	0.30	0.70	< 0.003	-	-	-	-
Low-Alloyed Tool Steel (Quenched + Tempered)									
2311 ISO-B	40 CrMnMo 7	0.38	0.30	1.50	< 0.002	2.00	-	0.20	-
2312	40 CrMnMoS 8-6	0.38	0.30	1.50	0.070	2.00	-	0.20	-
2738 ISO-BM	40 CrMnNiMo 8-6-4	0.38	0.30	1.50	< 0.002	2.00	1.00	0.20	-
Efficient Extrahard	-	0.30	0.10	1.45	< 0.002	1.35	0.65	0.50	-
2711 ISO-B	54 NiCrMoV 6	0.52	0.20	0.70	< 0.003	0.75	1.70	0.30	0.10
2711 ISO-B MOD	-	0.52	0.20	0.95	< 0.003	1.05	2.00	0.75	0.12
Thruhard Supreme®	-	0.26	0.10	1.45	< 0.002	1.25	1.05	0.60	0.12
Thruhard Diamond®	-	0.28	0.10	1.45	< 0.002	1.25	1.05	0.70	0.15

Steel Grade	Machinability	Thermal Conductivity	Fracture Toughness	Corrosion Resistance	Weldability	Wear Resistance	Polishability	Texturability	Chrome-Plateability	Through-Hardenability	Nitridability	PVD-Coatability	High-Temperature Strength
Low-Alloyed Tool Steel (Quenched + Tempered)													
2311 ISO-BM	●●	●●	●●	○○	●●●	●	●●	●●	●●	●	●	○	●●
2312	●●●	●●	○	○○	●●	●	○○	○○	○	●	●	○	●●
2738 ISO-BM	●●	●●	●●	○○	●●●	●	●●	●●	●●	●●	●	○	●●
Efficient ExtraHard	●●	●●●	●●	○○	●●●	●●	●●●	●●	●●	●+	●	●	●●+
2711 ISO-B	●●	●●	●●●	○○	●●	●●●	●●●	●●●	●●●	●●	●	●	●●
2711 ISO-B MOD	●●	●●	●●●+	○○	●+	●●●	●●●	●●●	●●●	●●●	●●+	●●	●●
Thruhard Supreme®	●●	●●●	●●	○○	●●●	●●●	●●●	●●●	●●●	●●●	●●	●+	●●●
Thruhard Diamond®	●●	●●●	●●●	○○	●●●	●●●	●●●+	●●●	●●●	●●●	●●●	●+	●●●

●●● = excellent ●● = good ● = standard ○ = low ○○ = very low

Low-Alloyed Plastic Mold Steels

Recommended Size Limitations for Plastic Mold Steels



* : width on request

**: for Standard Grade 2714 ISO-B we recommend Quench + Temper in Near-Net Shape (Contour-Hardening) for applications that require high toughness levels

Material Concept | 2311 ISO-BM

Contour milling to 3D-data

		Typical Chemical Composition (wt-%)					
Steel Grade	Limit	C	Si	Mn	S	Cr	Mo
2311 acc. SEE 202	min.	0.35	0.20	1.30	max.	1.80	0.15
	max.	0.45	0.40	1.60	0.035	2.10	0.25
2311 ISO-BM	typical	0.38	0.30	1.50	0.001	2.00	0.20

Characteristics:

- standard Mold Steel with sufficient through-hardenability for heat treated section thicknesses up to 400mm
- good Machinability
- easy to Polish
- Hard-Chrome Plateable

Heat Treatment Condition*:

- Quenched and Tempered to 280 – 325 HBW

Typical Applications:

- Small and medium-sized Injection- & Press Molds
- Mold Frames

*) Surface Hardness

Material Concept | 2312

Core Part made of 2312 undergoing rough machining

Steel Grade	Limit	Typical Chemical Composition (wt-%) C	Si	Mn	S	Cr	Mo
2312 acc. SEL	min.	0.35	0.30	1.40	0.050	1.80	0.15
	max.	0.45	0.50	1.60	0.100	2.00	0.25
2312	typical	0.38	0.30	1.50	0.070	2.00	0.20

Characteristics:

- resulphurized Mold Steel with sufficient through-hardenability for heat treated section thicknesses up to 400mm
- excellent Machinability due to controlled Sulphur-Alloying

not recommended for Polishing, Photo-Etching or Hard-Chrome Plating

Heat Treatment Condition*:

- Quenched and Tempered to 280 – 325 HBW

Typical Applications:

- Core Parts without requirements for the Surface Finish
- Mold Frames subjected to low Mechanical Stresses

*) Surface Hardness

Material Concept | 2738 ISO-BM

…an Invention of Buderus Edelstahl !

Cavity for Truck Motor Hood

		Typical Chemical Composition (wt-%)						
Steel Grade	Limit	C	Si	Mn	S	Cr	Ni	Mo
2738 acc. ISO 4957	min.	0.35	0.20	1.30	max.	1.80	0.90	0.15
	max.	0.45	0.40	1.60	0.030	2.10	1.20	0.20
2738 ISO-BM	typical	0.38	0.30	1.50	0.001	2.00	1.00	0.20

Characteristics:

- Alloying with about 1% of Nickel drastically improves through-hardenability compared to 2311 ISO-BM and allows for good core properties even in large dimension Tooling
- Nitridable and Hard-Chrome plateable
- Flame Hardenable
- good Polishability and suitable for Photo-Etching

Heat Treatment Condition*:

- Quenched and Tempered to 280 – 325 HBW

Typical Applications:

- Large Tools for Press Dies and Injection Molds with a thickness in excess of 600mm

*) Surface Hardness

Material Concept | Efficient ExtraHard

Typical Chemical Composition (wt-%)

Steel Grade	C	Si	Mn	S	Cr	Ni	Mo
Efficient ExtraHard	0.30	0.10	1.45	0.001	1.35	0.65	0.50

Characteristics:

- Cost-Effective, high-hardness Mold Steel
- with it‘s added Nickel-content, the through-hardenability is sufficient for dimensions up to 600 mm thickness (width on request)
- Nitridable and Hard-Chrome plateable
- Flame- & Laser Hardenable
- good Polishability and suitable for Photo-Etching

Heat Treatment Condition*:

- Quenched and Tempered to 350 - 395 HBW

Typical Applications:

- medium-sized Compression- & Injection Molds with high hardness requirements and a maximum heat-treated section thickness of 600mm

*) Surface Hardness

Material Concept | 2711 ISO-B

Typical Chemical Composition (wt-%)

Steel Grade	Limit	C	Si	Mn	S	Cr	Ni	Mo	V
2711 acc. SEL	min.	0.50	0.15	0.50	max.	0.60	1.50	0.25	0.07
	max.	0.60	0.35	0.80	0.025	0.80	1.80	0.35	0.12
2711 ISO-B	typ.	0.52	0.20	0.70	0.001	0.70	1.70	0.30	0.10

Characteristics:

- Plastic Mold Steel with good Toughness, good Strength at elevated temperatures and high compressive strength
- Nitridable and Hard-Chrome plateable
- Flame-Hardenable
- good Polishability and suitable for Photo-Etching

Heat Treatment Condition*:

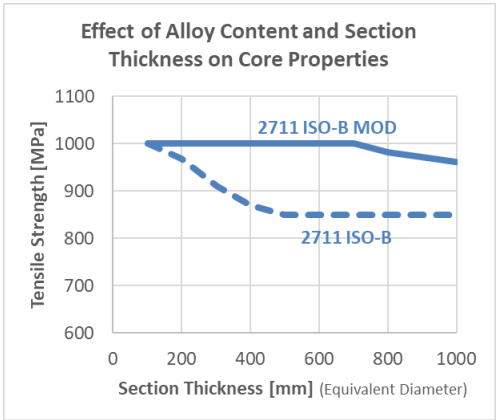
- Annealed to max. 250 HBW
- Quenched and Tempered to 280 – 325 HBW or 370 – 415 HBW
  (we recommend Q+T in Near-Net Shape)

Typical Applications:

- large Compression- & Injection Molds subjected to high Mechanical- & Thermal Stresses
- at higher working hardness, also suitable for processing SMC & GMT, in combination with surface coating if applicable

*) Oberflächenhärte

Pre-machined Mudguard Mold, prepared for Quench + Temper in Near-Net Shape
(generally recommended for Standard-Grade 2711 ISO-B)



Due to it's superior Through-Hardenability, we recommend 2711 ISO-B **MOD** when using larger, pre-hardened blocks without subsequent Heat Treatment

Material Concept | 2711 ISO-B **MOD**

Typical Chemical Composition (wt-%)

Steel Grade	Limit	C	Si	Mn	S	Cr	Ni	Mo	V
2711 acc. SEL	min.	0.50	0.15	0.50	max.	0.60	1.50	0.25	0.07
	max.	0.60	0.35	0.80	0.025	0.80	1.80	0.35	0.12
2711 ISO-B	typ.	0.52	0.20	0.70	0.001	0.70	1.70	0.30	0.10
2711 ISO-B MOD	typ.	0.52	0.20	**0.95**	0.001	**1.05**	**2.00**	**0.75**	0.12

Characteristics:

- Modified Plastic Mold Steel with good toughness, excellent Strength at elevated temperatures as well as high compressive strength
- improved Toughness and Wear Resistance compared to Standard-Grade 2711 ISO-B
- drastically improved Through-Hardenability compared to Standard-Grade 2711 ISO-B
- good Polishability and suitable for Photo-Etching
- Nitridable & Hard-Chrome plateable
- Flame- & Laser-Hardenable
- excellent Base-Metal Hardness in as-delivered conditions provides adequate support for PVD-Coatings

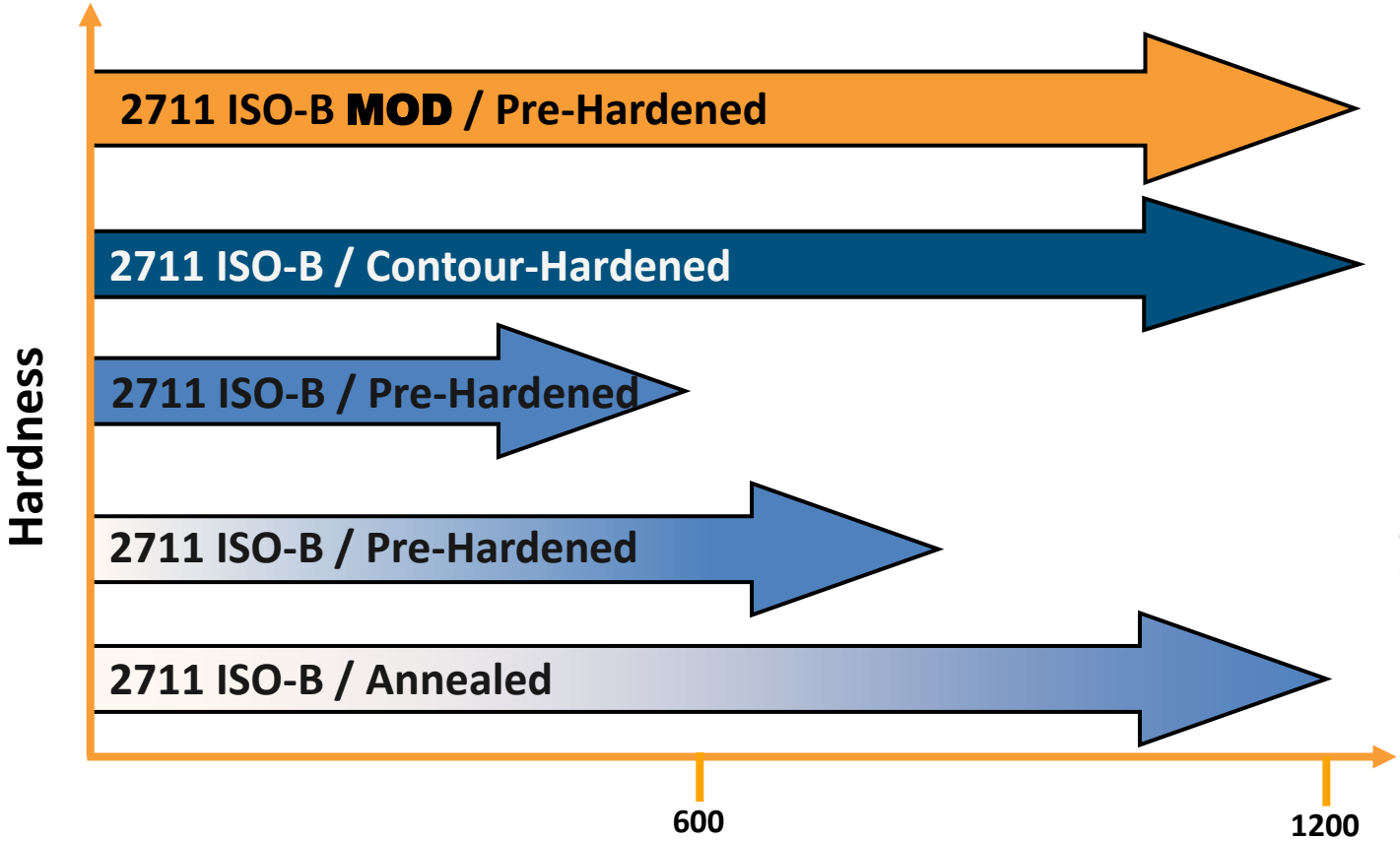
Heat Treatment Condition:

- Quenched + Tempered to a Surface Hardness of 370 – 415 HBW

Typical Applications:

- large Compression- & Injection Molds subjected to high Mechanical- & Thermal Stresses
- suitable for processing SMC & GMT, in combination with surface coating if applicable

Recommended Size Limitations for 2711 Material Concepts



Thruhard Supreme®

The Gold Standard for Plastic Molding in Large Dimensions

Material Concept | Thruhard Supreme®

Typical Chemical Composition (wt-%)

Steel Grade	C	Si	Mn	S	Cr	Ni	Mo	V
Thruhard Supreme®	0.26	0.10	1.45	0.001	1.25	1.05	0.60	0.12

Car Bumper Mold
(1160 x 1010 x 2700 mm, weight 22 metric tons)

Characteristics:

Thruhard Supreme® is distinguished from grade 2738 ISO-BM by:

- Higher Hardness and better Through-Hardenability
- Polishability up to 600 grit for HH & HHH Condition (High Gloss Finish available on request)
- Grain Reliability even with highly sensitive etch-graining designs
- improved Weldability
- higher Thermal Conductivity
- Flame- & Laser Hardenable, Nitridable, Hard-Chrome plateable and suitable for PVD as supplied

Heat Treatment Conditions*:

- TripleHard (HHH) : Quenched and Tempered to 355-400 HBW
- HighHard (HH) : Quenched and Tempered to 310-355 HBW
- Regular (HH) : Quenched and Tempered to 280-325 HBW

Applications:

Compression- & Injection Molds to accommodate large-dimension Parts such as Bumpers, Dashboards etc.

