Corrosion-resistant, high-performance tool steels for the food industry

voestalpine BÖHLER Edelstahl GmbH & Co KG
www.voestalpine.com/bohler-edelstahl

voestalpine
ONE STEP AHEAD.

METALLURGICAL EXPERTISE SINCE 1870

BÖHLER

As a technology leader and leading sustainable company in the relevant market sectors of the special steel industry, we have been offering our customers superior, customer-specific expertise in development, advice and production for more than 150 years. We also utilize our comprehensive research and test facilities to develop custom high-performance materials in order to redefine the performance envelope for highly demanding requirements.

We deploy the best available technologies in our production facilities, and we continuously pursue higher efficiently, lower emissions, resource conservation and lower energy consumption in the framework of our existing steel production.

Our unparalleled product quality, process stability and global logistics expertise ensure market-leading delivery performance in all global target markets.

The new special steel plant in Kapfenberg sets new standards for product quality and sustainability.

OUR CUSTOMERS BENEFIT FROM:

Product range
We offer high-performance materials for the food industry available from stock. For custom requirements, we can draw on our portfolio of around 250 steel grades. Our production facility and our metallurgical expertise enable us to modify alloys.

Cutting-edge technology
At our new special steel plant in Kapfenberg we set new standards for production quality, process reliability and environmental protection.

Extremely high product quality
Our advanced manufacturing processes, such as pressurized electroslag remelting and powder metallurgy, enable us to guarantee extremely high quality standards.

Test laboratory / Analyses
The modern laboratories of voestalpine BÖHLER Edelstahl provide our production facilities with vital information and product parameters for process control and product certification in accordance with test standards and customer specifications. For tests in the food industry, we also cooperate with certified external labs such as AGES (Austrian Agency for Health and Food Safety).

Worldwide distribution network
With our central warehouse in Kapfenberg and, as needed, distribution warehouses worldwide, we offer optimal availability thanks to short delivery times and high delivery reliability.

Environment
Along with conservation of resources, we are constantly establishing new measures to enable environmentally friendly production and operations. Sustainable production processes and the use of the best possible, environmentally friendly technologies have been an inherent part of our corporate philosophy for decades.

Today's standards for food processing make strong demands on the tools used in terms of technical properties and reliable protection against food contamination.

Materials from voestalpine BÖHLER Edelstahl are known for their excellent mechanical properties and are now also certified for resistance to the migration of chemical elements into foods.

BÖHLER SPECIAL STEELS FOR THE FOOD INDUSTRY

HIGHLIGHT TYPES

- BÖHLER M333 ISOPLAST®
- BÖHLER M340 ISOPLAST®
- BÖHLER M368 MICROCLEAN®
- BÖHLER M380 ISOPLAST®
- BÖHLER N360
- BÖHLER M390 MICROCLEAN®
- BÖHLER M303 EXTRA
- BÖHLER N690
- BÖHLER M315 EXTRA
- BÖHLER M789 AMPO
- BÖHLER N700 AMPO
- BÖHLER N680

Regulation (EC) APPROVED No. 1935/2004

MATERIAL TESTING FOR FOOD PROCESSING

BÖHLER special steels for food industry are absolutely harmless to health thanks to their high purity and corrosion resistance, and they do not lead to any taste impairment in direct contact with foods.

MATERIAL TESTING FOR OUR MATERIALS

	Heat treatment parameters			Test conditions	
				Tap water DIN 10531 100°C, 2 hours	Citric acid 5 g/l 40°C, 10 days
BÖHLER Grades	Austenization temperature TA [°C]	Tempering temperature (2x 2h) TT [°C]	**Hardness HRc**	Test represents use in weakly acidic and mildly salty media	Test represents long-term use in acidic media
BÖHLER M333 ISOPLAST	980 / 1000	250	51/52	✓	✓
BÖHLER M333 ISOPLAST	980 / 1000	525	48	✓	x
BÖHLER M340 ISOPLAST	1000	250	56	✓	✓
BÖHLER M340 ISOPLAST	1000	525	53	✓	x
BÖHLER M368 MICROCLEAN	1000	250	53	✓	✓
BÖHLER M368 MICROCLEAN	1000	525	52	✓	x
BÖHLER M380 ISOPLAST	1020***	200	58	✓	✓
BÖHLER M380 ISOPLAST	1020***	520	57	✓	-
BÖHLER N360 ****	1020***	200	58	✓	✓
BÖHLER M390 MICROCLEAN	1150	250	58	✓	x
BÖHLER M390 MICROCLEAN	1150	525	60	✓	x
BÖHLER M303 EXTRA	prehardened		30	✓	✓
BÖHLER N690	1050	150	60	✓	x
BÖHLER M315 EXTRA	prehardened		30	✓	x
BÖHLER M789 AMPO	1000	500*	52	✓	✓
BÖHLER N700 AMPO	1040	510**	40	✓	✓
BÖHLER N680 ****	1020***	200	58	✓	✓

