

# PERFORMANCE INCREASE FOR TOOLS







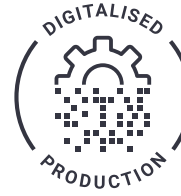
# PRECISION FINISHING SOLUTIONS

OTEC mass finishing machines stand for a comprehensive and far-reaching quality and performance increase for cutting, stamping, forming, bending and machining tools.

By increase, we mean longer tool life, consistent quality, better planning and machine processing to replace cost-intensive manual tasks. Rounding, deburring, smoothing or polishing processes are used depending on the requirement.

OTEC also offers precision finishing sample processing for individual machines and process simulations as well as downstream partners for process consultations and on-site service partners.

Our OTEC Campus also offers training courses both in-house and online.







### Technology leader

With more than 1,000 machines sold in the toolmaking industry, OTEC machine technology has been synonymous with perfect edge and surface processing – one of OTEC's core markets – since 1996. The machines can process even complex geometries and perform several processing steps at once using a wide range of granulates.

### Research & Development

By collaborating with universities, research institutes and other institutes, OTEC is continuously pushing the boundaries of feasibility, creating innovations and maximising the quality and cost-effectiveness of their processes.

### Process simulations

Digital process simulations and analyses allow a faster and more comprehensive understanding of processes, save on material and energy costs and reduce process configuration time by up to 90%.

### Material mix

OTEC processes can be used for processing hard metal (HM), tool steel, PCD, HSS, CBN, ceramic cutting materials as well as PVD, CVD and DLC coatings.

### Sustainability

OTEC machines are particularly flexible and therefore durable. Even after a product series is phased out, OTEC customers can continue to use it for other products.

Moreover, OTEC's goal is to become carbon neutral at its production site in order to meet its responsibility towards the environment and climate.

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**SURFACE  
PROCESSING  
FOR THE  
TOOLMAKING  
INDUSTRY**





## LONGER SERVICE LIFE AND PERFORMANCE

- Significantly less variation in service life
- Up to triple the service life
- Fewer tool changes

## IMPROVED CHIP REMOVAL AND STABLE CUTTING EDGES

- Defined cutting edge rounding and smoothing of the chip flutes
- Less friction and fewer sticky build-ups on the tool

## HIGHER QUALITY

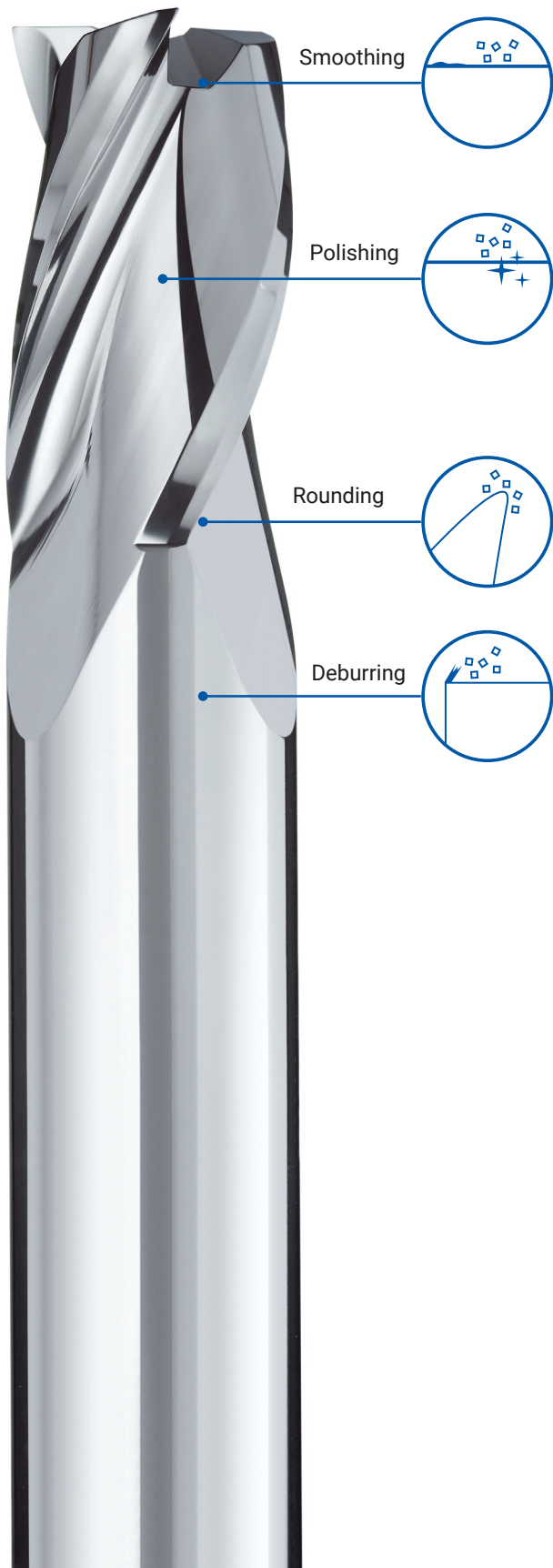
- Automated processes for consistent, constant results
- Improved surfaces on the component

