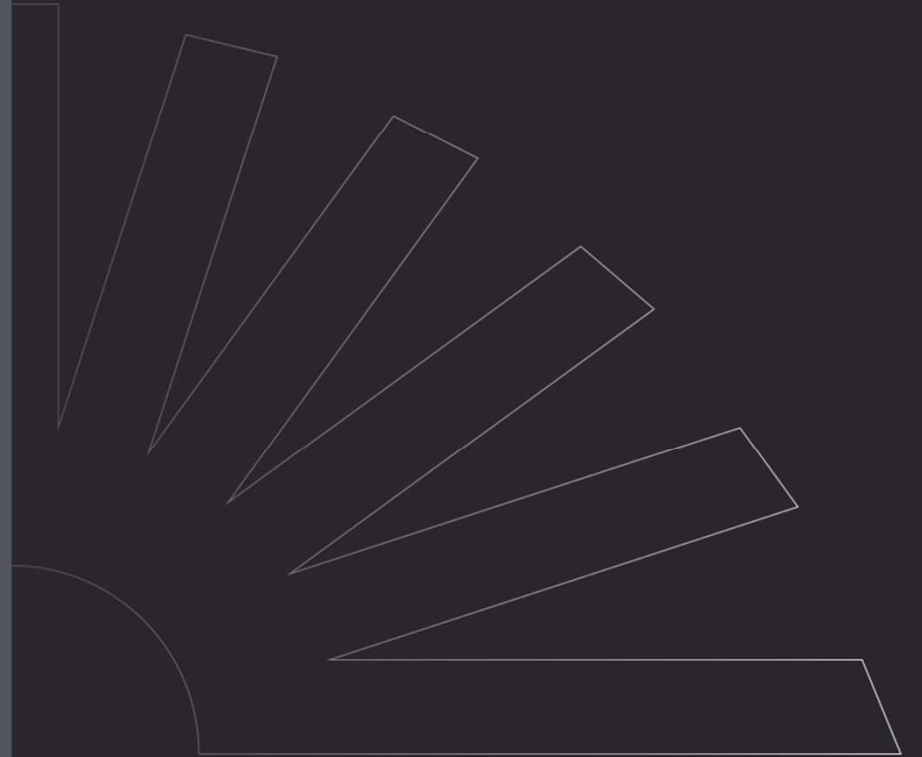




Growth summit meeting

Sunnen AG, Switzerland, October 16/17 2024



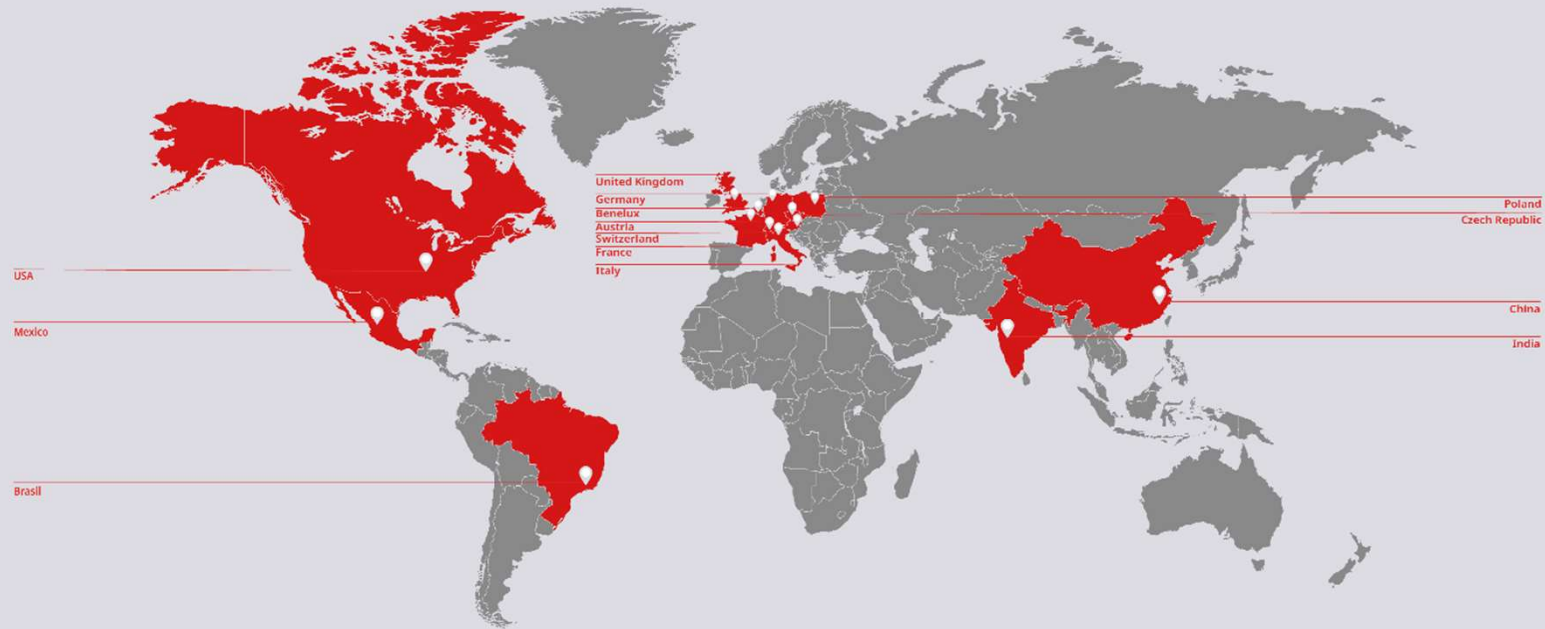


Sunnen success stories



St. Louis, Missouri, USA

Sunnen Products Company - global headquarters



Close to the customer

Sunnen manufacturing & technical support facilities

- Affiliates in Austria, Benelux, Brazil, China, Czech Republic, France, Germany, India, Italy, Mexico, Poland, UK
- Over 50 distributors supporting globally



Cologne, Germany

Sunnen Deutschland GmbH - Demo centre



Sunnen Deutschland GmbH

- Founded 1950
- Approx. 35 employees
- Specializing in :
 - Sales of honing equipment, machines and systems
 - Application centre
 - Service point
 - Central warehouse for Europe





Hydraulics