* Precipitation hardened 1 x 3 hours
** Precipitation hardened 1 x 4 hours
*** Treated by sub-zero-treatment after hardening
**** Only available in sheet form

✓ : Specific release limits not exceeded
x : Specific release limits exceeded
- : Not testet

Industrial food processing often involves cutting or shredding operations that place high demands on tools used.

Along with hardness and wear resistance, absolute safety is required with regard to health risks that can arise from food contamination by the processing tools. The decisive criterion for this is high resistance to migration of elements from steel into food.

Because every element has a different toxicological effect on the human body, careful registration of individual migrating elements is necessary to ensure food resistance. Test conditions that define various types of foods, contact times and temperatures have been defined by the Council of Europe in a guideline, together with limits for specific elements.
Selected BÖHLER products with high resistance to wear and corrosion have been tested accordingly with regard to their suitability for food processing. Corresponding declarations of compliance and reports are available.

MODERN FOOD PRODUCTION REQUIRES HIGH-PERFORMANCE MATERIALS

The mechanical processing steps in food production are often as varied as foods concerned. Slicing, grating, extruding, cutting, pressing and shredding are just some of the processes used in industry.

An important requirement for steel materials used in such operations is high wear resistance, both to achieve long service life of the tools made of these materials and to avoid food contamination by abraded particles.
In addition, high chemical resistance of the materials is also extremely important to prevent food contamination by metal ions from steel. Potential corrosion due to aggressive cleaning agents must also be avoided. To meet these demands, it is advisable to use high-quality materials produced using advanced manufacturing processes, such as pressurized electroslag remelting and powder metallurgy.
Continuous quality control during operation is also necessary to ensure consistent quality of steel products. Above all, careful testing of product behavior in contact with foods is essential to rule out any risk to consumer health.

STRICT TESTS
ENSURE SAFETY

The best way to assess chemical contamination of foods during processing is to perform practical tests using real food and test conditions. If this is not possible, for example because tool comes in contact with different foods, testing can be carried out using so-called food simulants.

Because national regulations on the use of metals and alloys in food processing vary within Europe, the Council of Europe has published a guideline for evaluation of food resistance. This technical guide, "Metals and alloys used in food contact materials and articles," includes defined food simulants and test conditions as well as limit values for permissible metal migration.

The decisive factor for assessment of food resistance is an analysis of different elements released.

The various chemical elements present in metal objects used to process foods often pose very different health risks when absorbed into human body.

They can be released to foods via metal ions. This is referred to as metal leaching or metal migration. If toxicological limits are exceeded, consumers may be at risk.

The organoleptic properties of food may also be adversely affected. Such an effect on smell, taste, appearance or consistency can also be a consequence of metal migration, even if there is no direct health risk.
For testing, samples are placed in a test solution, called food simulant, at a defined temperature for a defined exposure time. The assessment is determined by the increase in concentration of individual metal ions in the food simulant. A prerequisite for a positive assessment for food suitability is the case if no element has a concentration higher than defined specific release limit.

CLASSIFICATION OF FOODS – ALLOCATION TO FOOD SIMULANT

Which food simulant for which food?

The allocation of foods to test media is defined by Commission Regulation (EU) No. 10/2011 on materials and articles intended to come into contact with food. It provides classification of commonly used food simulants.

This regulation applies to plastic materials, but it can also be used for selection of food simulants for testing of metals.