## COST EFFECTIVENESS AND PROCESS RELIABILITY

- Easy to automate
- Reproducible processes
- Short processing times



# HIGH-PERFORMANCE PROCESSES FOR UNIVERSAL PROCESSING TASKS



## CUTTING EDGE ROUNDING

### Objectives

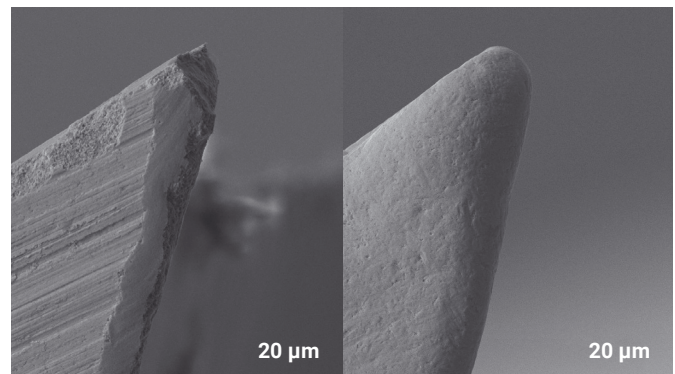
- Reduced jaggedness on the cut
- Removal of loose grits from the HM surface after grinding
- Targeted cutting edge rounding of 5 - 100  $\mu\text{m}$  radius according to customer specifications
- Simultaneous smoothing of the rake face/flute

### Process

- Processing in DF- or SF-Series
- Dry polishing or dry grinding

### Advantages

- More stable cutting edge
  - Fewer downtimes, shorter set-up times, etc.
  - Consistent edge rounding even with different geometries
- Improved cutting edge surface
  - Less heat generated on the rake face
- Higher machining performance
  - Increase in possible feed rate during drilling of up to 4.5 higher
  - Higher cutting speed
- Tool life increased by a factor of up to 3.5
- Improved layer adhesion to prevent undefined flaking due to excessive internal stress



Cutting edge before and after homogenisation



O TEC mass finishing machines are ideal for a whole range of surface processing tasks in the toolmaking industry. The O TEC DF- and SF-Series machines can be used to achieve customised processing results and advantages.

## POLISHING MACHINING

### Objectives

- Polishing the chip flutes
- Stabilising and smoothing the cutting edge
- Reduced surface roughness

### Process

- Processing in DF- or SF-Series
- Dry polishing abrasives

### Advantages

- Improved chip removal
- Prevents chip jamming and resultant tool fracture
- Reduced cutting forces
- Prevents built-up edges forming and cold welding
- Better surface on the component
- Improved layer adhesion
- Less heat generated on the tool, fast chip removal due to reduced friction, less wear

## THREAD FORMERS PROCESSING

### Objectives

- Targeted rounding of moulded edges
- Reduced grinding times
- Homogenisation of the surface in the thread area

### Process

- Processing in SF-Series with pulse finishing
- Wet polishing abrasives

### Advantages

- Reduction in deformation forces of around 60%
- Consistent edge rounding even with different geometries
- Targeted abrasion at the moulded edge



Cutting tool before and after processing



Thread former before and after processing

## POLISHING STAMPING TOOLS, THERMOFORMING TOOLS

### Objectives

- Reduced surface roughness
- Longer service life particularly for forming and thermoforming tools
- Improved high-gloss look
- Improved corrosion protection in everyday use
- Removal of sticky build-ups and deposits

### Process

- Processing in DF- or SF-Series using dry polishing or grinding abrasives depending on the component and initial quality:
  - e.g. wet pre-grinding, polishing with dry polishing abrasives
  - e.g. using only dry polishing abrasives depending on the initial quality

### Advantages

- Reduced friction
- No material welds:
  - Very little material abrasion, so no loss of shape
  - No jamming of tools
- Meets visual requirements
- Corrosion protection, much less susceptible to rusting due to polished surfaces



Stamping tool after processing

## POLISHING INJECTION MOULDING TOOLS

### Objectives

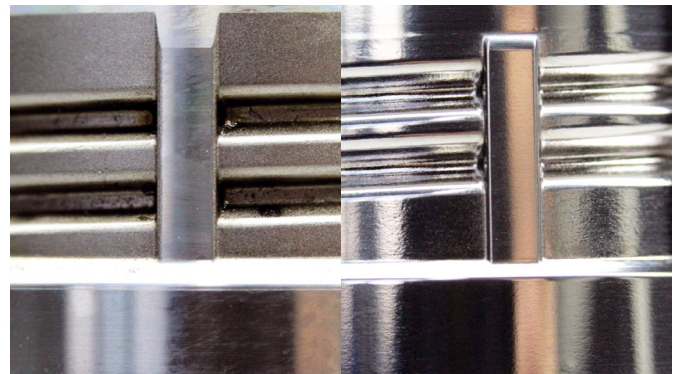
- Polishing the surface
- Tool maintenance, cleaning and polishing

### Process

- Processing in DF- or SF-Series
- Dry polishing abrasives

### Advantages

- Good demoulding properties due to polished surfaces
- No adhesion of material residues in the mould
- Less manual work due to machine polishing
- Consistent quality thanks to reproducible processes



Injection moulding tool before and after processing



## COATINGS SMOOTHING

### Objectives

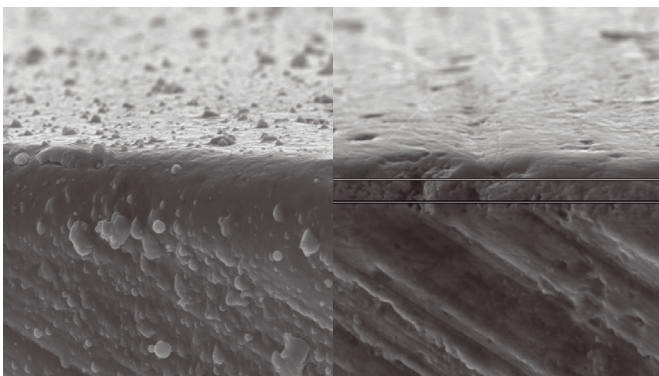
- Reduced friction
- Improved chip flow

### Process

- Standard processes in DF- and SF-Series using HSC abrasives
- Standard processes in DF- and SF-Series using H3-H4 and M4-M5