*) Surface Hardness

Thruhard Supreme®

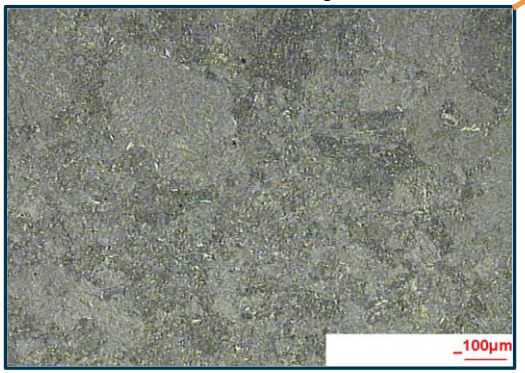
Chemical Composition (wt-%)

Steel Grade	Limit	C	Si	Mn	S	Cr	Ni	Mo	V
2738 acc. ISO 4957	min.	0.35	0.20	1.30	max.	1.80	0.90	0.15	-
	max.	0.45	0.40	1.60	0.030	2.10	1.20	0.25	
2738 ISO-BM	typical	0.38	0.30	1.50	0.001	2.00	1.00	0.20	-
Thruhard Supreme®	typical	0.26	0.10	1.45	0.001	1.25	1.05	0.60	0.12

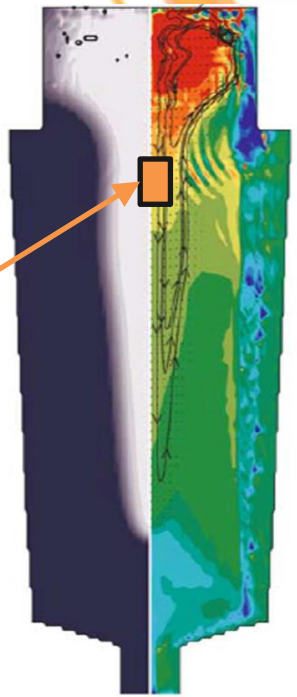
The chemical composition of Thruhard Supreme® has been optimized to reduce the detrimental effects of Macrosegregation in ingots dimensions required for large-sized Plastic Molds

1.2738

Thruhard Supreme®



Test Location

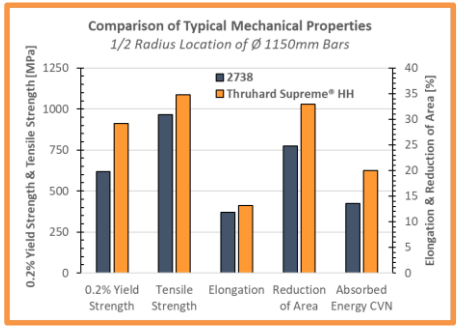


Microstructures in the core area after quenching and Tempering

of a large plastic mould steel block 1150 x 1150 x 3000mm (31t)

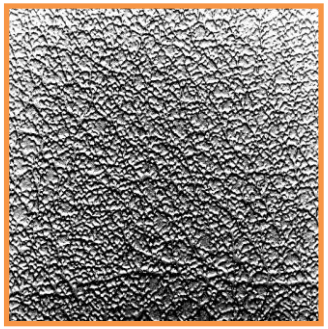
There are lots of Reasons for choosing Thruhard Supreme®

uniform Hardness distribution throughout the entire Cross-Section

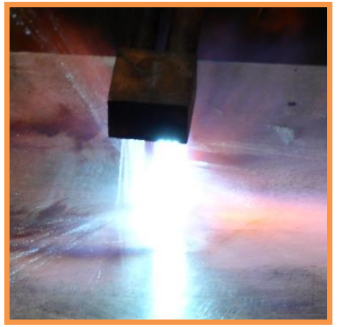


drastically improved Mechanical Properties

excellent Polishability (up to 600 grit)



excellent Texturability & high Grain Reliability



reduced susceptibility to Stress-Cracking during Welding or Surface Hardening

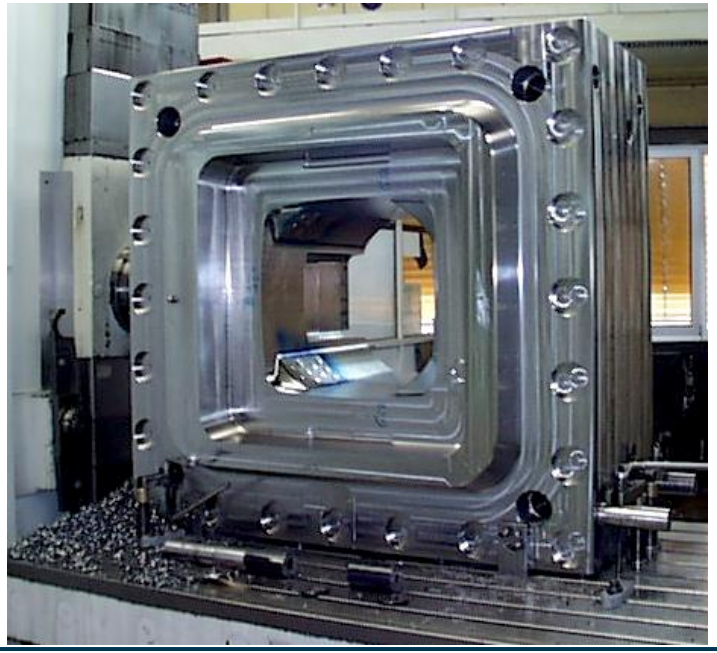
Applications for Thruhard Supreme® HighHard (HH)

Porsche Panamera Turbo

Injection Mold for the Bumper

Applications for Thruhard Supreme® HighHard (HH)

as-forged Dimensions:
1270 x 1830 x 2020mm

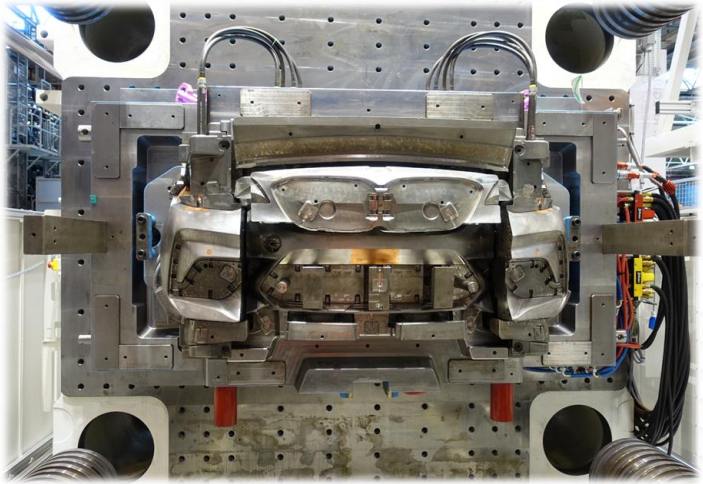


as-forged Dimensions:
1270 x 1830 x 900mm

Source:
Fa. Otto

Core and Cavity for a Dust Bin Mold

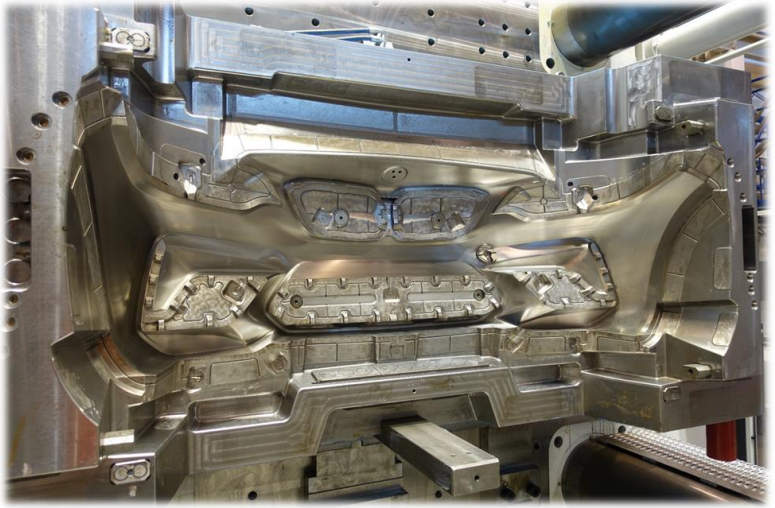
Applications for Thruhard Supreme® HighHard (HH)



BMW M2 Competition (F87-Facelift)

Injection Mold for the front Bumper

as-forged Dimension:
1200 x 1170 x 2800mm



Source: Magna Exteriors (Meerane) GmbH

Thruhard Diamond®

Supreme Performance with a Mirror-Finish

Thruhard Diamond® TripleHard (HHH)

Steel Grade	C	Si	Mn	S	Cr	Ni	Mo	V
Thruhard Diamond®	0.28	0.10	1.45	0.001	1.25	1.05	0.70	0.15

Characteristics:

HighGloss Plastic Mold Steel developed by Buderus Edelstahl

Thruhard Diamond® is pushing the proven Thruhard Supreme® Material Concept one step further:

- Remelting for extreme Cleanliness and the most homogeneous Microstructure possible
- polishability up to 3 µm diamond paste (e.g. Mirror-Surface Finish acc. class SPI-A1 or ISO 1302-N1)
- excellent Texturability even with highly sensitive etch-graining designs
- Laser Hardenable or Nitridable, Hard Chrome plateable and suitable for PVD as supplied
- up to 45% higher Thermal Conductivity compared to ESR Lens Mold Steels like H11/H13 or 1.2083
- vastly superior Weldability compared to H11/H13 or 1.2083

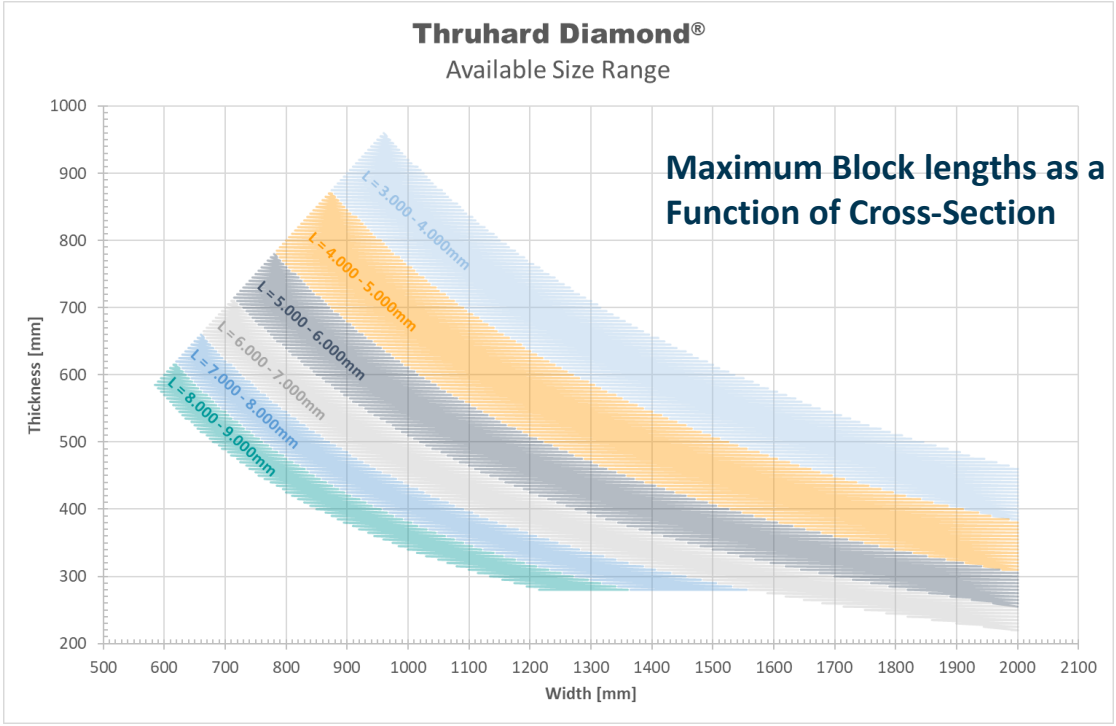
Heat Treatment Condition:

- Quenched and Tempered to a Surface Hardness of 360 – 405 HBW

Applications:

Injection Molds and Compression Dies with the most demanding Surface Finish Requirements for producing items such as transparent Headlight Components, Automotive Trim and Radiator Grille Panels. Ideally suited for interior use, both for polished surfaces and for extra fine-grained surfaces.

Available Sizes | Thruhard Diamond® TripleHard (HHH)



Size Limits for Rectangular / Square Blocks		
Width:	2.000	mm
Thickness:	960	mm
Cross-Section:	924.000	mm^2
Weight:	25.000	KG

Buderus Plastic Mold Steels for Polishability Requirements

Buderus | Edelstahl

SPI	ISO 1302	Ra [µm]	Grinding / Polishing	Products	Buderus Steel Grade	Hardness
A-1	N1	0.025	3 µm Diamond-Paste	transparent with optical Function (e.g. Headlight – Lens)	**Thruhard Diamond® TripleHard**	360 – 405 HBW
A-2	N2	0.05	6 µm Diamond-Paste	transparent, without optical Function (e.g. Headlight – Cover)	**Thruhard Diamond® TripleHard**	360 – 405 HBW
A-3	N3	0.1	15 µm Diamond-Paste	non-transparent, coated (e.g. Radiator – Cowling)	Thruhard Supreme® TripleHard	355 – 400 HBW
B-1	N4	0.2	600-grit Paper	non-transparent, painted (e.g. Bumper)	Thruhard Supreme® HighHard 2767 ISO-B	310 – 355 HBW min. 50 HRC
B-2	N5	0.4	400-grit Paper	non-transparent, coated (e.g. Exhaust Header –Cowling)	2711 ISO-B / 2711 ISO-B MOD Efficient ExtraHard 2343 ISO-B MOD	370 – 415 HBW 350 – 395 HBW min. 44 HRC
B-3	N6	0.8	320-grit Paper	non-transparent, etched / painted (e.g. Dashboard)	Thruhard Supreme® 2738 ISO-BM Efficient® 2311 ISO-B 2316 ISO-B MOD (Corrosion Resistant)	280 – 325 HBW 280 – 325 HBW 280 – 325 HBW 280 – 325 HBW 265 – 310 HBW
C-1	N7	1.6	600-grit Stone	non-visible Components	2738 ISO-BM Efficient® 2311 ISO-B 2316 ISO-B MOD (Corrosion Resistant)	280 – 325 HBW 280 – 325 HBW 280 – 325 HBW 265 – 310 HBW

Typical Applications for Surface Quality Class SPE – A1

Headlight (PC, PMMA, etc.)