Testing of food contact materials

Classification of foods – allocation to food simulant
Commission Regulation (EU) No. 10/2011, Annex III, Table 2
Example excerpt:

Reference number	Description of food	Food simulants					
07	**Milk products**	A	B	C	D1	D2	E
07.01	**A** Milk and milk based drinks, whole, partly dried and skimmed or partly skimmed				X		X
	B Milk powder including infant formula (based on whole milk powder)				X		X
07.02	Fermented milk such as yoghurt, buttermilk and similar products		X (*)		X		
07.03	Cream and sour cream		X (*)		X		
07.04	**A** Cheeses, whole, with not edible rind					X/3 (**)	X
	B Natural cheese without rind or with edible rind (Gouda, Camembert, and the like) and melting cheese					X/3 (**)	X
	C Processed cheese (soft cheese, cottage cheese and similar)		X (*)		X		

Food simulant B: acidic media — Test with acidic medium necessary

Other simulants (A, C, D1,D2, E) are covered by the aqueous test — Test with aqueous medium necessary

(A, C, D1… ethanol 10-50%, D2… plant-based oil, E… dry food)

USE AND CERTIFICATION OF BÖHLER GRADES

Also suitable for acidic foods (pH < 4.5)

These BÖHLER grades can be used with all types of food.

BÖHLER grades	Heat treatment	
	T_H [°C]	T_A [°C]
BÖHLER M333 ISOPLAST	980/1000	250
BÖHLER M340 ISOPLAST	1000	250
BÖHLER M368 MICROCLEAN	1000	250
BÖHLER M380 ISOPLAST	1020	200
BÖHLER M303	prehardened	
BÖHLER M789 AMPO	1000	500
BÖHLER N700 AMPO	1040	510
BÖHLER N360	1020	200
BÖHLER N680	1020	200

Test conditions

Food simulant	Citric acid 5 g/l
Exposure time	10 days
Test temperature	40°C

Grades with the stated heat treatment fulfill the requirements for long-term use with acidic foods.

Examples of acidic foods
(according to EU Regulation 10/2011):

- Fruits or vegetables in the form of purée
- Preserved vegetables
- Fruits in its own juice or in sugar syrup

- Preserved fish in an aqueous medium
- Preserved meat in an aqueous medium
- Crustaceans and mollusks in aqueous media

- Fermented milk products
- Cream and sour cream
- Processed cheese and cheese in an aqueous medium

- Vinegar
- Sauces with aqueous or fatty character and mustard
- Preparations for soups, broths, sauces in any other form than powdered or dried
- And others; see Regulation No. 10/2011

Suitable for mildly acidic foods (pH > 4.5), as well as oily, greasy, dry or alcoholic foods

BÖHLER grades	Heat treatment	
	T_H [°C]	T_A [°C]
BÖHLER M333 ISOPLAST	980/1000	250
BÖHLER M333 ISOPLAST	980/1000	525
BÖHLER M340 ISOPLAST	1000	250
BÖHLER M340 ISOPLAST	1000	525
BÖHLER M368 MICROCLEAN	1000	250
BÖHLER M368 MICROCLEAN	1000	525
BÖHLER M380 ISOPLAST	1020	200
BÖHLER M380 ISOPLAST	1020	520
BÖHLER N360	1020	200
BÖHLER M390 MICROCLEAN	1150	250
BÖHLER M390 MICROCLEAN	1150	525
BÖHLER M303	prehardened	
BÖHLER N690	1050	150
BÖHLER M315	prehardened	
BÖHLER M789 AMPO	1000	500
BÖHLER N700 AMPO	1040	510
BÖHLER N680	1020	200

Test conditions

Food simulant	Artificial tap water DIN 10531
Exposure time	2 hours
Test temperature	100° C

Grades with the stated heat treatment fulfill the requirements for non-acidic foods with short-term contact.

Examples of non-acidic foods
(according to EU Regulation 10/2011)

- Cereals
- Flour, bread, muesli
- Dry pasta

- Chocolate and confectionery products
- Sugar and sugar syrup

- Fats and oils
- Butter and margarine
- Animal fats

- Non-acidic fruits and vegetables (whole, sliced, dried, dehydrated, etc.)
- Dried fruits and nuts

- Non-acidic animal products (e.g. fresh meat)
- Herbs, spices, coffee and cocoa
- Frozen foods
- And others; see Regulation No. 10/2011

APPLICATION
EXTRUSION

Extrusion is industrially used in the production of many foods. Extruders knead, mix, cook and portion foods. This leads to high demands with regard to force and wear, which can only be economically met by tool steels with extremely high resistance to pressure and wear.