### Advantages

- Improved tool performance
  - Less heat generated
  - Better chip removal
- Increase in service life by up to a factor of 3.5
- Less wear
- Improved high-gloss look



Removal of droplets

## DEBURRING

### Objectives

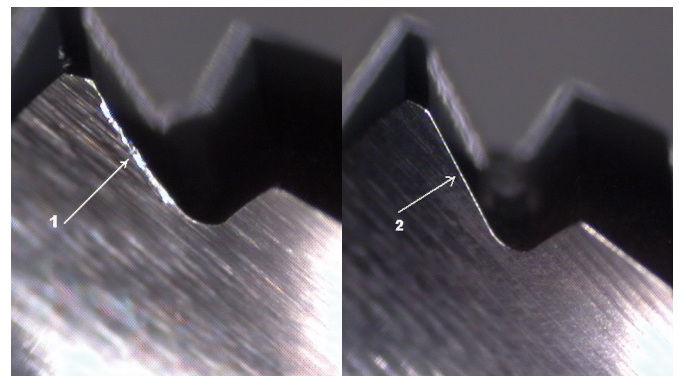
- Removal of burrs on steel parts (carrier tools)
- Deburring of insert seats
- Deburring of HSS tools
- Performance increase for the tool
- Defined edge rounding

### Process

- Wet Finishing of steel parts using grinding abrasives in CF-Series, DF-Series and SF-Series
- Dry Finishing of HSS tools using dry grinding granulate in DF-Series and SF-Series
- Wet Finishing of HSS tools using microfinishing grinding bodies in SF-Series

### Advantages

- Prevents the risk of accidents when changing the replaceable cutting inserts
- Secure seating of the replaceable cutting inserts
- Faster and complete processing of complex geometries
- Significant improvement in how parts feel
- Improved layer adhesion
- Required edge rounding is achieved



Significant burr before processing

After processing, the cutting edge is free of burrs and the edges are rounded

# FOR MAXIMUM PERFORMANCE

## TOOLS AND TYPES OF PROCESSES

	Rounding cutting edge	Polishing rake face	Polishing cutting edge/ reducing jaggedness	Reducing surface roughness	Complete polishing
<b>MACHINING</b>					
Milling tools	✓	✓	✓	✓	✓
Drill bits	✓	✓	✓		
Taps	✓				
Thread formers					✓
Reamers	✓		✓		
Micro-tools	✓	✓			✓
Cutting inserts	✓	✓		✓	
HM teeth for saw blades	✓				
Gear-cutting tools	✓	✓			
<b>FORMING, PUNCHING, MOULD MAKING</b>					
Stamps	✓		✓		✓
Dies	✓		✓		✓
Pressing tools					✓
Crimping tools				✓	✓
Bending tools					✓
Can closure tools					✓
Injection moulding tool components				✓	✓
<b>OTHER</b>					
Carrier tools					✓
Tool holders					✓
Non-return valves					✓
Extruder screws					✓
Tablet tools				✓	✓

\* for HSS



	Smoothing coatings	Deburring	Dry grinding process	Dry polishing process	Wet grinding process	Wet polishing process
	✓		✓	✓		
	✓		✓	✓		
	✓	✓*	✓	✓		
	✓			✓		✓
	✓		✓			
	✓		✓	✓		
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				✓		

# DRAG FINISHING TECHNOLOGY

In the OTEC Drag Finishing Process, workpieces are dragged at high speed through the abrasive in a rotating motion. The high contact pressure and the high relative speed between the workpiece and abrasive reliably ensure an optimum result in the shortest time.

## Processing options

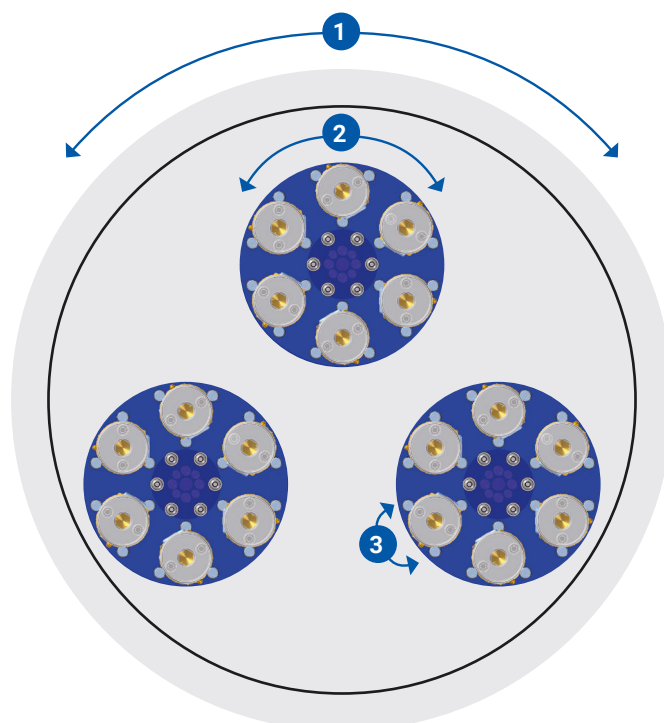
- Exact edge rounding
- Smoothing
- High-gloss finish
- Removal of droplets
- Smoothing after coating

Custom-designed workpiece holders make a significant contribution to the perfect processing results obtained by the DF-Series. They not only hold workpieces perfectly in place but also allow fast loading and easy batch changes.