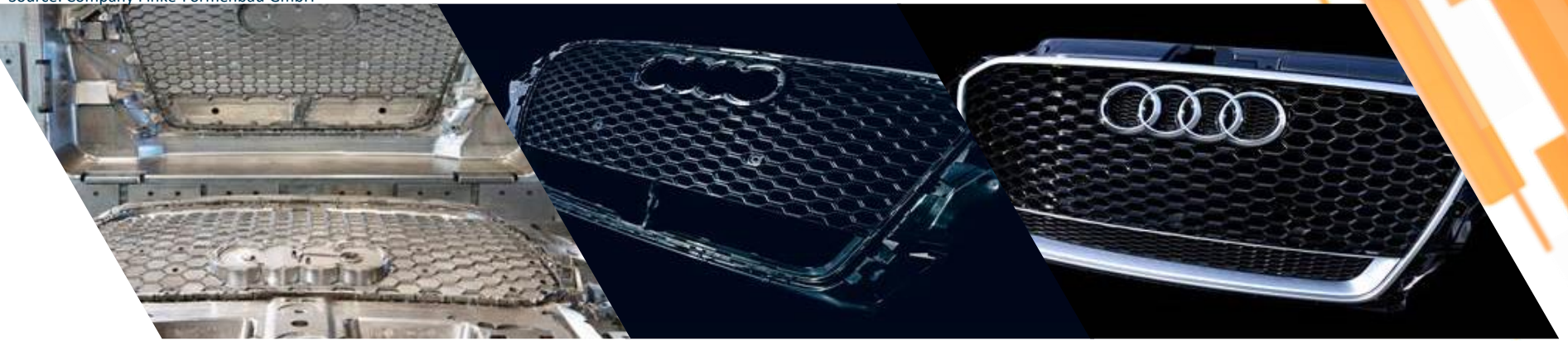
Bezel – A1
(non-transparent, Al-coated PC)

Lens
A1

Transparent Components with light–optical Function
A1

Typical Applications for Surface Quality Class SPE – A2

Source: Company Finke-Formenbau GmbH



Mold made from Thruhard Supreme® HighHard

painted PC Radiator Cowling

incl. Al-coated Design Elements

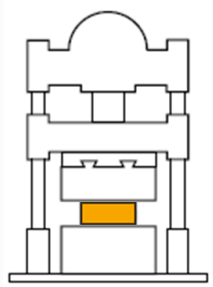
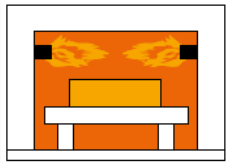
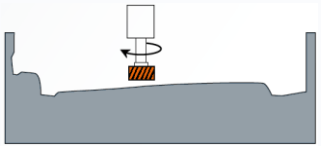
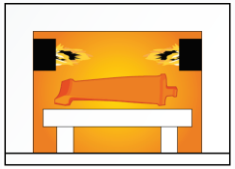
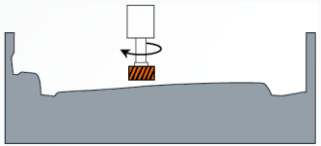
Taillight

(typically made from PMMA)

Production Process of Thruhard Diamond® Molds

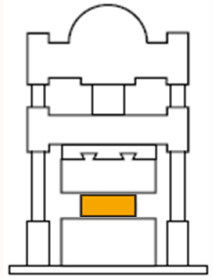
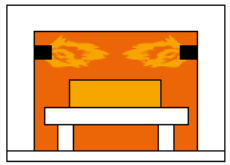
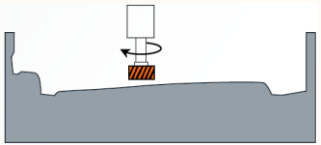
Buderus | Edelstahl

Typical Lens Mold Production Process for 1.2343 (H11) or 1.2344 (H13)

Forging → Fine Structure Annealing → Machining to Near-Net Shape → Vacuum Hardening → Final-Machining → Surface - Finishing

Typical Lens Mold Production Process for Thruhard Diamond®

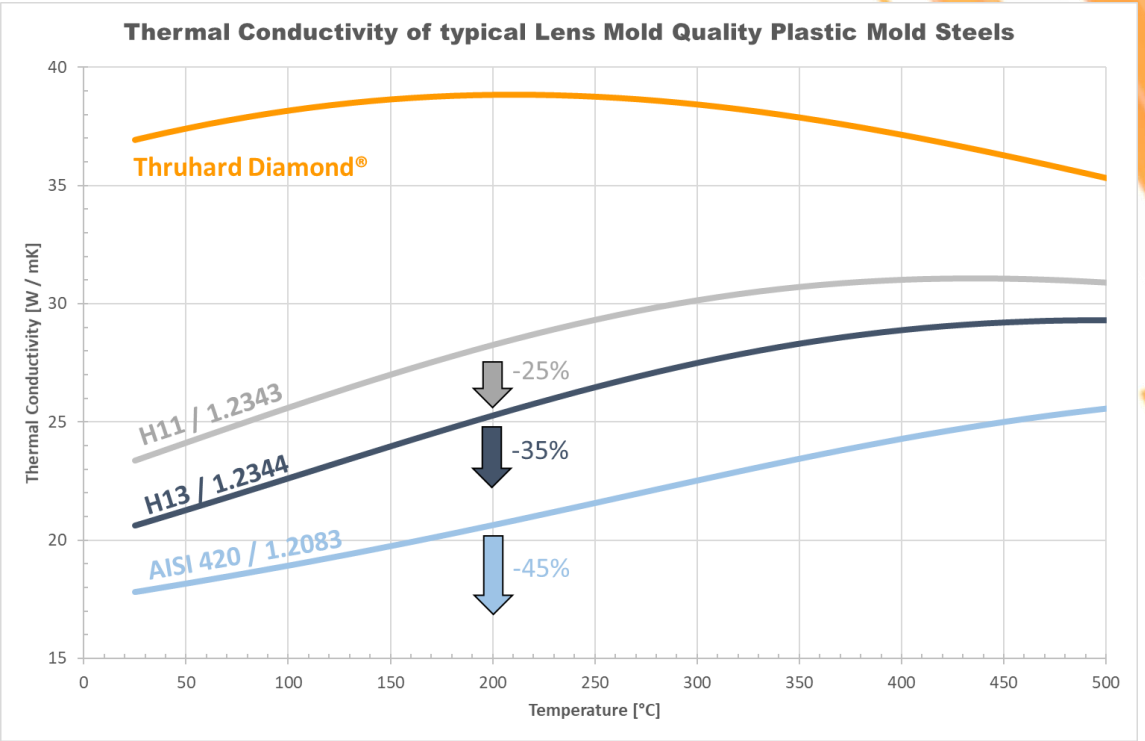




Forging → Quench + Temper to Final Hardness → **Time & Money saved** → Final-Machining → Surface - Finishing

Thermal Conductivity of Thruhard Diamond®

Achievable cycle times and therefore the cost-effectiveness of the plastic injection molding process itself are highly dependent on the intensity of heat transfer from the molten plastic to the cooling media through the mold's base metal.

For optimum productivity and efficiency, Thruhard Diamond® offers up to 45% higher Thermal Conductivity compared to other Lens Mold steel grades.



Material Concept | Thruhard Diamond®

TripleHard (HHH)

Statement of our Polishing Partner (Translated from German Language):

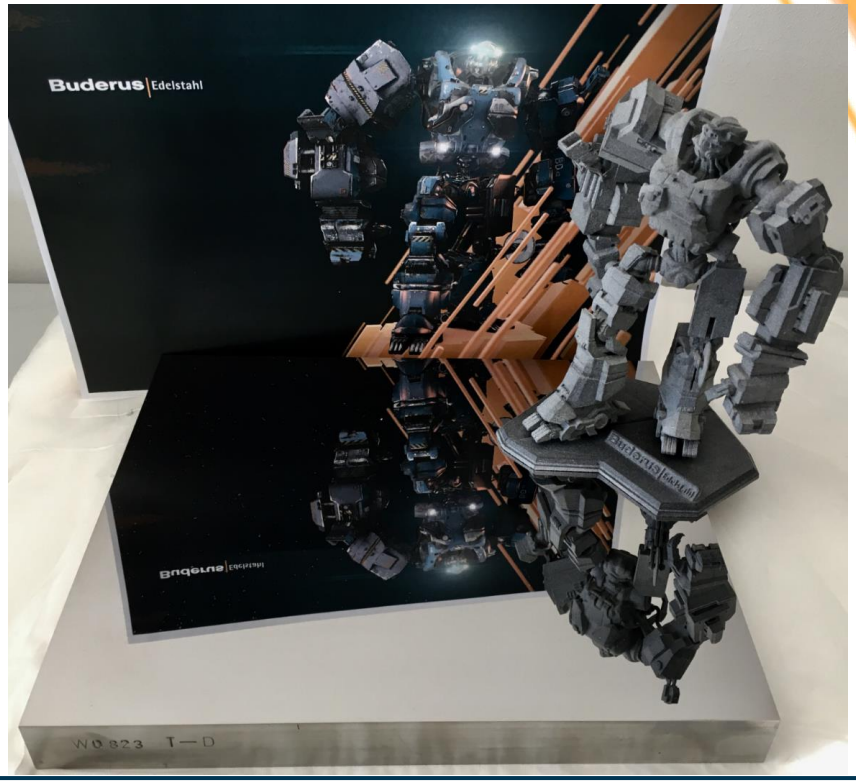
*"In all process steps, the material showed **very good** polishability.*

*We'd also rate the final result of the High-Gloss Polish (considering the fact that it is a Pre-Hardened Plastic Mold Steels) as **very good**.*

*Compared to conventional airmelted Steels, this remelted Grade offers a **very good High-Gloss Polishability**, that is very well-suited for the production of headlights"*

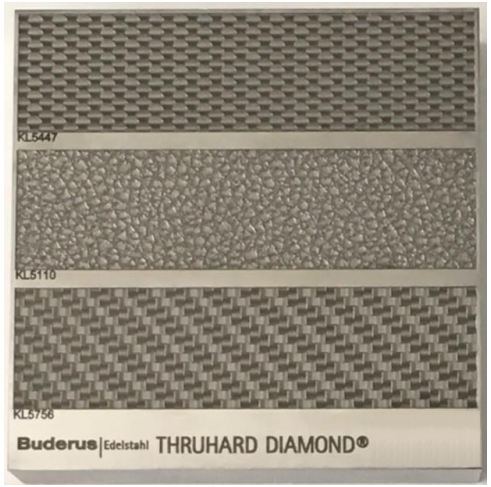
KIEFER GMBH
Polierpartner der Werkzeug- und Formenbauer

Mirror Polishing of Thruhard Diamond®

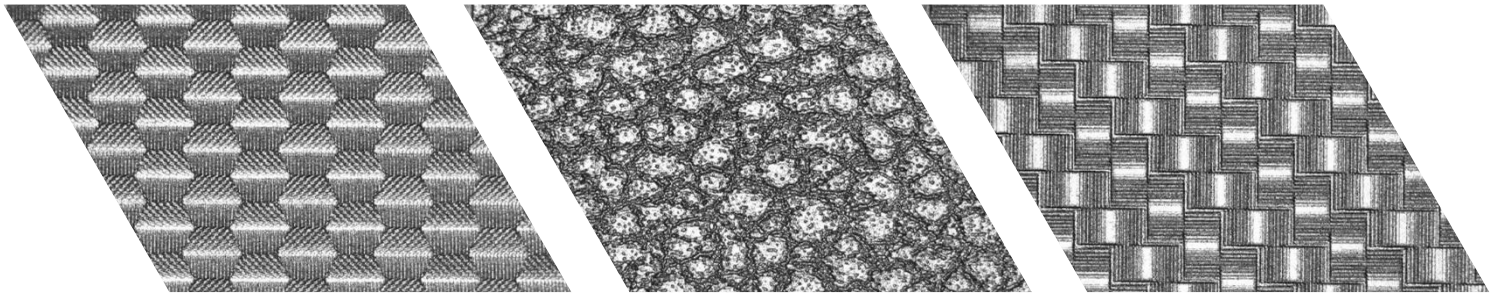


Material Concept | Thruhard Diamond® TripleHard (HHH)

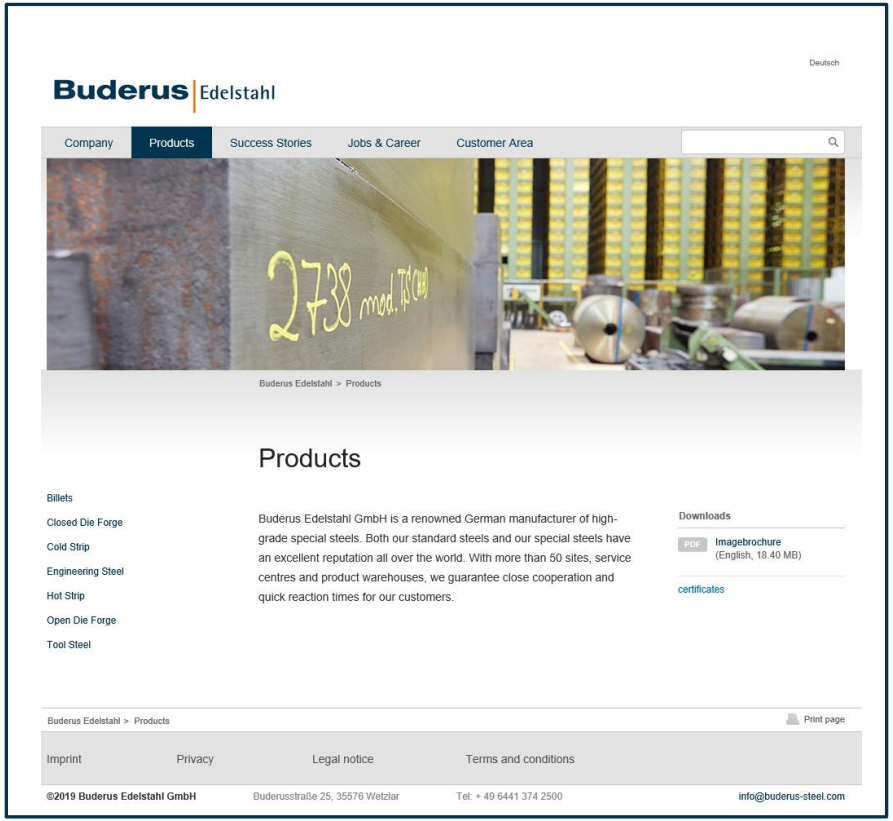
Laser-Texturing of Thruhard Diamond®

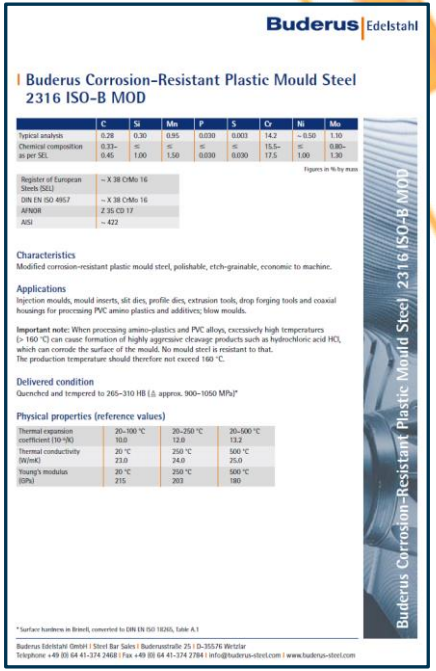


- Structure KL5447: “Diamond-like”
- Structure KL5110: “Leather-like”
- Structure KL5756: “Carbon-like”



Further Information





For further Information as well as current Certificates and Material Datasheets, please visit our Website at:

www.Buderus-Steel.com and www.degisimcelik.com.tr

Buderus | Edelstahl

DEĞİŞİM ÇELİK
ISIL İŞLEM LTD. ŞTİ.