Extrusion screws and dies are the most highly stressed components in extrusion machines. voestalpine BÖHLER Edelstahl offers a range of tried and tested tool steels that ensure extremely high quality, consistent taste, cost-effective processes and safe products.

APPLICATION
KNIVES

Better cutting thanks to material expertise and consistent adaptation to customer needs.
Customer benefits are top priority at voestalpine BÖHLER Bleche. This is demonstrated by small machining allowances and our cutting service. A wide variety of cutting methods are possible, such as laser cutting, cold sawing, shearing or plasma cutting, flame or powder cutting, and water jet cutting.

High-grade knife steels are used in food industry and in cardboard and paper industry, in metalworking, in textile industry, and in plastics processing.

You benefit from our strength – the entire production chain is in our hands.
voestalpine BÖHLER Edelstahl is a master in all advanced technologies for melting and remelting, including EAF / AOD, VID, ESR / Pressure ESR, and powder metallurgy.

Cross-rolling technology:
uniform properties over the entire sheet, independent of lengthwise or crosswise direction.

Cross-rolling ensures excellent workability and higher reliability. voestalpine BÖHLER Bleche produces high-quality knife steels with excellent processing properties. The special cross-rolling technology and advanced production facilities ensure consistent material properties with lowest possible machining allowances.
This fulfills the most stringent demands for manufacturing and in use. Quick availability and technical support enable our customers to respond faster to new challenges.

Advantages of cross-rolled sheets compared to conventional material formed in only one direction:

- Optimal sheet yield
- Higher production reliability
- Better processing properties
- Lower machining allowances
- Less warping