## Operating principle of the Drag Finishing Unit

Triple rotation around

- 1 Rotor plate axis
- 2 Driven multi-holder
- 3 Workpiece axis





# STREAM FINISHING TECHNOLOGY

In the Stream Finishing Process, workpieces are clamped in a holder and lowered into a rotating container filled with an abrasive or polishing medium. The workpiece rotates and is processed as the medium circulates around it.

## Compressed processes

In this process, workpiece surfaces can be deburred and edges can be rounded, smoothed and polished in a single operation. This is made possible by the high flow speeds of the abrasives achieved using SF technology. The resulting forces press the fine abrasive granules into the smallest, hard-to-reach areas (grooves, flutes, etc.). This enables roughness depths of below Ra 0.03  $\mu\text{m}$  and significantly improves the tribological properties:

- Reduced peak roughness
- Random (isotropic) surface structures

## Result

- Improved flow and withdrawal behaviour
- Improved lubricating film stability

## Component-based motion control

A contour-controlled motion sequence ensures the targeted processing of defined areas and consistent processing over the entire workpiece. The machine's special design allows the flow angle of the abrasive to be adjusted according to the component. This combination of high automation, powerful processing forces and quick workpiece changing during the procedure allow for extremely fast and efficient workpiece processing.

The intermittent drive is ideal for asymmetrical tools as individual edges and surfaces can be specifically targeted and/or processed gently.

## Technical features

- Precisely defined and quickly repeating movement intervals between media and workpiece
- Processing times < 1 min possible
- Easy to automate

# STREAM FINISHING WITH PULSE FINISHING TECHNOLOGY

## Patented cutting edge technology

The PULSE FINISHING process developed specially for processing tools takes care of even the most demanding processing tasks.

Otec's Stream Finishing machines are available with a rotary drive, intermittent drive or PULSE FINISHING drive as required. The PULSE FINISHING process is based on precisely defined and quickly repeating movement intervals between media and workpiece.

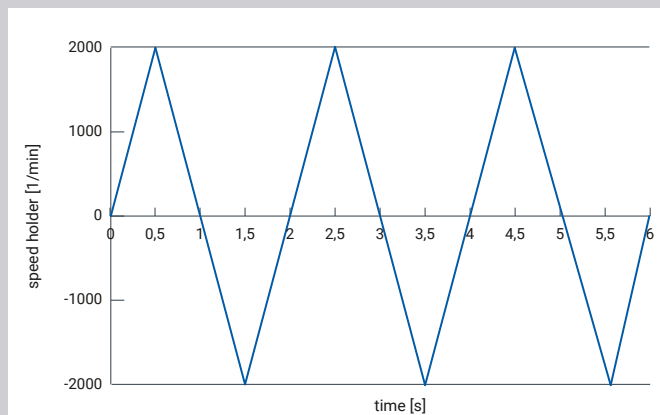
The patented pulse drive was specially developed to meet the requirements of series production in the modern toolmaking industry. PULSE FINISHING allows users to meet the demanding speed, quality and reliability requirements in mass production.

The short processing times also shorten the payback period. This makes investments in automated machines like Stream Finishing Machines commercially viable.



## The principle of the Pulse Finishing Process

- Alternating rotation of workpiece up to  $\pm 2,000$  rpm
- High tangential acceleration up to 40 g
  - Strong grinding effect
  - Very short processing times
- Very low Rpk values ( $< 0.1 \mu\text{m}$ ) quickly obtainable
- Processing of hard-to-reach areas



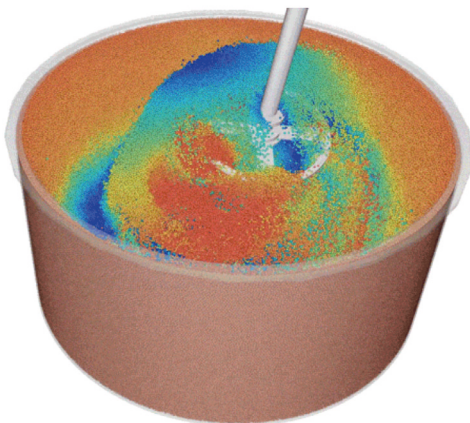
# DIGITAL PROCESS SIMULATION

Process simulation reflects the high degree of digitalisation at OTEC and stands for even more efficient and resource-saving design and optimisation of the processes. It provides analyses and knowledge that allow you to understand the process even faster and more comprehensively.

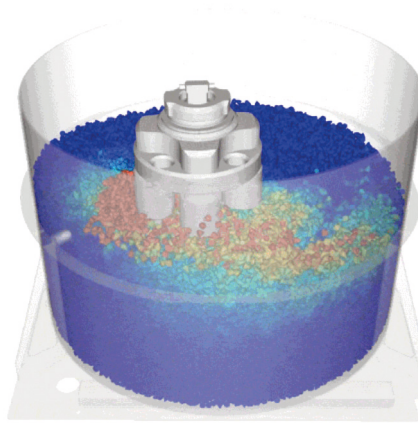
Simulation not only saves on material and energy costs but also reduces process configuration time by up to 90%. Unlike traditional process definition, process simulation neither requires real workpieces to be processed or materials to be used, nor does it involve manufacturing work in upstream processes. It can also calculate and analyse the flow conditions across the entire workpiece virtually.