- Cylinders
- Blocks + Valves
- Axial piston pumps



Aviation

- Landing Gears
- Turbines
- Shafts



Injection Mold & Die

- Extruder
- Manifolds
- Carbide Dies



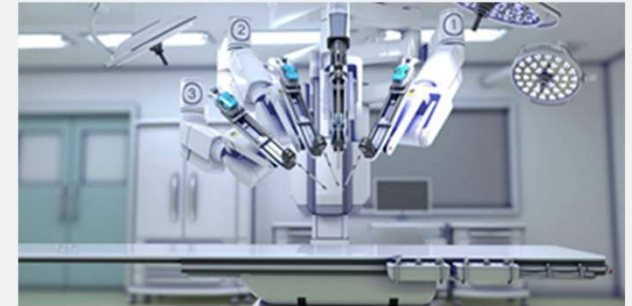
Energy Industry

- Components
- Wind power plants
- Turbines



Car & Engine Components

- Injectors
- Conrods
- Gears

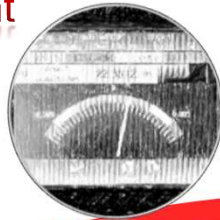


Medical Applications

- Special bearings
- Prothesis
- Ceramic parts



Measuring Equipment



Honing Oil and Coolant



Accompany



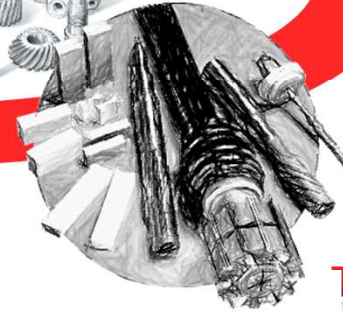
Services



Machines and Systems



Tools and Abrasives





Success stories – Why we are successful?

- We are experts in a wide range of applications
- We create customer oriented solutions
- We solve the problem of the customer