Hot-Work & Die-Steels

Production and Applications

Overview of Buderus Edelstahl Hot-Work & Die Steels

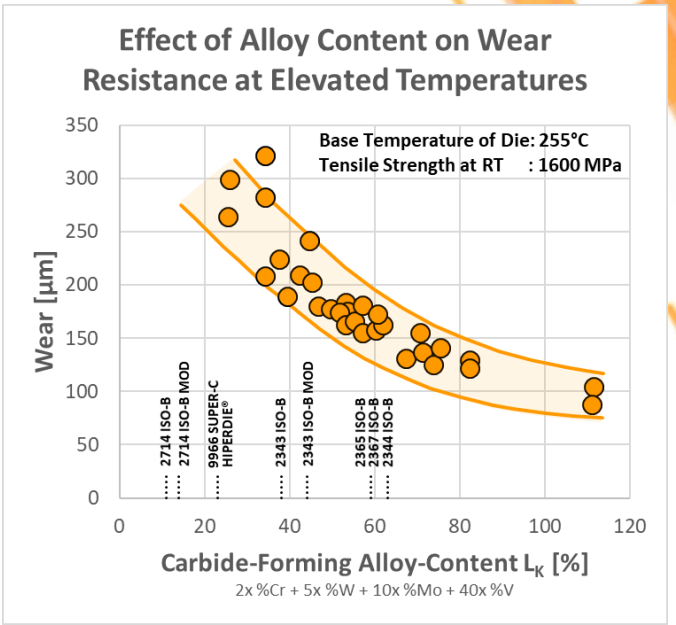
DEĞİŞİM ÇELİK ISIL İŞLEM LTD. ŞTİ.

Buderus | Edelstahl

Typical Chemical Composition (weight-%)

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb	LK
CrMoV - Tool Steels										
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-	38
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-	44
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-	63
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-	59
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-	59
CrMoNiV - Tool Steels										
HIPERDIE®	0.35	0.25	0.50	< 0.002	2.70	0.65	1.00	0.20	+	23
NiCrMoV - Tool Steels										
2714 ISO-B	0.54	0.25	0.80	< 0.002	1.10	1.70	0.50	0.10	-	11
2714 ISO-B MOD	0.55	0.25	0.95	< 0.002	1.10	2.00	0.75	0.10	-	14
9966 SUPER-C®	0.33	0.25	0.20	< 0.002	1.50	3.00	0.80	0.30	-	23

Property	C	Cr	Mo	V	W	Co
Carbide Precipitation	↑↑↑	↑	↑↑	↑↑↑	↑↑	-
Wear Resistance	↑↑↑	↑	↑↑	↑↑↑	↑↑	↑
Tempering Resistance	↑↑	↑	↑↑	↑↑	↑↑↑	↑↑↑
Toughness	↓↓↓	↓	↑	↑	~	↓
Grindability & Polishability	↓↓↓	↓	↓↓	↓↓↓	↓↓	↓



Properties of Buderus Edelstahl Hot-Work & Die-Steels

Grade	High-Temperature Strength	Toughness	Resistance to Thermal Shock	High-Temperature Wear Resistance	Thermal Conductivity	Polishability
CrMoV - Tool Steels						
2343 ISO-B	●	●●	●	●+	●	●●
2343 ISO-B MOD	●	●●●	●●	●+	●	●●●
2344 ISO-B	●●	●+	●	●●	●	●
2365 ISO-B	●●●	●	●●	●●	●●	○○
2367 ISO-B	●●●	●+	●●	●●●	●●	○○
CrMoNiV - Tool Steels						
HIPERDIE®	●●+	●●+	●●	●+	●●●	●
NiCrMoV - Tool Steels						
2714 ISO-B	○	●●+	○	○	●●●	●
2714 ISO-B MOD	○+	●●●	●	○+	●●●	●+
9966 SUPER-C®	●●	●●●	●●	●+	●●	●●

●●● = very good

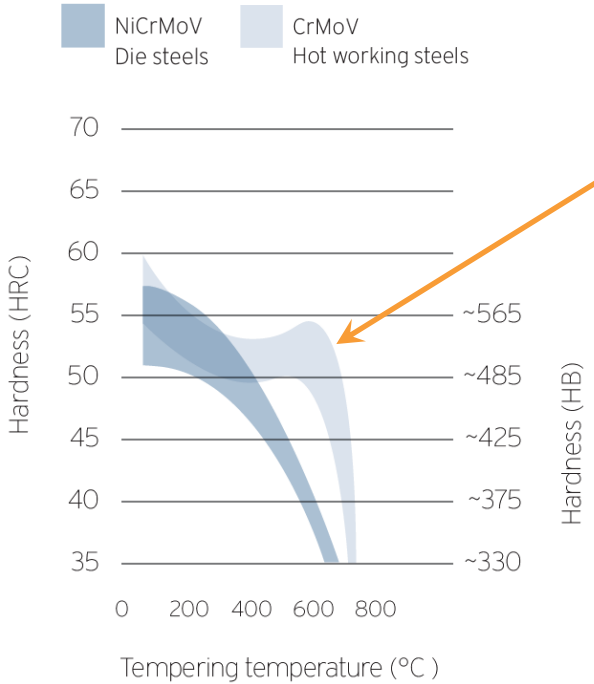
●● = good

● = standard

○ = poor

○○ = not recommended

1st category:
Wear-resistant hot-work steels with Chromium (1.23xx)

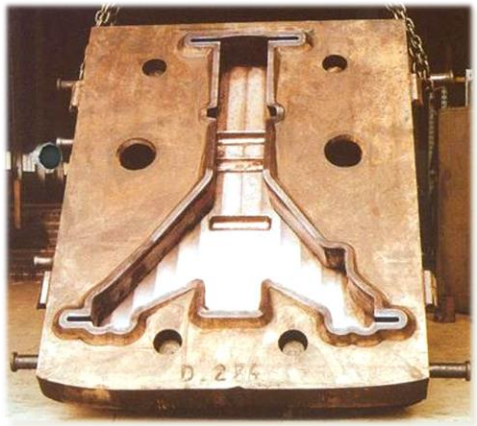


Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
CrMoV - Tool Steels									
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
NiCrMoV - Tool Steels									
2714 ISO-B	0.54	0.25	0.80	< 0.002	1.10	1.70	0.50	0.10	-
2714 ISO-B MOD	0.55	0.25	0.95	< 0.002	1.10	2.00	0.75	0.10	-
9966 SUPER-C®	0.33	0.25	0.20	< 0.002	1.50	3.00	0.80	0.30	-

(other grades are available on request)

Material Concept | 2343 ISO-B



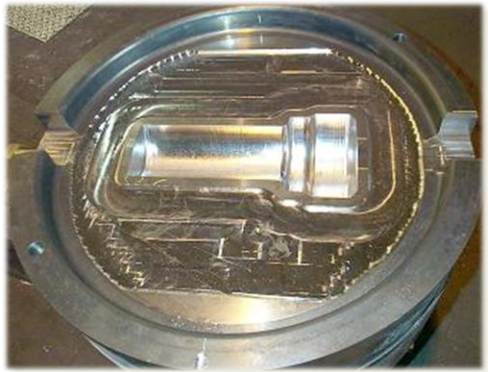
Press-Die made from 2343 ISO-B

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
CrMoV - Tool Steels									
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-

Properties:

CrMoV-alloyed Hot-Work Tool Steel combining good toughness and Wear Resistance

Material Concept | 2344 ISO-B



Insert for Press-Die

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
CrMoV - Tool Steels									
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-

Properties:

Classic Hot-Work Tool Steel with very good Tempering- and Wear Resistance due to it‘s doubled Vanadium-Content compared to 2343 ISO-B

Material Concept | 2365 ISO-B

Mandrels

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
CrMoV - Tool Steels									
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-

Properties:

Due to it‘s high resistance to thermal shock, 2365 ISO-B is recommended for applications where parts are continuously subjected to severe alternating heating- and cooling cycles (e.g. water-cooled tools)

Material Concept | 2367 ISO-B

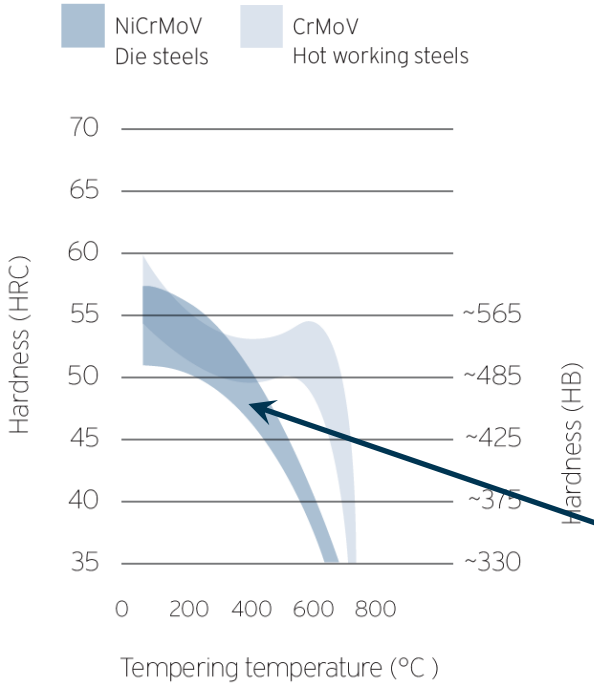
Steering-Knuckle Insert

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
CrMoV - Tool Steels									
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-

Properties:

Due to its chemical composition with high contents of Molybdenum and Vanadium, 2367 ISO-B has excellent High-Temperature Strength and Wear Resistance

2nd category:
Crack-resistant hot-work steels Nickel (1.27xx)



Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
CrMoV - Tool Steels									
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
NiCrMoV - Tool Steels									
2714 ISO-B	0.54	0.25	0.80	< 0.002	1.10	1.70	0.50	0.10	-
2714 ISO-B MOD	0.55	0.25	0.95	< 0.002	1.10	2.00	0.75	0.10	-
9966 SUPER-C®	0.33	0.25	0.20	< 0.002	1.50	3.00	0.80	0.30	-

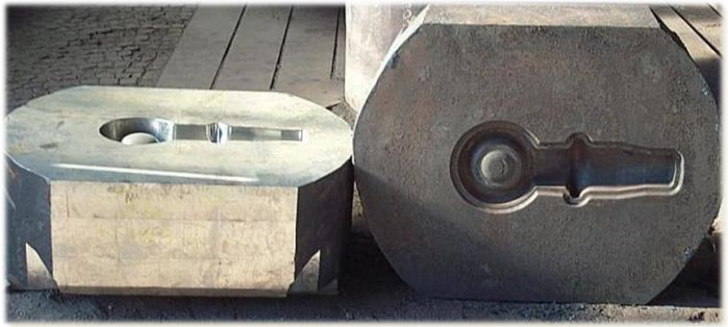
(other grades are available on request)

Material Concept | 2714 ISO-B and 2714 ISO-B MOD

Grade	C	Si	Mn	S	Cr	Ni	Mo	V
NiCrMoV - Tool Steels								
2714 ISO-B	0.54	0.25	0.80	< 0.002	1.10	1.70	0.50	0.10
2714 ISO-B MOD	0.55	0.25	0.95	< 0.002	1.10	2.00	0.75	0.10

2714 ISO-B MOD has been developed for:

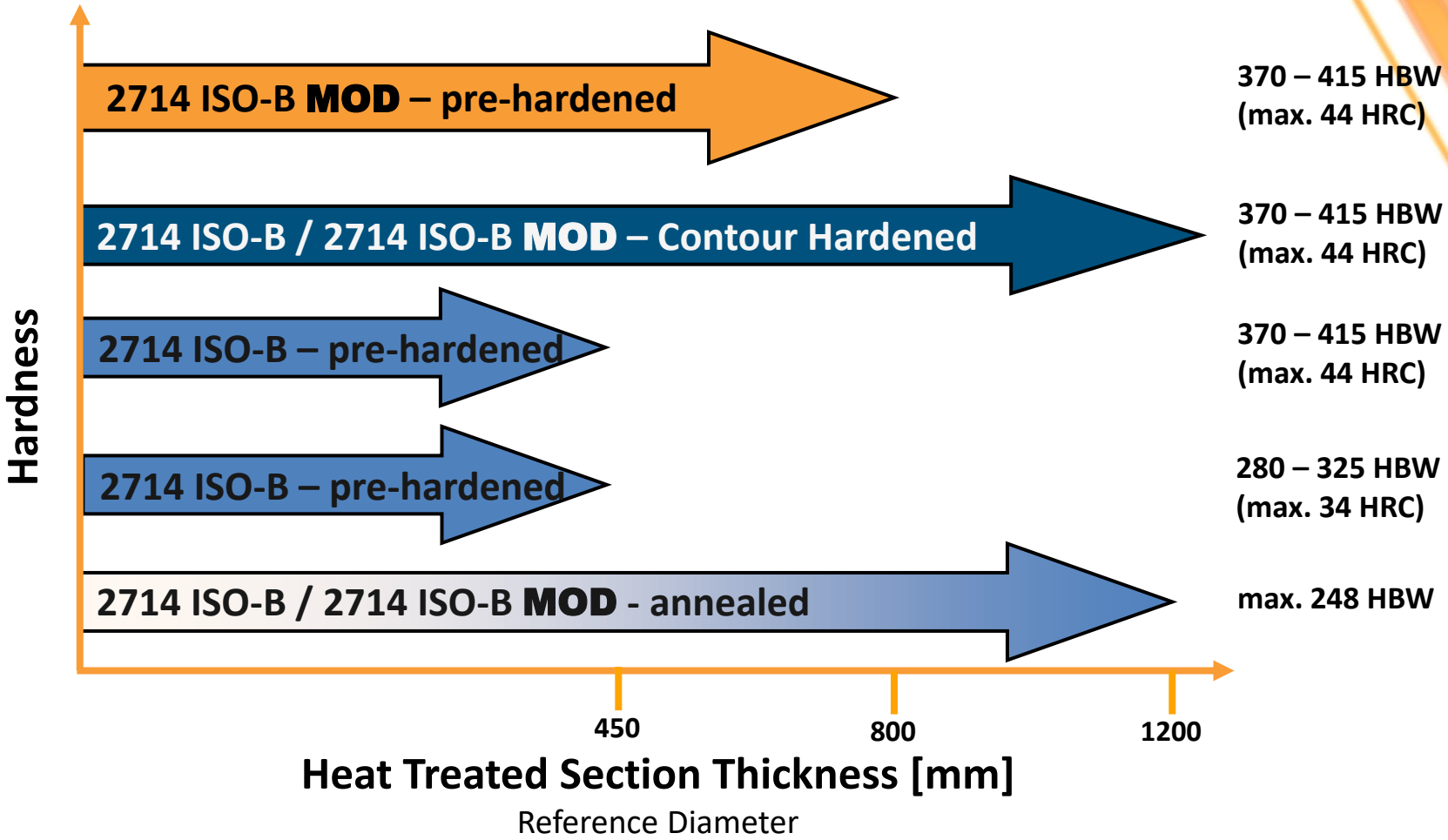
- higher Wear Resistance
- increased High-Temperature Strength
- drastically improved through-hardenability (>400mm)