## Perfect surfaces using a database

Making an important contribution to reducing energy and costs is not all: OTEC's process simulation also provides valuable impetus for achieving perfect surfaces on a technical level, for example by identifying stagnation points and flow separation, analysing pressures, speeds and contact times on the workpiece surface and adjusting workpiece orientation to achieve optimised flow characteristics. This information can be used to achieve faster and more homogeneous smoothing.



Stream Finishing Process in the simulation



Drag Finishing Process in the simulation

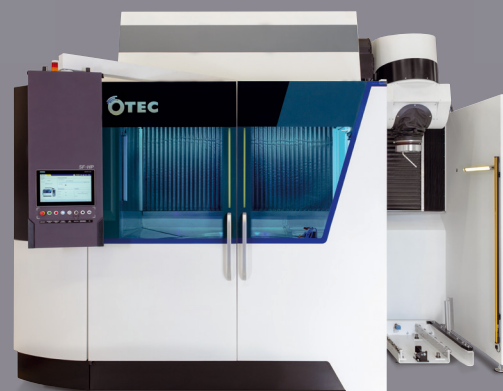


STREAM FINISHING MACHINE SF-HP

## EXTRA LARGE. UP TO 200 KG.

### SURFACE SOLUTIONS FOR LARGE AND HEAVY WORKPIECES

- For smoothing, polishing and deburring
- Adapted according to your particular needs in a single process
- Workpieces up to 650 mm and 200 kg can be processed
- Integrated automation solution



More information







More information

Control panel with smart software

Stationary process container with abrasive

Control panel with smart software

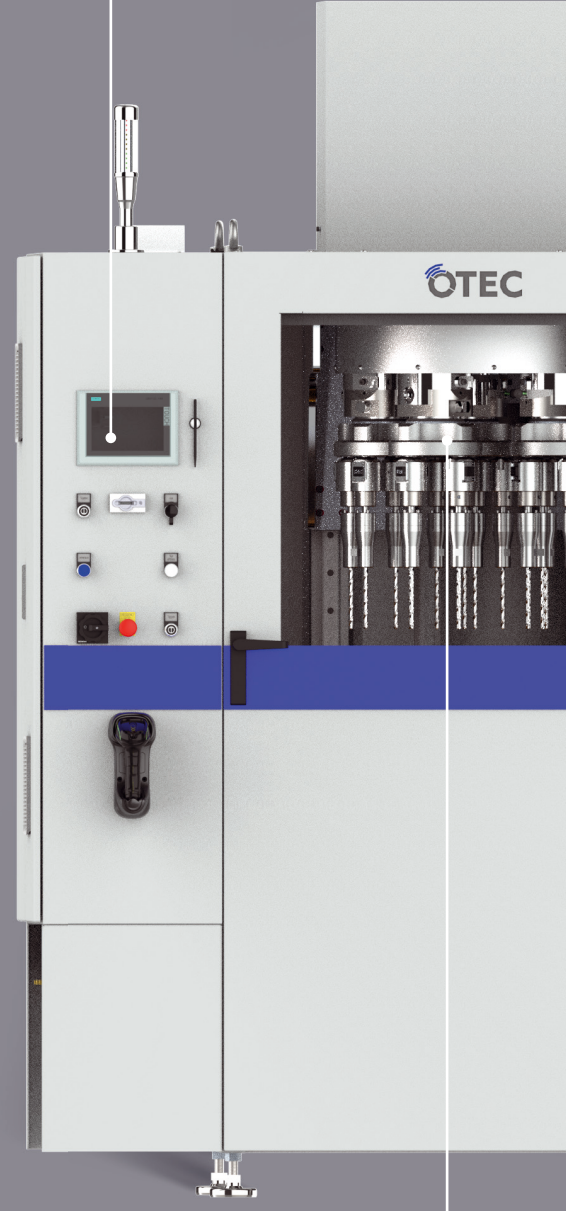


**DF-Series**

**DF-3:** 3 holders with up to 6 tools each, i.e. up to 18 in total

Driven holders with various insertion points for tools

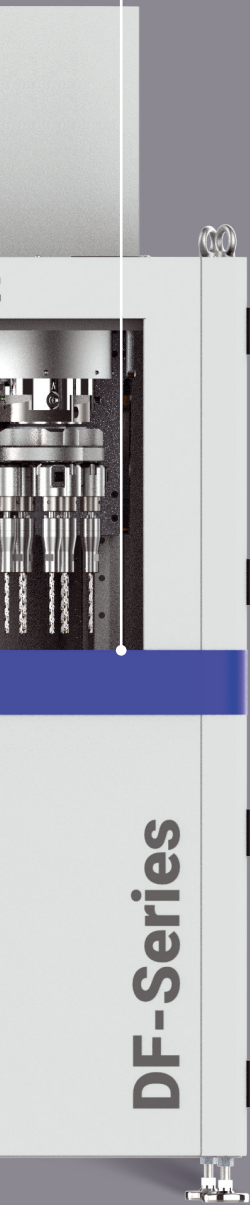
Quick change holder and clamp bushing holder



Driven holders with various insertion points for tools

Quick change holder and clamp bushing holder

Stationary process  
container with abrasive



DF-5: 5 holders with  
up to 6 tools each,  
i.e. up to 30 in total

# DRAG FINISHING UNITS

## DF-3 AND DF-5

Manual units for smoothing and polishing different tools

### Advantages

- Very cost-effective
- Perfect processing results
- Short processing times
- Not much manpower required at the unit, multi-machine operation possible
- Container cooling for constantly low media temperature level available
- For Dry and Wet Finishing
- Automatic lifting doors for easy loading and unloading



