

# MATERIALS TESTING FOR FOOD PRODUCT PROCESSING

Modern standards in food product processing have strict requirements for the material properties of tools used and for contamination safety. Materials from voestalpine BÖHLER Edelstahl are known for their excellent mechanical properties, and have now been certified for resistance to migration of chemical elements into food products as well.



Industrial processing of food products often includes cutting or comminuting procedures that place high demands on the tools used. In addition to hardness and wear resistance, they demand absolute safety in terms of health risks that can be caused by contamination of the food products by the processing tools.

The essential criterion for this is high resistance to migration of elements out of the steel and into the food products. Because every element has a different toxicological effect on a human organism, careful detection of individual migrating elements is needed in order to guarantee food product resistance. Test conditions that define various types of food products, contact times, and temperatures have been defined by the Council of Europe in a directive, together with limits for specific elements. Selected BÖHLER products with high wear and corrosion resistance are

tested accordingly for compatibility with food product processing. Declarations of Conformity and inspection reports are now available.

## Modern production of food products demands high-performance materials

The mechanical processing steps in the production of food products are often as varied as the food products themselves. Slicing, grating, extruding, cutting, pressing, and comminuting are just some of the processes used in industrial applications. An important requirement for the steel materials used is high wear resistance, both in order to achieve long service life for the tools made of the material, and to avoid contaminating the food products with particles shed under abrasion. Beyond this, however, high chemical resistance of the materials is also of great importance in order

to avoid contaminating the food products with metal ions from the steel. Corrosion due to aggressive cleaning agents must also be avoided.

To meet these requirements, it makes sense to use high-quality materials produced in modern production processes, such as gas-shielded electroslag remelting or powder metallurgy. Continuous quality controls during operations are also needed in order to guarantee consistent quality of the steel products. Most important, however, is careful testing of the behavior of the products when in contact with food products, in order to rule out any risk to consumer health.

## Strict testing guarantees safety

The best way to evaluate chemical contamination when processing food products is to perform a practical test using real food products and test conditions. If

BÖHLER Grades	Heat treatment parameter		Hardness HRC	Test conditions	
	Austenitising temperature $T_A$ [°C]	Tempering temperature (2x2h) $T_T$ [°C]		Tap water DIN 10531 100°C, 2h	Citric acid 5g/L 40°C, 10 days
BÖHLER M333 ISOPLAST®	1000	250	52	X	X
BÖHLER M333 ISOPLAST®	1000	525	48	X	
BÖHLER M340 ISOPLAST®	1000	250	56	X	X
BÖHLER M340 ISOPLAST®	1000	525	53	X	
BÖHLER M390 MICROCLEAN®	1150	250	59	X	
BÖHLER M390 MICROCLEAN®	1150	525	60	X	
BÖHLER M303	1000	620	33	X	X
BÖHLER N690	1050	150	60	X	

X: Limits not exceeded (Specific Release Limits)

this is not possible, for example because the tool comes into contact with various food products, then a test using food simulants may be applied instead. Because national regulations on the use of metals and alloys in food product processing vary within Europe, the Council of Europe has published a directive for evaluating food product resistance. This technical guideline, „Metals and alloys used in food contact materials,“ includes defined food simulants and test conditions, as well as limit values for permissible metal ion migration.

The critical point for evaluating food product resistance is to consider the various elements released. The various chemical elements present in metal objects used to process food products often have very different health risks when absorbed by the human body.

They can be given off into the food products in the form of metal ions. This is referred to as metal leachability or migration. If the toxicological limits are exceeded, then consumers may be at risk. The organoleptic properties of the food products may also change in an undesired way. Such an effect on the smell, taste, appearance, or consistency can also be due to metal ion migration, even if there is no direct health risk. For the test, samples are placed in the simulated food product at a defined

temperature for a defined length of exposure time. The increase in concentration of individual metal ions in the test solution is the crucial factor for the evaluation. A prerequisite for a positive evaluation as suitable for food products is that no element has a concentration above the specific defined limit („specific release limit“).

## Certified solutions for challenging food product processes

The preferred group of materials used for mechanical processing steps in the food products industry is that of martensitic chromium steels. These steel grades are characterized by high wear resistance and good corrosion resistance. Due to the wide range of different requirement profiles in this segment, a wide range of these steels is available with a fine-tuned portfolio of properties. Each grade contains different amounts of alloying elements, and their tendency to migrate in contact with food products depends on the element itself, other alloying components, and the corrosion resistance of the particular grade of steel. This means that it is necessary to evaluate each grade individually, and of course different heat treatment conditions must also be considered.

The BÖHLER steels tested by the Austrian

Agency for Health and Food Safety (AGES) are listed in the above table, along with their test results. The samples were tested in the heat treatment condition typical for the practical application. The table shows which grades tested positively for which test conditions. The simulants used were standardized tap water and citric acid, which represent various food products. Detailed information on the tests, corresponding Declarations of Conformity, and test reports can be requested from BÖHLER sales companies. These certifications reflect compliance with Regulation (EC) 1935/2004 on materials and objects for food contact and Regulation (EC) 2023/2006 on good manufacturing practice for materials and objects intended for food contact.

With these steel grades now certified for food products applications, voestalpine BÖHLER Edelstahl provides a selection of high-quality materials for the mechanical processing of food products where high wear resistance is required. The element-specific tests performed and the high quality standard for producing steel products guarantee safety, when applied correctly, with respect to critical contamination of food products due to metal migration.

The sales companies and BÖHLER website can provide additional information.

» Council of Europe directive for testing resistance to food products: <https://www.edqm.eu/en/food-contact-materials>  
 » Regulation (EC) 1935/2004, Regulation (EC) 2023/2006 and Regulation (EU) 10/2011: <https://eur-lex.europa.eu/legal-content>  
 » BÖHLER sales companies and website: [www.voestalpine.com/boehler-edelstahl](http://www.voestalpine.com/boehler-edelstahl)