2714 ISO-B
small- & medium-sized crack-susceptible dies

2714 ISO-B MOD
large Press-Die for Aluminum-Forging,
Dimensions: 965 x 620 x 1970 mm

Recommended Size Limitations for 2714 Steels



Overview of Buderus Edelstahl Hot-Work & Die Steels

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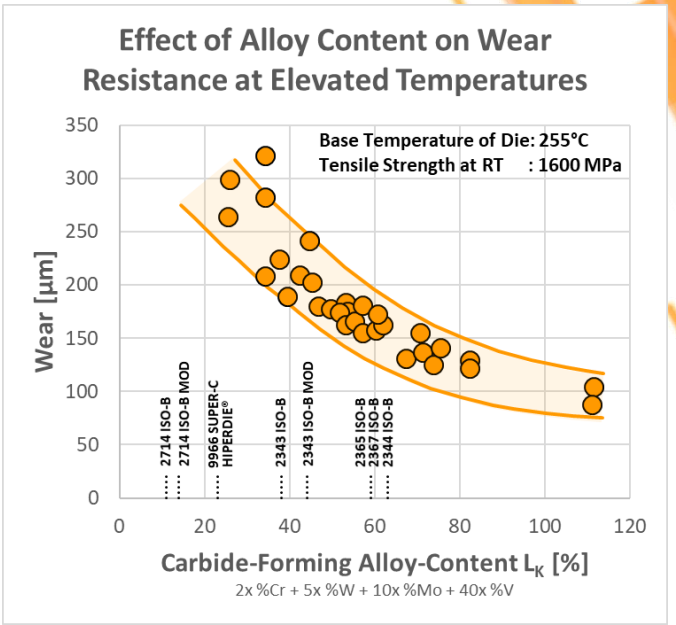
Typical Chemical Composition (weight-%)

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb	LK
CrMoV - Tool Steels										
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-	38
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-	44
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-	63
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-	59
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-	59
CrMoNiV - Tool Steels										
HIPERDIE®	0.35	0.25	0.50	< 0.002	2.70	0.65	1.00	0.20	+	23
NiCrMoV - Tool Steels										
2714 ISO-B	0.54	0.25	0.80	< 0.002	1.10	1.70	0.50	0.10	-	11
2714 ISO-B MOD	0.55	0.25	0.95	< 0.002	1.10	2.00	0.75	0.10	-	14
9966 SUPER-C®	0.33	0.25	0.20	< 0.002	1.50	3.00	0.80	0.30	-	23

Property	C	Cr	Mo	V	W	Co
Carbide Precipitation	↑↑↑	↑	↑↑	↑↑↑	↑↑	-
Wear Resistance	↑↑↑	↑	↑↑	↑↑↑	↑↑	↑
Tempering Resistance	↑↑	↑	↑↑	↑↑	↑↑↑	↑↑↑
Toughness	↓↓↓	↓	↑	↑	~	↓
Grindability & Polishability	↓↓↓	↓	↓↓	↓↓↓	↓↓	↓



Properties of Buderus Edelstahl Hot-Work & Die-Steels

Grade	High-Temperature Strength	Toughness	Resistance to Thermal Shock	High-Temperature Wear Resistance	Thermal Conductivity	Polishability
CrMoV - Tool Steels						
2343 ISO-B	●	●●	●	●+	●	●●
2343 ISO-B MOD	●	●●●	●●	●+	●	●●●
2344 ISO-B	●●	●+	●	●●	●	●
2365 ISO-B	●●●	●	●●	●●	●●	○○
2367 ISO-B	●●●	●+	●●	●●●	●●	○○
CrMoNiV - Tool Steels						
HIPERDIE®	●●+	●●+	●●	●+	●●●	●
NiCrMoV - Tool Steels						
2714 ISO-B	○	●●+	○	○	●●●	●
2714 ISO-B MOD	○+	●●●	●	○+	●●●	●+
9966 SUPER-C®	●●	●●●	●●	●+	●●	●●

●●● = very good

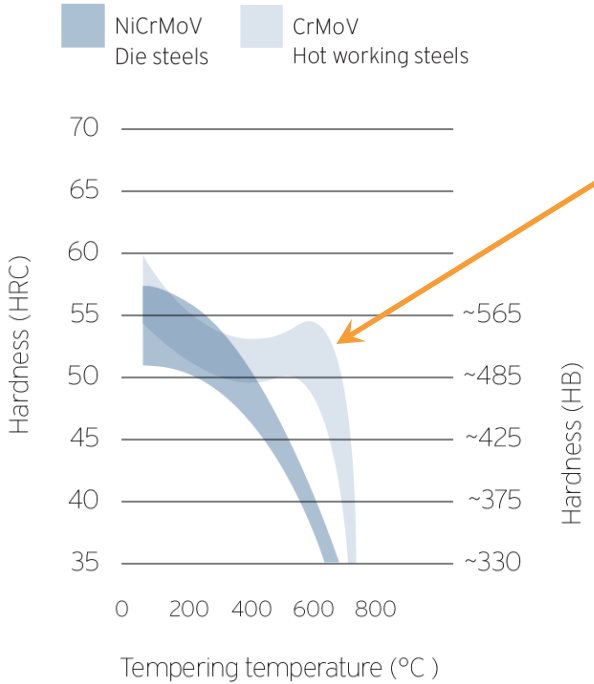
●● = good

● = standard

○ = poor

○○ = not recommended

1st category:
Wear-resistant hot-work steels with Chromium (1.23xx)

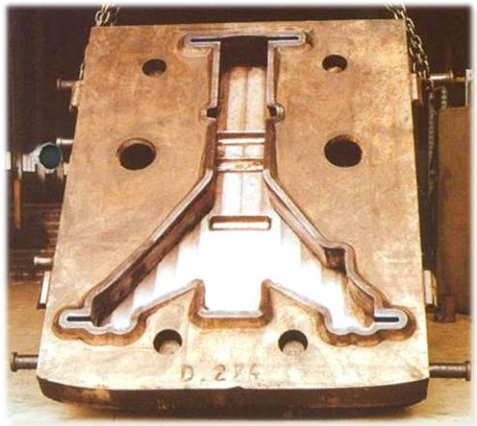


Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
CrMoV - Tool Steels									
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
NiCrMoV - Tool Steels									
2714 ISO-B	0.54	0.25	0.80	< 0.002	1.10	1.70	0.50	0.10	-
2714 ISO-B MOD	0.55	0.25	0.95	< 0.002	1.10	2.00	0.75	0.10	-
9966 SUPER-C®	0.33	0.25	0.20	< 0.002	1.50	3.00	0.80	0.30	-

(other grades are available on request)

Material Concept | 2343 ISO-B



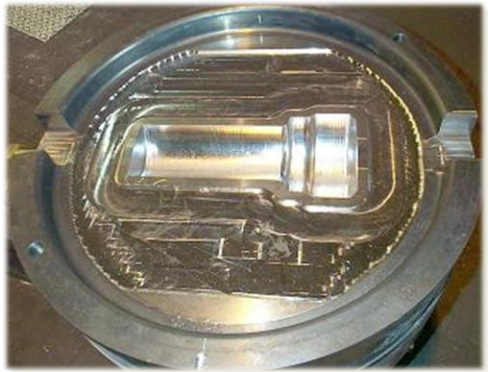
Press-Die made from 2343 ISO-B

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
CrMoV - Tool Steels									
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-

Properties:

CrMoV-alloyed Hot-Work Tool Steel combining good toughness and Wear Resistance

Material Concept | 2344 ISO-B



Insert for Press-Die

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
CrMoV - Tool Steels									
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-

Properties:

Classic Hot-Work Tool Steel with very good Tempering- and Wear Resistance due to it‘s doubled Vanadium-Content compared to 2343 ISO-B

Material Concept | 2365 ISO-B

Mandrels

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
CrMoV - Tool Steels									
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-

Properties:

Due to it‘s high resistance to thermal shock, 2365 ISO-B is recommended for applications where parts are continuously subjected to severe alternating heating- and cooling cycles (e.g. water-cooled tools)

Material Concept | 2367 ISO-B

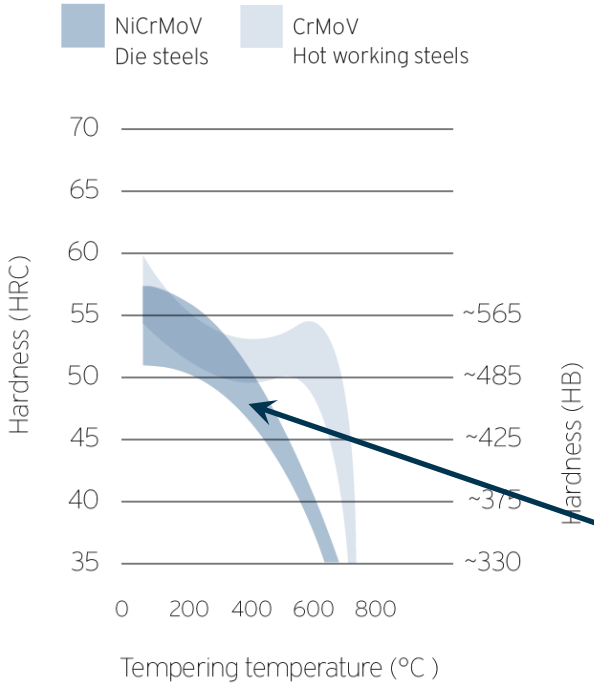
Steering-Knuckle Insert

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
CrMoV - Tool Steels									
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-

Properties:

Due to its chemical composition with high contents of Molybdenum and Vanadium, 2367 ISO-B has excellent High-Temperature Strength and Wear Resistance

2nd category:
Crack-resistant hot-work steels Nickel (1.27xx)



Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
CrMoV - Tool Steels									
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
NiCrMoV - Tool Steels									
2714 ISO-B	0.54	0.25	0.80	< 0.002	1.10	1.70	0.50	0.10	-
2714 ISO-B MOD	0.55	0.25	0.95	< 0.002	1.10	2.00	0.75	0.10	-
9966 SUPER-C®	0.33	0.25	0.20	< 0.002	1.50	3.00	0.80	0.30	-

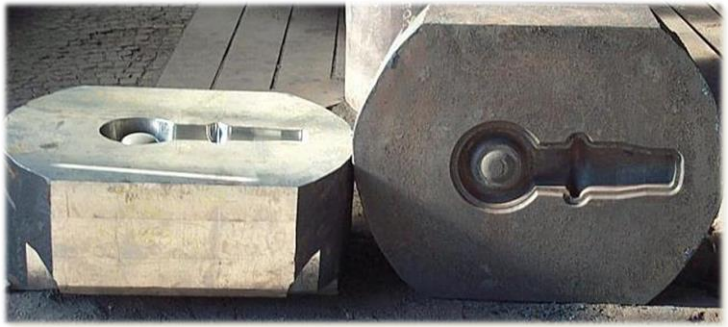
(other grades are available on request)

Material Concept | 2714 ISO-B and 2714 ISO-B MOD

Grade	C	Si	Mn	S	Cr	Ni	Mo	V
NiCrMoV - Tool Steels								
2714 ISO-B	0.54	0.25	0.80	< 0.002	1.10	1.70	0.50	0.10
2714 ISO-B MOD	0.55	0.25	0.95	< 0.002	1.10	2.00	0.75	0.10

2714 ISO-B MOD has been developed for:

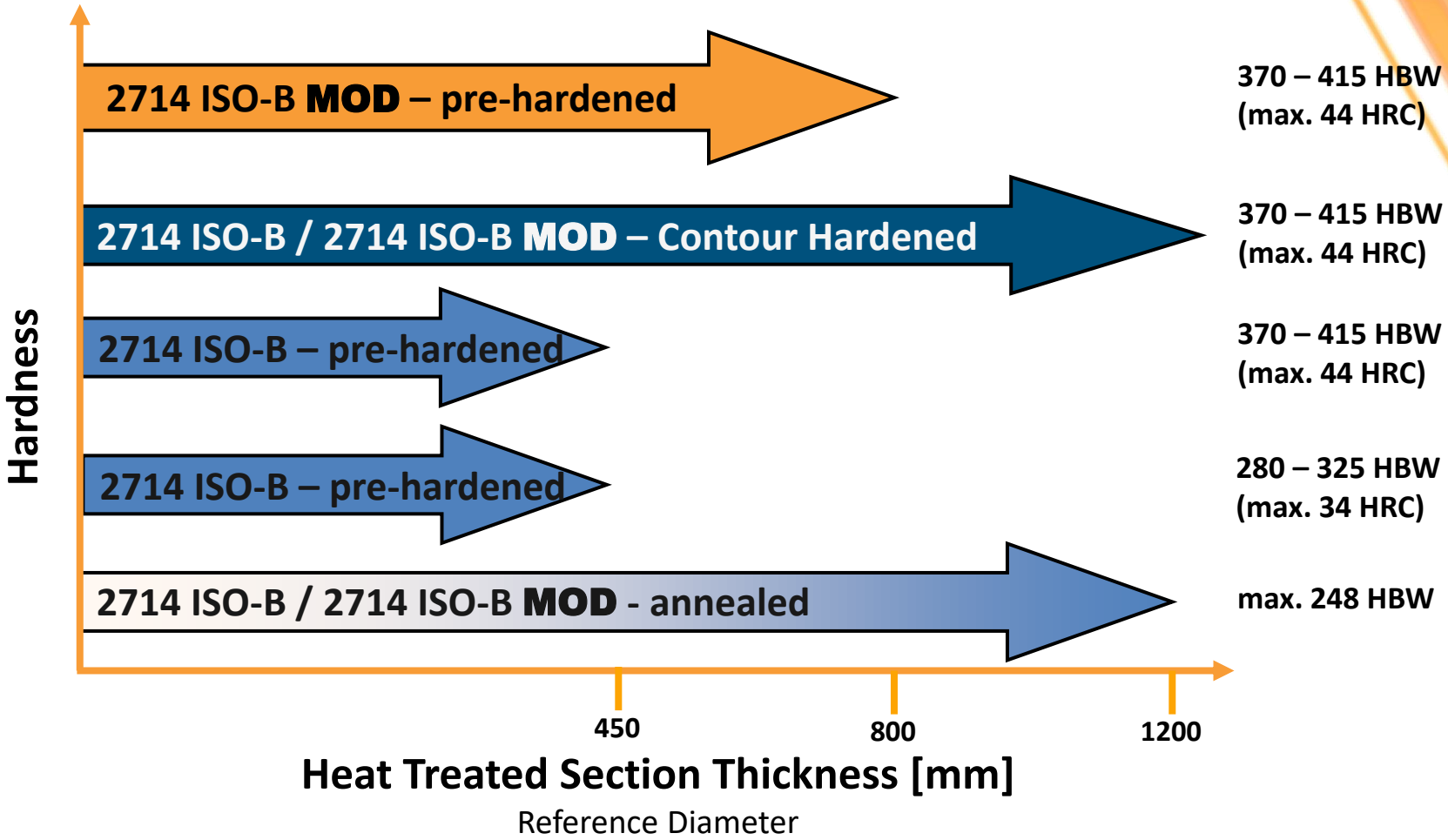
- higher Wear Resistance
- increased High-Temperature Strength
- drastically improved through-hardenability (>400mm)