### Maximum workpiece length

250 mm



### Shaft diameter

- 3 - 32 mm
- Custom-made holder also allows processing of tools up to 200 mm



### Cycle times per tool

- Coat smoothing: approx. 25 s/tool with processing time of 150 s
- Edge rounding: approx. 35 s/tool (DF-5)  
approx. 50 s/tool (DF-3) with processing time of 10 min



### Properties

- Process container diameter: DF-3: 625 mm  
DF-5: 725 mm
- Easy process container changeover without pallet jack
- Fast container changes
- Solid welded design

Control panel with  
Industry 4.0 package  
available

# STREAM FINISHING MACHINE

## SF-SERIES MANUAL

OTEC Stream Finishing Machines stand for versatile, flexible and efficient solutions for small to large series production – available on request with the required automation for every application.

- Manual or automatic loading and tightening
- Manual or automatic workpiece holder angle adjustment
- For Dry and Wet Finishing
- Easy process container changeover
- Switch easily between different types of workpieces



### Maximum workpiece length

Processing length of approx. 300 mm or shorter if necessary



### Shaft diameter

Approx. 250 mm



### Cycle times per tool

Cycle time per workpiece of approx. 2 min for a processing time of 5 min and a machine with 4 stations



### Properties

- Up to 4 processing stations
- Manual unit with many adjustment options
- Flow angle adjustment
- Adjustment of distance to container wall
- Change abrasive easily by changing containers using a trolley





More  
information



Decentralised lifting  
unit – all holders are  
immersed at the same  
time in the process

Processing unit  
angle adjustment

**OTEC**

Rotating process container  
filled with abrasive

Spindle optionally available  
with standard, intermittent  
or pulse drive

Automatic lifting doors

Made  
in  
Germany



More information



OTEC collet system  
type M, S, L

Integrated automation  
with chain loader,  
gripper system

Proven Stream  
Finishing Technology

Collet  
change unit

Tool storage and  
collet storage in  
loader bushings

Recommended standard equipment with pulse  
drive with collet tightening of up to 2,000 rpm  
and automatic immersion angle adjustment





Control panel for  
SF and ILS with  
Job Manager



# STREAM FINISHING MACHINE WITH CHAIN LOADER

## SF-ILS INTEGRATED LOADING SYSTEM

Stream Finishing Unit with automatic loading using chain and gripper system for processing tools.



### Maximum workpiece length

150 mm for automatic loading



### Shaft diameter

3 - 20 mm



### Cycle times per tool

- Coat smoothing (30 s processing time): approx. 56 s/tool
- Edge rounding (90 s processing time): approx. 116 s/tool



### Properties

- Loading system with automatic collet changes for loading tools of any diameter
- Chain loader with 64 or 160 positions, 5 of which are for collets
- Storage for 5 collets with different diameters
- Job Manager for 10 different tool types with 5 different shaft diameters
- Process container diameter: 780 mm
- Process container can be changed using a trolley



# STREAM FINISHING MACHINE WITH PALLET LOADER

## SF-PLS PRISMA LOADING SYSTEM

Stream Finishing Unit with prisma loading system for flexible processing of different tool diameters and lengths



### Maximum workpiece length

220 mm for automatic loading



### Shaft diameter

3 - 20 mm



### Cycle times per tool

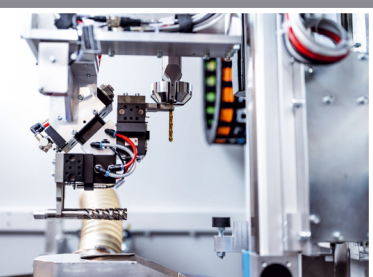
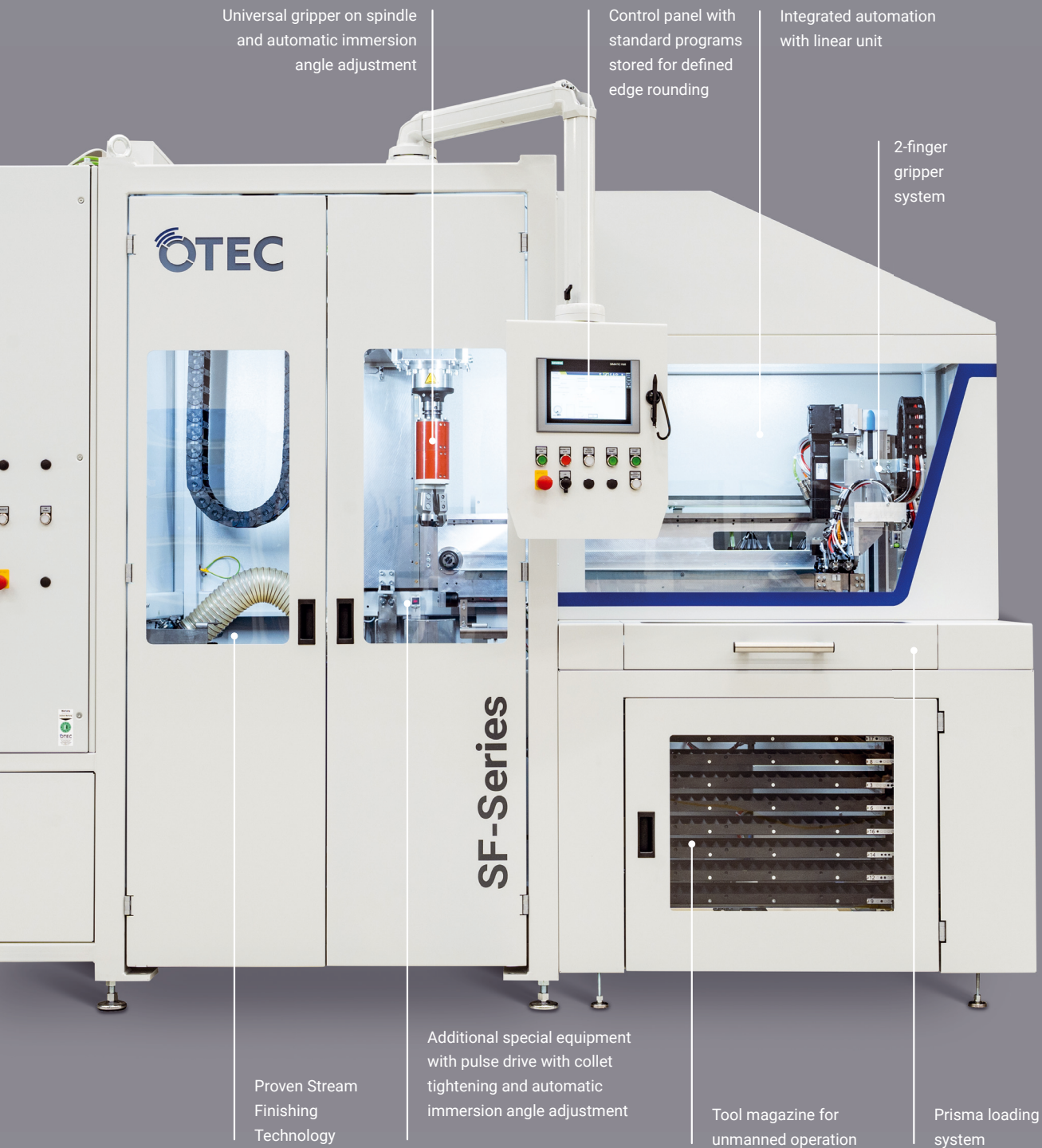
- Coat smoothing (30 s processing time): approx. 50 s/tool
- Edge rounding (90 s processing time): approx. 110 s/tool