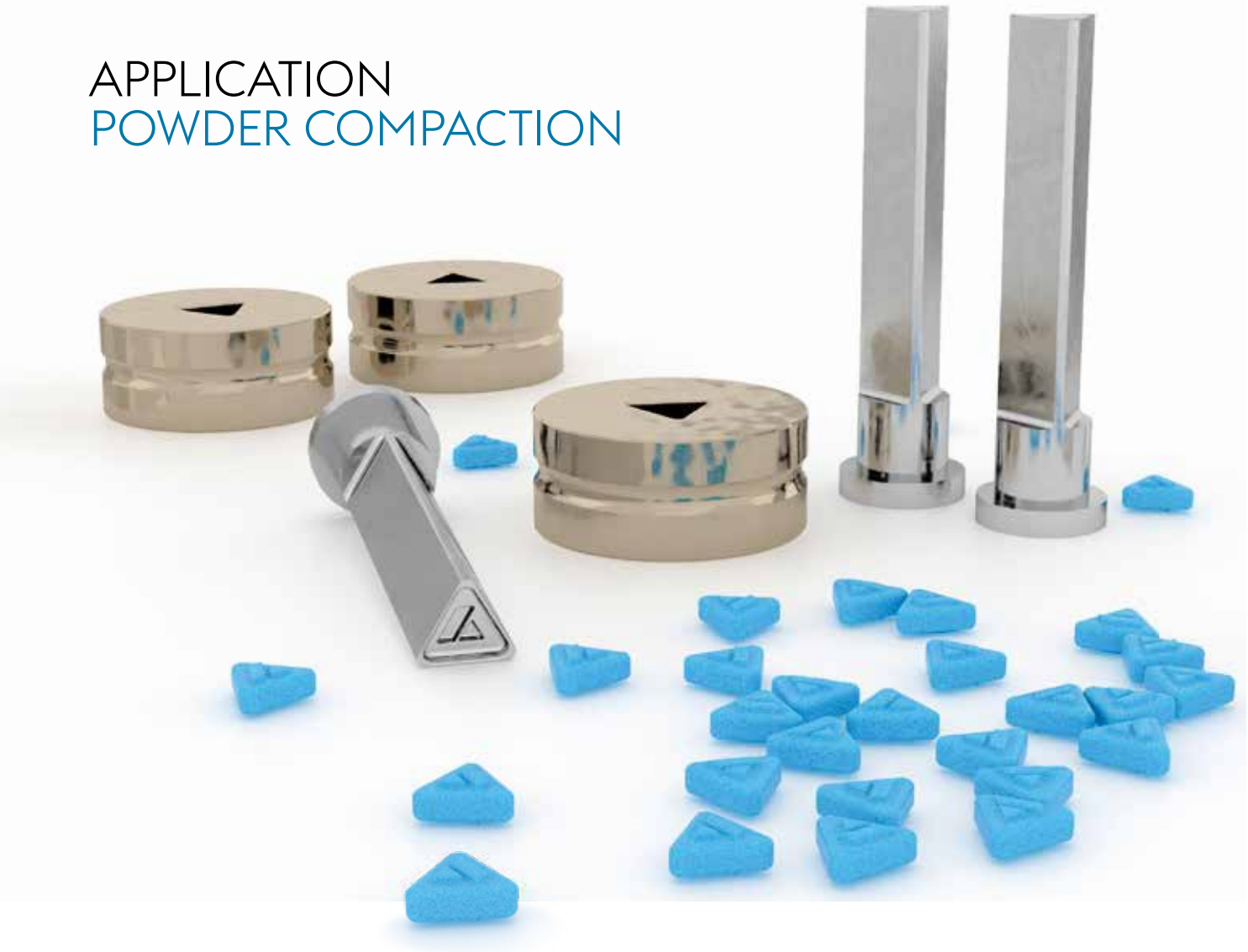
We have the total solution

- Custom sheet metal formats
- Custom surface finishes, from sand-blasted to polished
- Cutting service with a wide variety of cutting options:
  laser cut, cold sawn, plasma cut, sheared, flame/powder cut, water-jet cut
- Individual technical support

Custom sheets for:

- Cutter knives /
  knives for meat and sausage processing
- Knife applications
  in industrial fish processing
- High-quality knife applications
  such as hunting knives or kitchen knives

APPLICATION
POWDER COMPACTION



Powder compaction

Press punches are often subjected to high compression forces. Along with high abrasive wear resistance, they require high corrosion resistance. To sustainably fulfill these requirements, a high-quality tool steel must be used, taking into account the relevant production process (ESR, PM) and customer-specific heat treatment. Tool steels from voestalpine BÖHLER Edelstahl fulfill all of these requirements in this sensitive application area, with the following benefits:

- Improved process properties (pressure resistance, toughness, wear resistance and corrosion resistance)
- Less product contamination
- Longer tool life

Customer benefits

- » Longer service life compared to industry standard
- » Higher machine availability and efficiency
- » Much lower total cost of ownership (TCO)
- » Lower maintenance costs
- » Improved processing properties
- » Tailored solutions for individual requirements

APPLICATION
GRINDING MILL

Grinding mills:
Grinding coffee, cereal grains, herbs and spices, etc. imposes special conditions on tools used. Whether for disc or roller mills, our customers' decision criteria are always the same:

- High resistance to wear, fracture and corrosion
- Better and longer sharpness thanks to better edge stability
- Uniform material quality (ESR, PM) for consistent quality and a stable production process

Customer benefits

- Longer mill lifetime compared to industry standard
- Premium steels for a better product line
- Better fracture resistance in the presence of undesirable hard components (sand, etc.)
- No chemical interaction that affects the taste of the product

APPLICATION
PACKAGING / CAN CLOSING ROLLS

Can closing rolls

For this filling and closing process, our customers focus on cycle time and product safety. Trouble-free operation of a filling line requires suitable technology and tools. voestalpine BÖHLER Edelstahl offers premium materials to meet these requirements, with the following advantages:

- Improved process properties (pressure resistance, toughness, resistance to wear and corrosion)
- Less product contamination
- Longer tool life

Customer benefits

- » Longer service life compared to industry standard
- » Higher machine availability and efficiency
- » Much lower total cost of ownership (TCO)
- » Lower maintenance costs
- » Improved processing properties
- » Tailored solutions to meet individual requirements

APPLICATION
PORTIONING

Portioning units require high to extremely high corrosion resistance, depending on the foodstuff, and therefore require certification for acidic foodstuffs (pH < 4.5) or testing for aqueous foodstuffs (pH > 4.5).

CLEANING

Along with processing food, the line has to be cleaned between processing of different types of food or when it is shut down. Aggressive cleaning agents are often used in this case and could cause severe corrosion damage to the material. Rinsing with water should be done as quickly as possible after disinfection, and the line should be dried if possible.

The data contained in this brochure is merely for general information and therefore shall not be binding on the company. We may be bound only through a contract explicitly stipulating such data as binding. The manufacture of our products does not involve the use of substances detrimental to health or to the ozone layer.

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