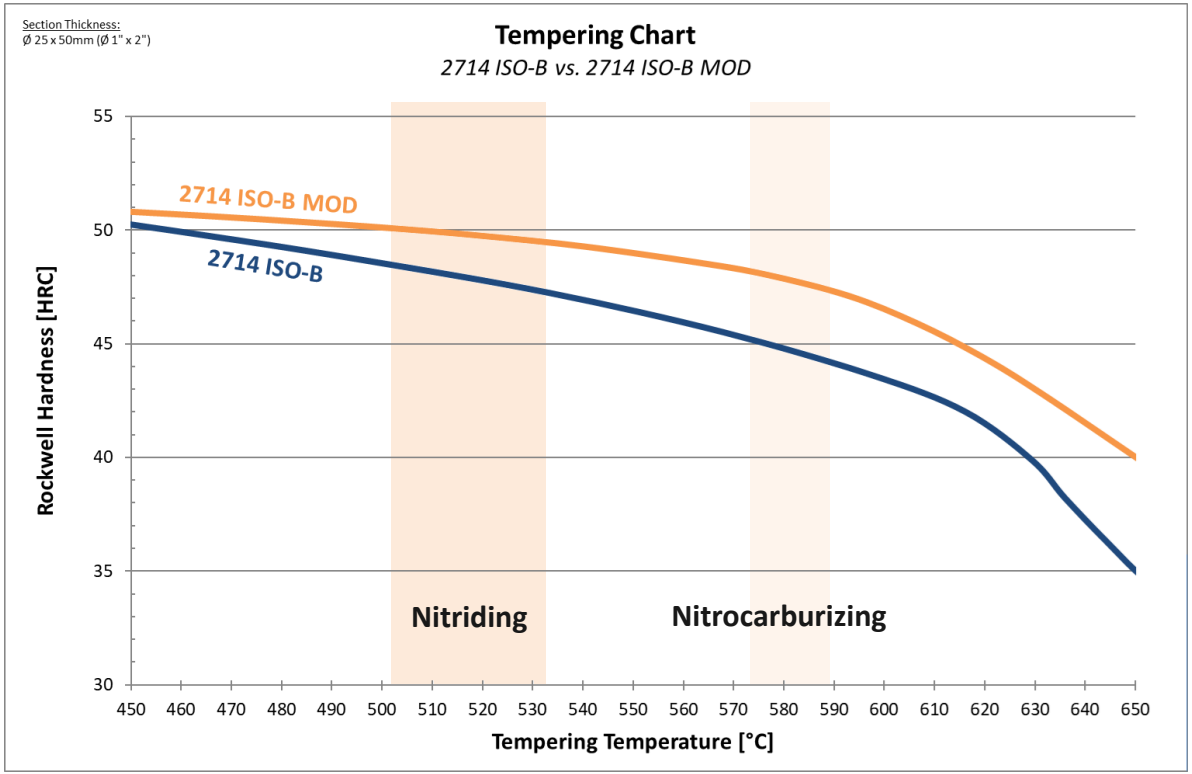
2714 ISO-B
small- & medium-sized crack-susceptible dies

2714 ISO-B MOD
large Press-Die for Aluminum-Forging,
Dimensions: 965 x 620 x 1970 mm

Recommended Size Limitations for 2714 Steels



A Comparison of Temper Resistance



Improved Tempering Resistance of the 2714 ISO-B MOD provides more Options for Nitriding or Nitrocarburizing without sacrificing base-metal hardness

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9966 SUPER-C®

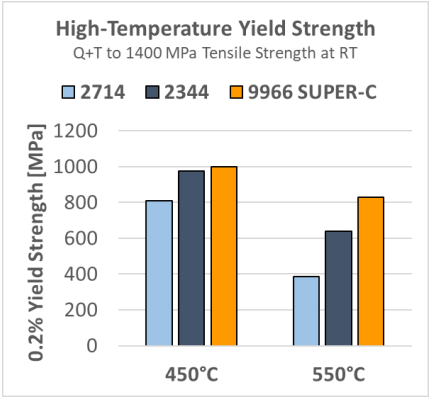
Material Concept | 9966 SUPER-C®

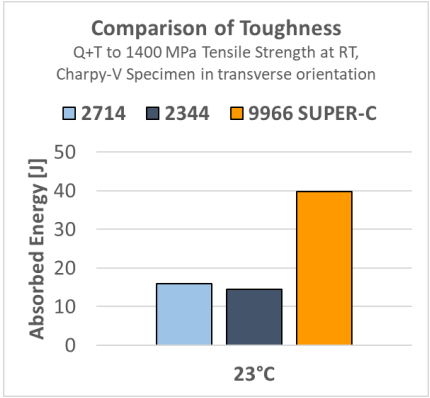
Properties:

- Nickel-alloyed High-Performance Die Steel with patented Composition
- very good High-Temperature Strength (comparable with 1.2343/1.2344)
- drastically improved Toughness and Wear Resistance compared to 2714 ISO- B and 2714 ISO-B MOD

Applications:

- highly crack-susceptible Dies
- Die-Inserts with deep and / or complex engraving
- highly-stressed Die-Holders



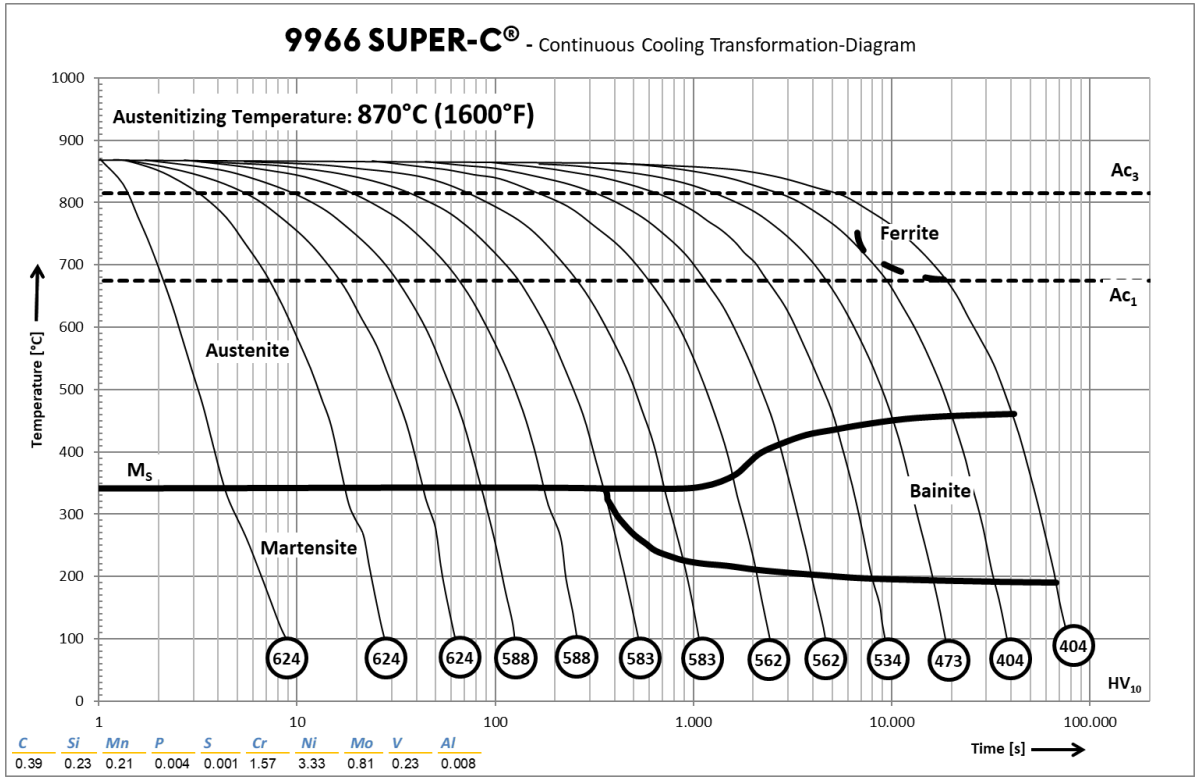


contour-hardened Die-Holder

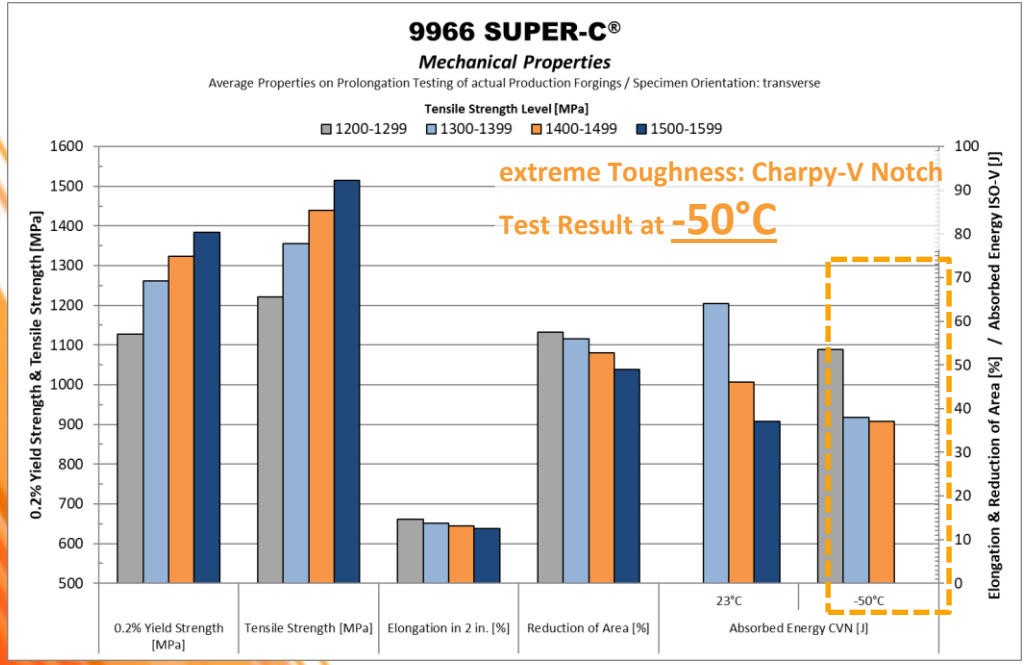
Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
NiCrMoV - Tool Steels									
2714 ISO-B	0.54	0.25	0.80	< 0.002	1.10	1.70	0.50	0.10	-
2714 ISO-B MOD	0.55	0.25	0.95	< 0.002	1.10	2.00	0.75	0.10	-
9966 SUPER-C®	0.33	0.25	0.20	< 0.002	1.50	3.00	0.80	0.30	-

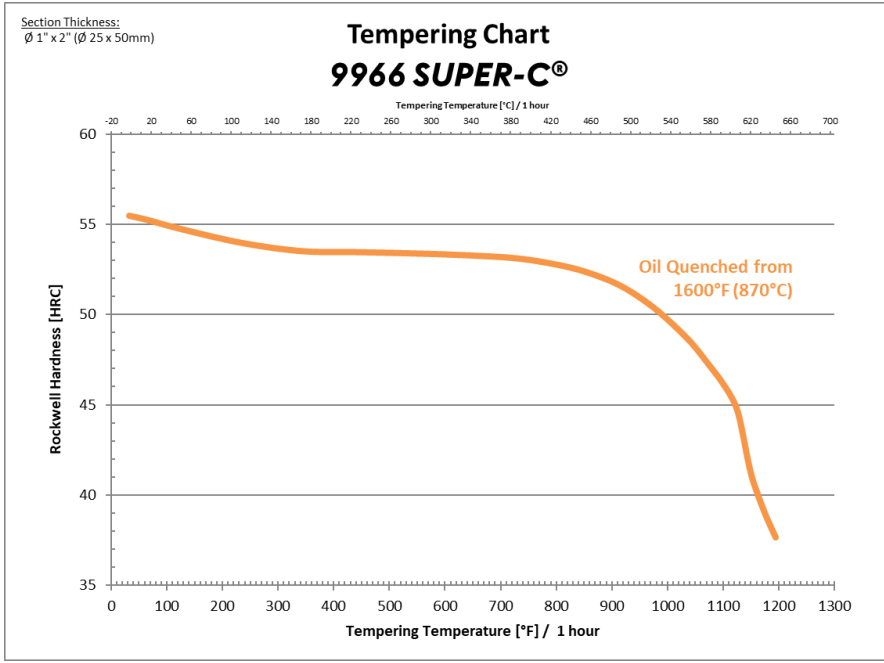
Through-Hardenability | 9966 SUPER-C®

9966 SUPER-C® has excellent through-hardenability and is suitable even for the largest Tooling dimensions



Mechanical Properties | 9966 SUPER-C®





Applications | 9966 SUPER-C®

contour-hardened Die-Holder

Die-Holder after final-machining

Applications | 9966 SUPER-C®

Dies prior to Contour-Hardening

Dies after Contour-Hardening

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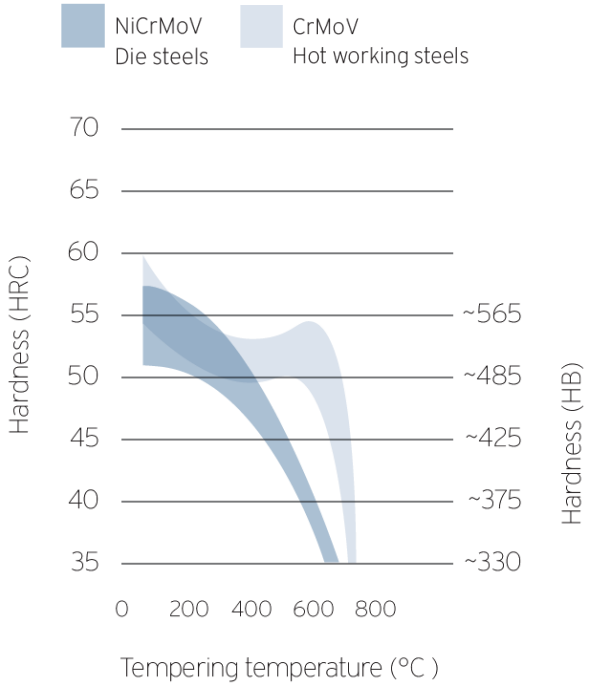
HIPERDIE®