### Properties

- Loading unit with pallet loader and gripper system
- Capacity: 360 tools on 18 pallets of 20 tools for unmanned runtimes of 5.5 h at a processing time of 30 seconds and up to 20 h at a processing time of 180 seconds
- Large area gripper in working spindle for clamping range of 3 - 20 mm shaft diameter
- Loading and processing of tools of any diameter
- Process container diameter: 780 mm
- Process container can be changed using a trolley
- 9 pallets can be removed and loaded at once using a loading trolley







More information

1 lifting unit with up to 2 processing units

Automation with loading robot and gripper system and, depending on equipment, with gripper and collet change



Smart control panel with Industry 4.0 package available

OTEC collet system type M, S, L

Proven Stream Finishing Technology

Recommended standard equipment with pulse drive with collet tightening of up to 2,000 rpm and automatic immersion angle adjustment



Made in Germany





Tool storage on pallets (also possible on customer pallets) – and, depending on equipment, with storage for changeover gripper and additional collets



# STREAM FINISHING MACHINE WITH LOADING CELL

## SF-RLS ROBOT LOADING SYSTEM

### SMALL VERSION

Stream Finishing Unit with automatic loading by a loading robot and gripper system



#### Maximum workpiece length

200 mm for automatic loading



#### Shaft diameter

3 - 26 mm



#### Cycle times per tool

- Coat smoothing (30 s processing time):  
approx. 30 s/tool (SF-2/1)  
approx. 50 s/tool (SF-1/1)
- Edge rounding (90 s processing time):  
approx. 60 s/tool (SF-2/1)  
approx. 110 s/tool (SF-1/1)



#### Properties

- 1 lifting unit allows processing of up to 2 tools at the same time
- Automatic positioning of the processing spindle in an inclined position during processing
- FMB loading unit with Fanuc robot
- Processing of batch sizes divisible by 2 (even batch quantities).  
A dummy is used if the number of tools is uneven.
- The collets must always be loaded during processing
- Process container diameter: 780 mm
- Process container can be changed using a trolley

# STREAM FINISHING MACHINE WITH LOADING CELL

## SF-RLS ROBOT LOADING SYSTEM

### LARGE VERSION

Stream Finishing Unit with automatic loading by a loading robot and gripper system



#### Maximum workpiece length

250 mm for automatic loading



#### Shaft diameter

3 - 26 mm



#### Cycle times per tool

- Coat smoothing (20 s processing time): approx. 20 s/tool
- Edge rounding (60 s processing time): approx. 30 s/tool



#### Properties

- 3 lifting units allow continuous processing of tools with optimised cycle times
- FMB loading unit with Fanuc robot
- Process container diameter: 1,050 mm
- Process container can be changed using a trolley



Smart control panel with Industry 4.0 package available



More information

3 processing units  
with 3 lifting units

Automation with loading  
robot and gripper system and,  
depending on equipment, with  
gripper and collet change