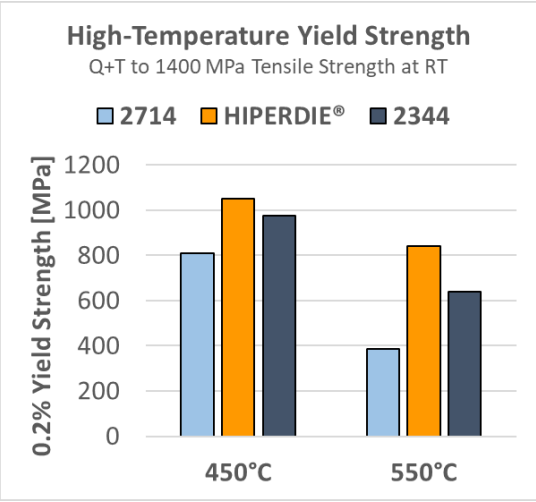
Material Concepts | Typical Compositions (weight-%)

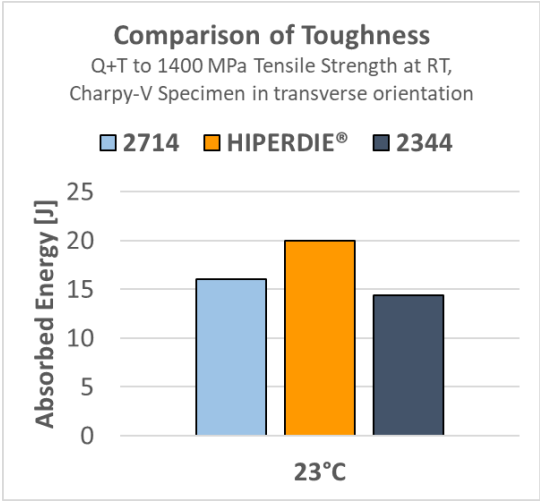


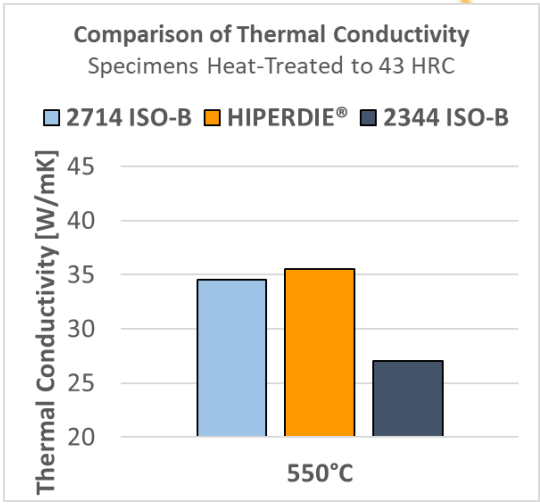
Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Nb
CrMoV - Tool Steels									
2343 ISO-B	0.38	1.00	0.40	< 0.002	5.00	-	1.20	0.40	-
2343 ISO-B MOD	0.35	0.30	0.40	< 0.002	5.00	-	1.35	0.50	-
2344 ISO-B	0.40	1.00	0.40	< 0.002	5.00	-	1.30	1.00	-
2365 ISO-B	0.32	0.30	0.30	< 0.002	3.00	-	2.70	0.65	-
2367 ISO-B	0.36	0.35	0.45	< 0.002	5.00	-	2.90	0.50	-
CrMoNiV - Tool Steels									
HIPERDIE®	0.35	0.25	0.50	< 0.002	2.70	0.65	1.00	0.20	+
NiCrMoV - Tool Steels									
2714 ISO-B	0.54	0.25	0.80	< 0.002	1.10	1.70	0.50	0.10	-
2714 ISO-B MOD	0.55	0.25	0.95	< 0.002	1.10	2.00	0.75	0.10	-
9966 SUPER-C®	0.33	0.25	0.20	< 0.002	1.50	3.00	0.80	0.30	-

(other grades are available on request)

High-Temperature Yield Strength, Toughness & Thermal Conductivity
(Tensile Strength at RT approximately 1400 MPa)

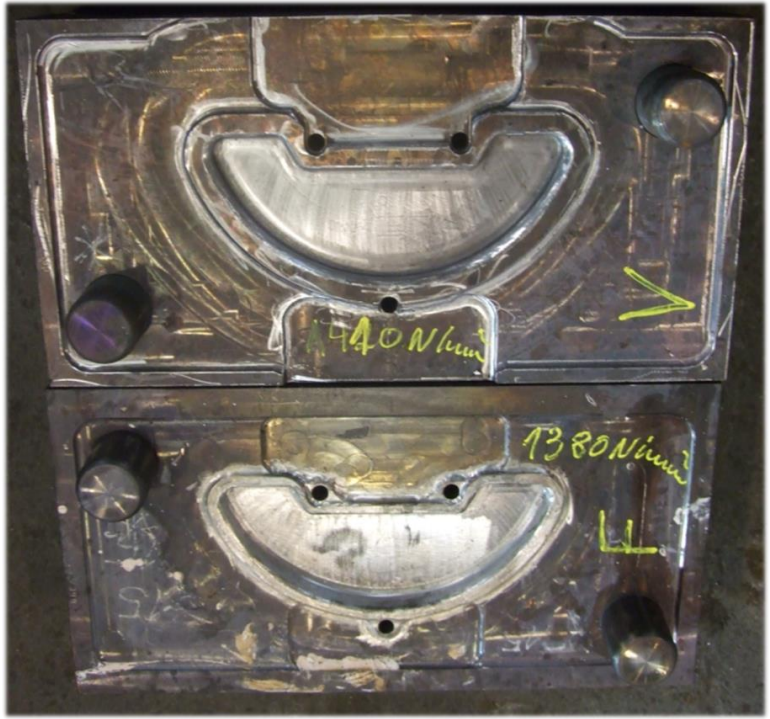






Experiences from our own Closed-Die-Forging Shop

Press-Die Quenched + Tempered to 410 HBW prior to Closed-Die Forging on 3200 t Screw Press



Pre-Forming Die

Finishing-Die

Experiences from our own Closed-Die-Forging Shop

Visual Examination of the Pre-Forming-Die prior to- and after Forging-Lots I to V

Forging-Lot	Quantity	Maintenance & Repair	Assessment
I	2409	grinding	OK
II	616	grinding	slight wear, fine incipient cracks in the radii of the finishing die
III	1562	grinding	slight wear, fine incipient cracks in the radii of the finishing die
IV	1977	grinding	noticeable wear, fine incipient cracks in the radii of the finishing die
V	2439 Σ 9003	grinding	noticeable wear, fine incipient cracks in the radii of the finishing die

Experiences from our own Closed-Die-Forging Shop

Visual Examination of the Finishing-Die prior to- and after Forging-Lots I to V

Grade	Pre-Forming Die (Quantity)	Finishing Die (Quantity)	Assessment
2714 ISO-B	**6000**	**4500**	still useable after weld cladding
HIPERDIE®	**9003**	**9003**	still useable after weld cladding
2344 ISO-B	**8000**	on average **4000** due to premature die fracture	not suitable for use in the Finishing Die

HIPERDIE® | Applications & Properties

designed for Applications requiring
more Toughness than 2344 ISO-B and
more Wear Resistance than 2714 ISO-B

Properties	2714 ISO-B	HIPERDIE®	2344 ISO-B
Working Hardness [HRC]	36 - 46	36 - 46	41 - 46
Tempering Resistance	●●	●●●	●●●
High-Temperature Yield Strength	●	●●	●●
Wear Resistance	●	●●	●●●
Toughness	●●	●●	●
Thermal Conductivity	●●	●●	●
Machinability	●●●	●●	●
Weldability	●	●●	●

●●● = very good

●● = good

● = standard

○ = poor

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HIPERDIE® | Applications & Properties

Buderus | Edelstahl

	Hammer-Dies	Press-Dies	Die Holders
small (max. 500 kg)	2714 ISO-B HIPERDIE®	2344 ISO-B 2365 ISO-B 2367 ISO-B	2714 ISO-B
medium (max. 3000 kg)	2714 ISO-B 2714 ISO-B MOD	2344 ISO-B 2367 ISO-B HIPERDIE®	2714 ISO-B (contour-hardened)
large and / or **susceptible to cracking**	2714 ISO-B 2714 ISO-B MOD (contour-hardened)	2714 ISO-B 2344 ISO-B HIPERDIE®	2714 ISO-B (contour-hardened)

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HIPERDIE® | Material-Datasheets

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Buderus Hot Work Tool Steel HIPERDIE®

	C	Si	Mn	P	S	Cr	Mo	Ni	V	Others
Typical analysis	0.35	≤ 0.35	0.50	≤ 0.025	≤ 0.003	2.70	1.00	0.60	0.20	+

Figures in % by mass

Characteristics

Special CrMoV-alloyed hot work tool steel with excellent high-temperature strength and better toughness properties than grade 2344 as well as higher thermal conductivity than the classic hot work tool steels 2343, 2344 and 2367. In comparison to the NiCrMoV – tool steels 2711/2714 HIgh PERformance DIE is characterized by higher wear resistance, comparable to grade 2343.

Applications

- Close-die forging: Small and medium-sized dies and die inserts for a large number of forgings.
- Highly stressed plastic moulds: Small and medium moulds as well as mould inserts subject to abrasive stress caused by processing of thermosetting plastics, thermoplastics and composite materials also in combination with surface treatments.

Where there is a requirement for
– Polishability > 400 paper grit
– Sensitive etch designs (e.g. HNO_3)
– Higher thermal conductivity
we recommend grade Thruhard Supreme®

- Light alloy processing: Gravity – as well as low pressure die – casting moulds and tools up to 45 HRC.

Delivered condition

Annealed to max. 250 HB
Quenched and tempered to customer specification on request
to max. 430 HB (≙ approx. 1450 MPa)*
Sizes upon request

Physical properties (reference values)

Thermal expansion coefficient (10^{-6}/K)	20–100 °C 11.9	20–250 °C 12.8	20–500 °C 13.8
Thermal conductivity (W/mK)	20 °C 38.3	250 °C 37.1	500 °C 35.3
Young's modulus (GPa)	20 °C 209	250 °C 204	500 °C 198

* Surface hardness in Brinell, converted to DIN EN ISO 18265, Table A.1

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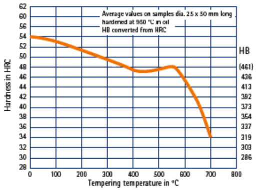
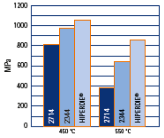
HIPERDIE®

Heat treatment		
Stress relieving	Temperature:	Approx. 650 °C in the annealed state 40 °C below tempering temperature in the quenched and tempered state
	Duration:	1 hour per 50 mm wall thickness
	Cooling:	Furnace
Soft annealing	Temperature:	750 °C
	Duration:	1 hour per 25 mm wall thickness
	Cooling:	Furnace
Hardening	Temperature:	950 °C
	Duration:	1 minute per mm wall thickness
Quenching hardness	Max. 54 HRC	in oil, salt bath or vacuum
Tempering	Temperature:	See tempering curve
	Duration:	1 hour per 25 mm wall thickness
	Cooling:	Air
Working hardness	Max. 430 HB	

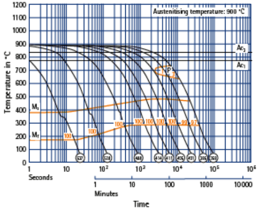
Tempering curve

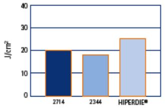




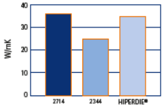
Comparison of high-temperature yield strength
Quenched and tempered to approx. 1400 MPa

TTT curve (continuous)





Comparison of impact value
Quenched and tempered to approx. 1400 MPa
ISO-V samples surface transverse 20 °C



Comparison of thermal conductivity at 250 °C

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HWS Supreme

Material Concept | HWS - Supreme

Typical Chemical Composition (weight-%)

Grade	C	Si	Mn	S	Cr	Ni	Mo	V	Other
HWS - Supreme	0.30	0.25	0.25	0.001	5.00	0.30	1.75	1.05	+ Microalloying

Highly modified- and microalloyed 5%-CrMoV Hot-Work Tool Steel

- excellent High Temperature Wear- & Heat-Checking Resistance
- Composition optimized for high Toughness and reduced susceptibility to Temper Embrittlement
- very good Nitridability due to high content of Nitride-forming elements Cr, Mo and V
- produced as standard using our special Fine-Structure Heat Treatment process for optimum Microstructure and longest Tool Life

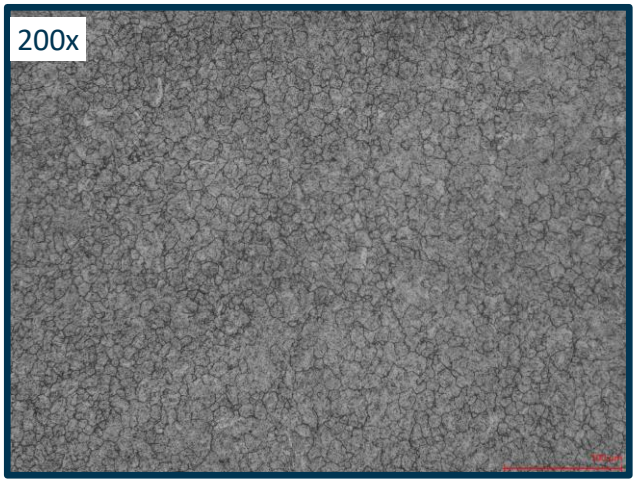
Available Heat Treatment Conditions:

- Annealed to a Surface Hardness of max. 229 HBW
- Quenched + Tempered or Vacuum-Hardened to Customer Requirements

Applications:

- highly-stressed Forging Dies requiring extreme Wear Resistance while retaining good Toughness
- Die-Casting Molds and Inserts with high tool-life expectancy
- Tools for Hot-Stamping
- Extrusion Tools and Dies
- Plastic Molding Tools for processing of Polymers with abrasive additives like Glass Fiber, Carbon-Fiber, etc.

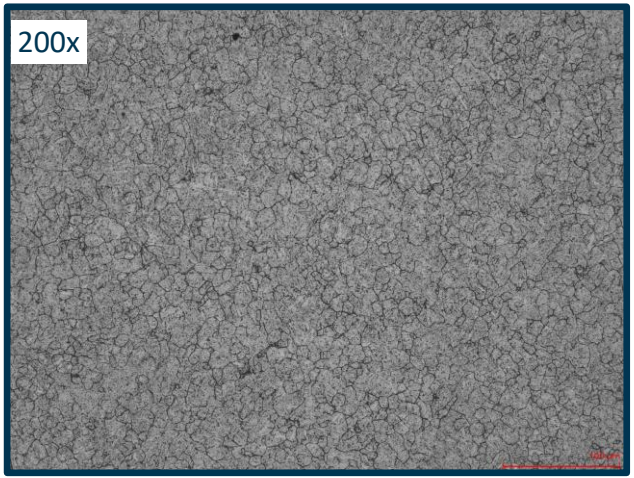
Microstructure | HWS – Supreme (44 – 46 HRC)



Surface

Quenched + Tempered Microstructure

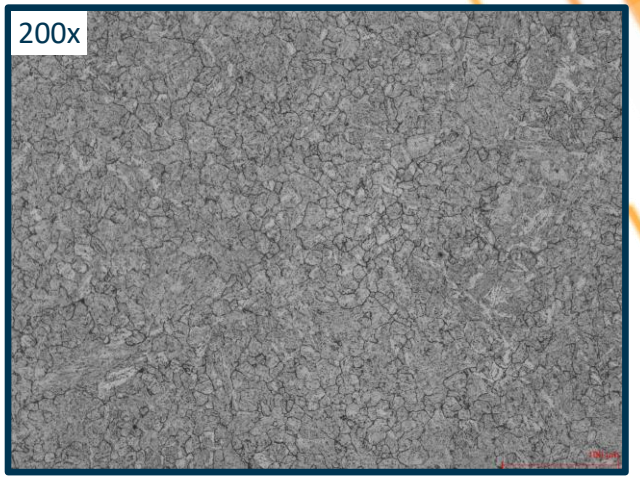
Grain Size 7-9 acc. ISO 643 (Bechet-Beaujard)



Mid-Radius

Quenched + Tempered Microstructure

Grain Size 7-9 acc. ISO 643 (Bechet-Beaujard)



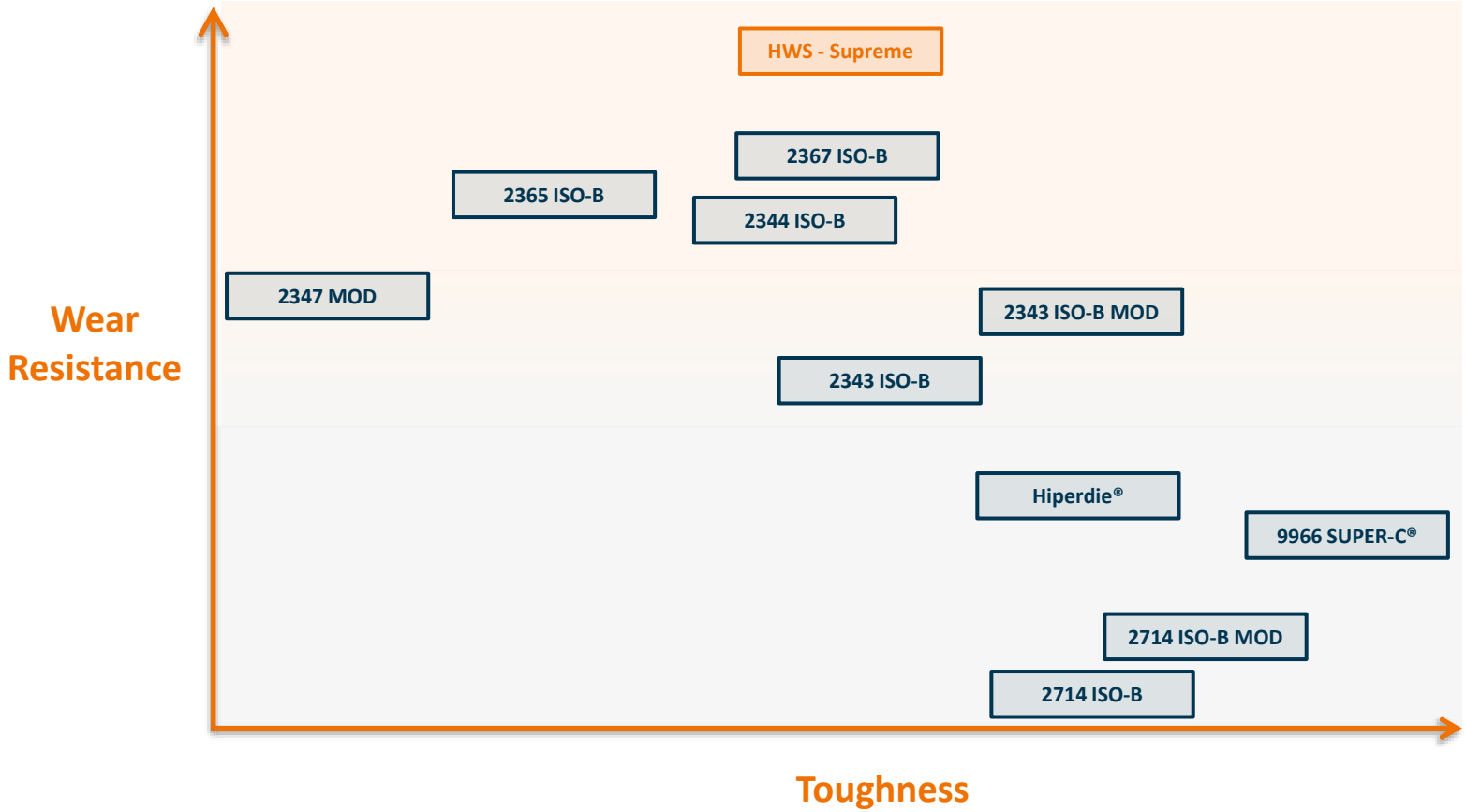
Core

Quenched + Tempered Microstructure

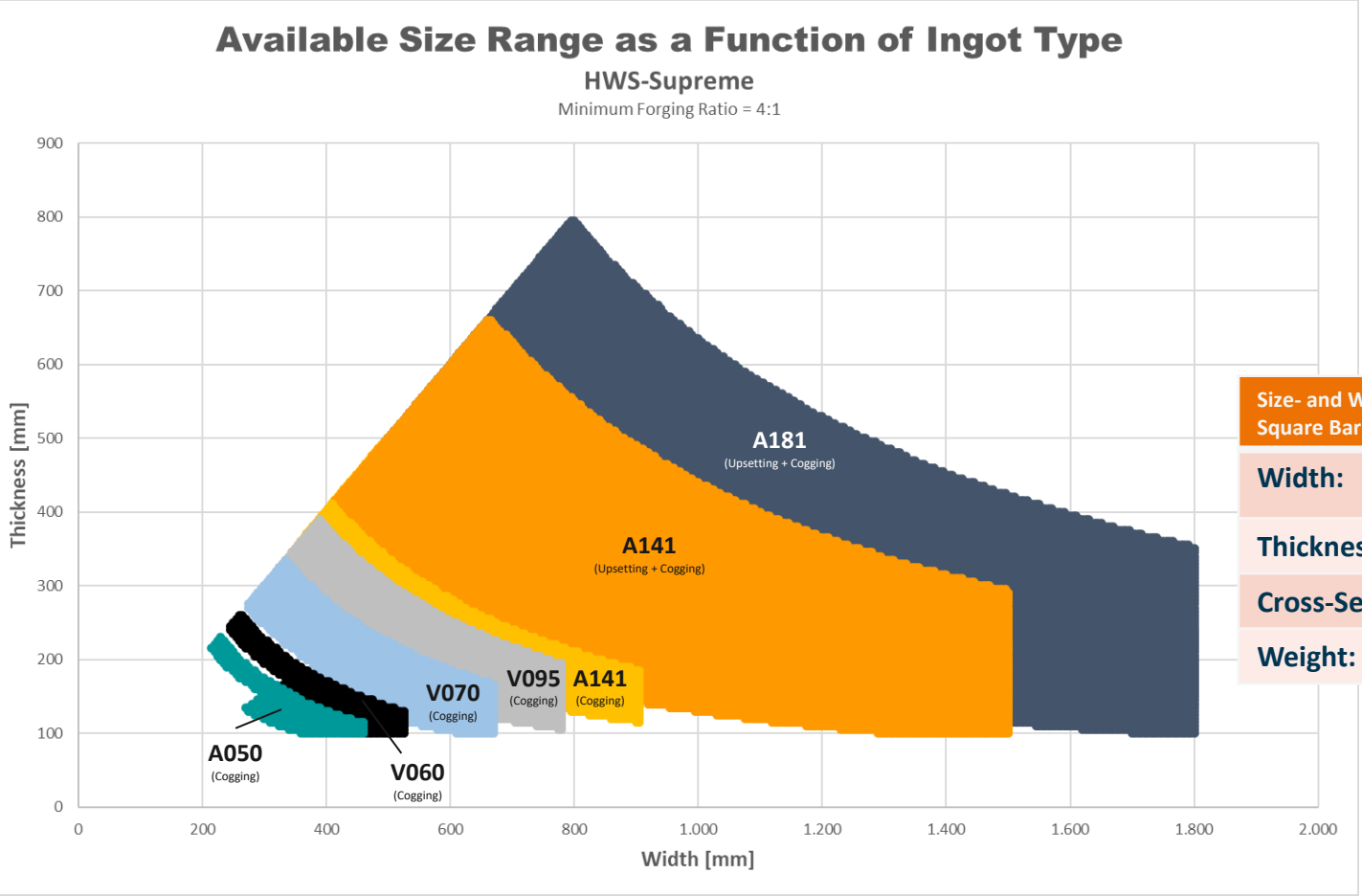
Grain Size 7-9 acc. ISO 643 (Bechet-Beaujard)

A fine and homogeneous grain size is an advantage for fatigue resistance (so for the lifetime of the die)

Properties of the Buderus Hot-Work Tool Steel Range

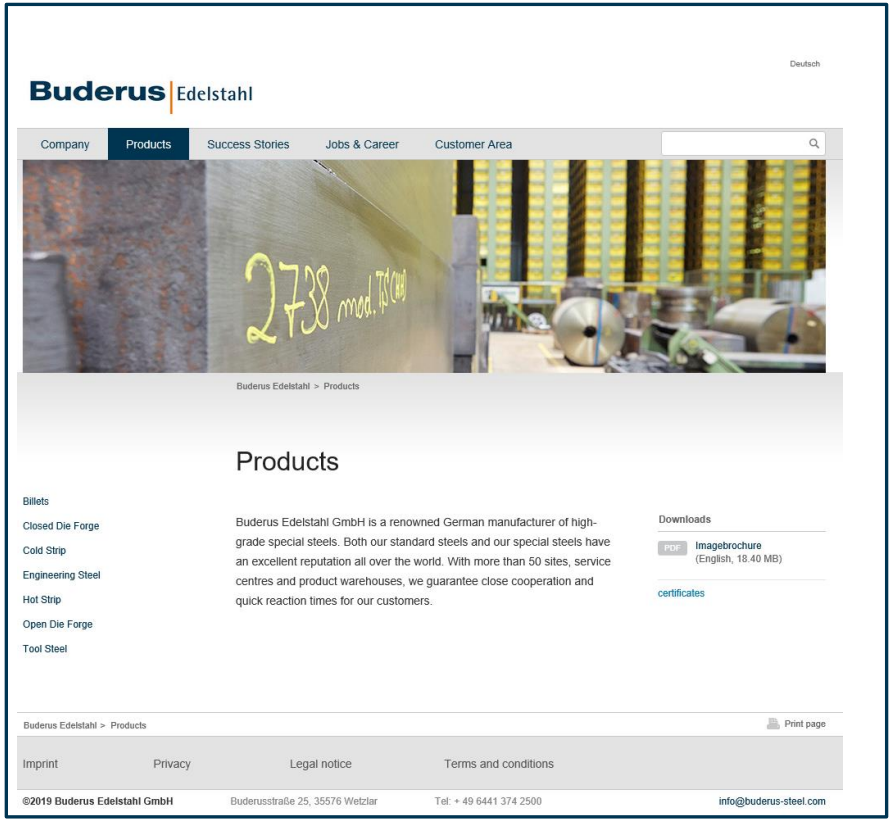


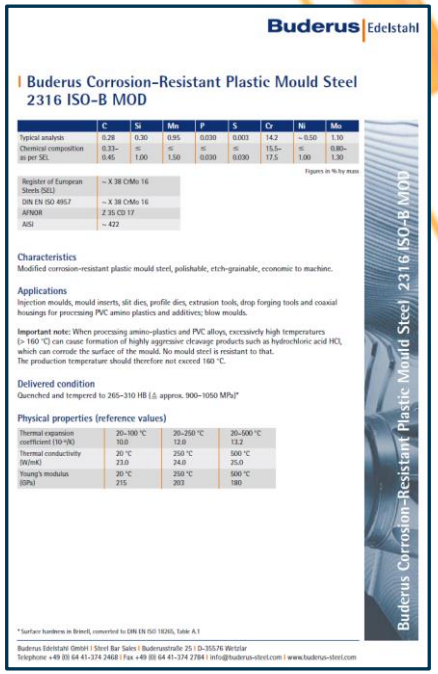
Size Range for HWS – Supreme with rectangular Cross-Sections



Size- and Weight Limits for Rectangular- and Square Bars		
Width:	1.800 (for a Thickness of max. 350mm)	mm
Thickness:	795	mm
Cross-Section:	636.000	mm^2
Weight:	14.000	KG

Further Information





For further Information as well as current Certificates and Material Datasheets, please visit our Website at: www.Buderus-Steel.com and www.degisimcelik.com.tr

Buderus | Edelstahl

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Thank You!

Hadımköy Mah Mustafa İnan

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