OTEC collet system  
type M, S, L

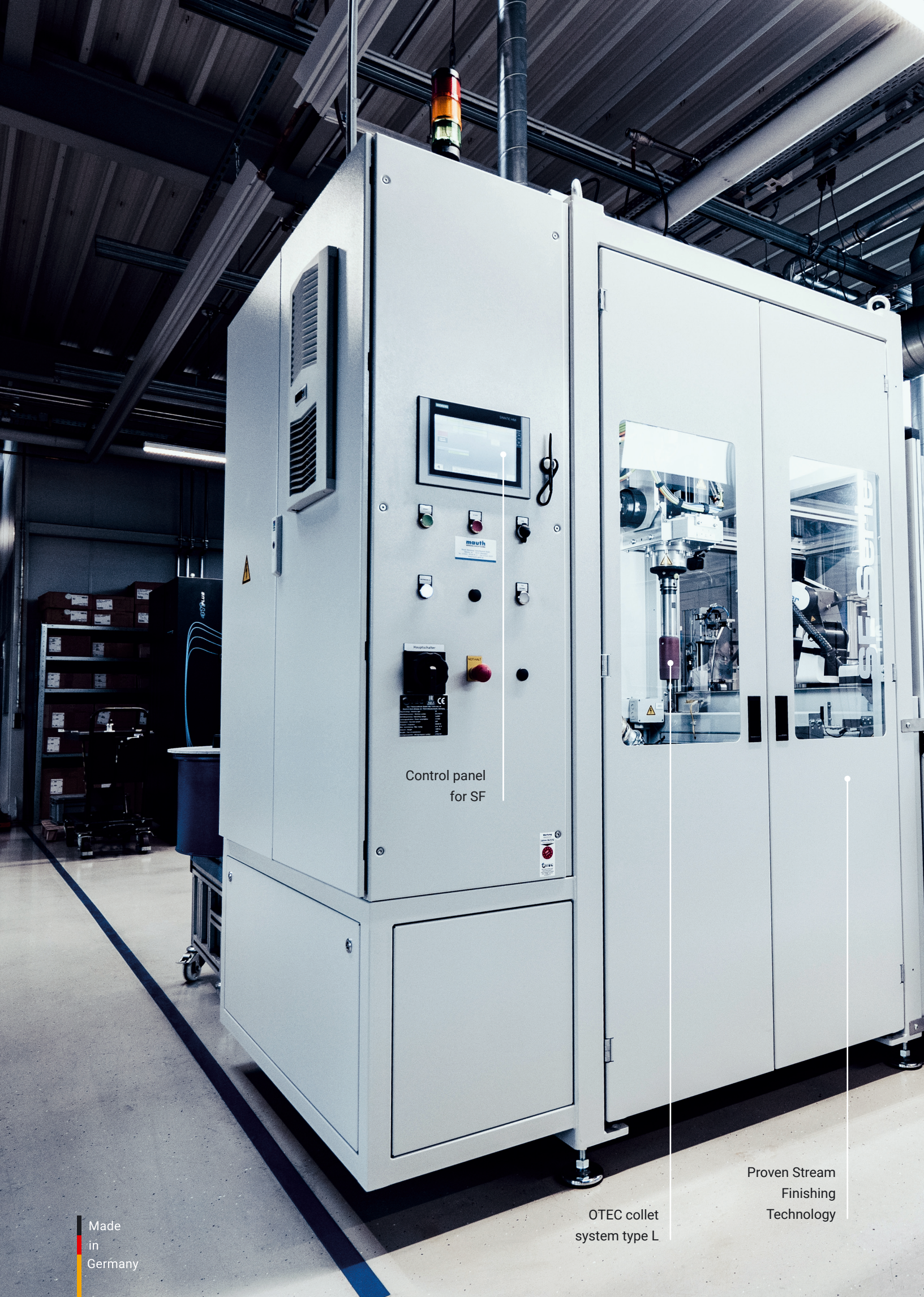
Proven Stream  
Finishing Technology

Recommended standard equipment with  
pulse drive with collet tightening of up to  
2,000 rpm and automatic immersion angle  
adjustment

Tool storage on pallets (also  
possible on customer pallets) –  
and, depending on equipment,  
with storage for changeover  
gripper and additional collets

Made  
in  
Germany





Control panel  
for SF

OTEC collet  
system type L

Proven Stream  
Finishing  
Technology

Made  
in  
Germany





More information

Automation with loading robot and gripper system

# CUSTOMISED AUTOMATION SOLUTIONS

SF units provide the technical basis for special-purpose machine manufacturing at OTEC. They are suitable for individual requirements and can be combined with customised automation solutions.

Control panel for loading cell





# ABRASIVES FOR PROCESSING TOOLS

	Rounding cutting edge	Rounding moulded edges	Polishing rake face	Polishing cutting edge/reducing jaggedness	Reducing surface roughness
<b>MACHINING</b>					
<b>1 HSC Granulates</b> Hard shells + silicon carbide	✓	✓	(✓)		✓
<b>2 H3 Granulates</b> Hard shells + polishing powder			✓	(✓)	✓
<b>3 H4 Granulates</b> Hard shells + polishing powder	✓*		✓	✓	(✓)
<b>4 M4 and M5 Granulates</b> Corn + polishing powder	(✓)		(✓)		
<b>5 Ceramic Abrasives</b>					✓
<b>6 Plastic Grinding Chips</b>					✓
<b>7 KXMA/GXMA</b> Microfinishing grinding bodies	(✓)	✓			✓
<b>8 Porcelain Polishing Bodies</b>					

\* up to 8µ



	Complete polishing	Smoothing coatings	Deburring	Dry grinding process	Dry polishing process	Wet grinding process	Wet polishing process
		✓	(✓)	✓			
	✓	(✓)	(✓)	✓	(✓)		
	✓	(✓)		(✓)	✓		
		(✓)			✓		
			✓			✓	✓
			✓			✓	✓
		(✓)	✓			✓	(✓)
	✓						✓





Made  
in  
Germany

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