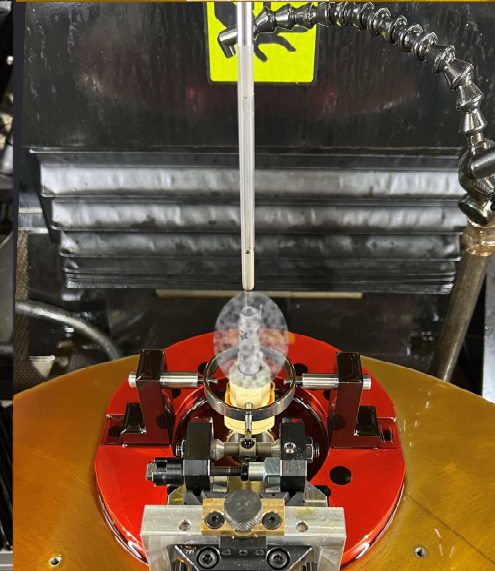
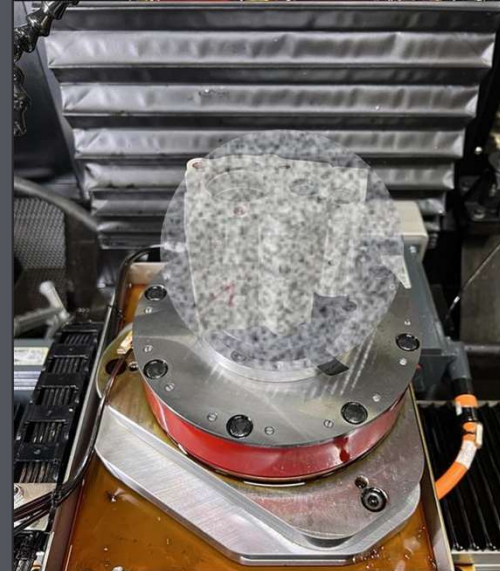
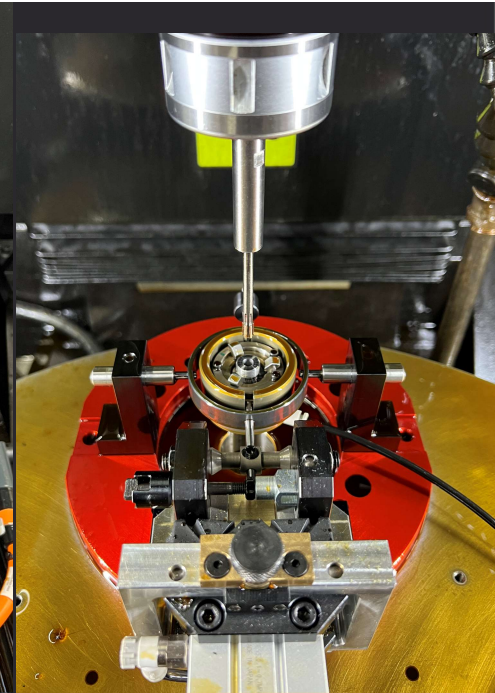
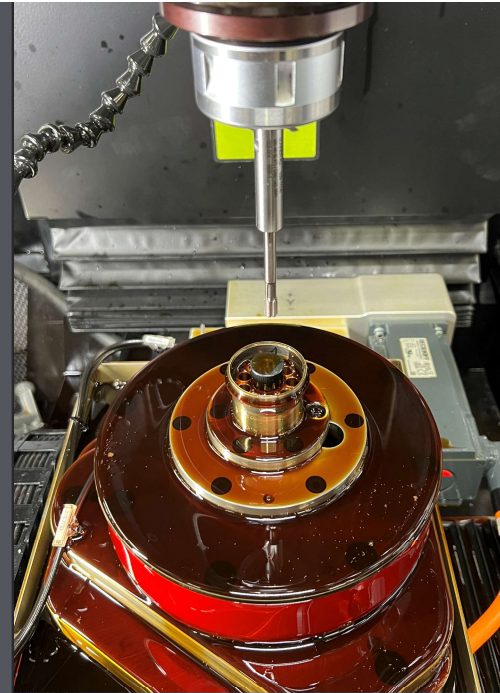


Customer request – Aviation technology



Task definition

- 5 different parts (bores)
- Highly sophisticated
- Low batch sizes
- Short set-up time





SV3010 with nc-controlled x/y-table & integrated air gaging system





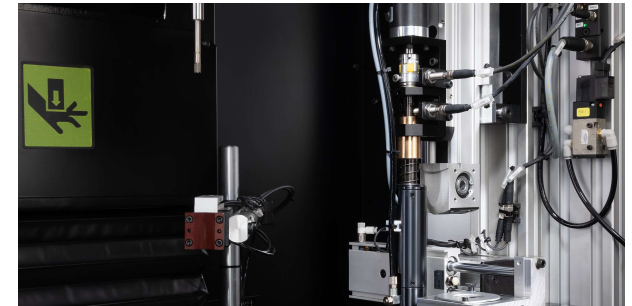
X/Y - table

-
- Versatile
 - Enables integrated measurement



Floating base

-
- Perfect alignment
 - Universal



Integrated air gaging

-
- Highest precision
 - Repeatability
 - Feed-back



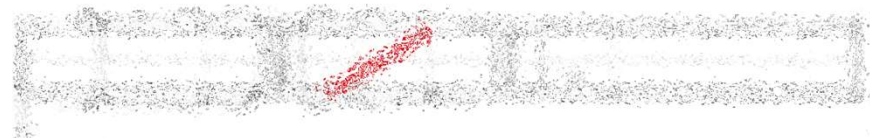
1. Thin-walled sleeve, stainless steel

Requirements

- Diameter 6.5 mm
- Length 60/100 mm
- Stock removal 0.05 mm
- Surface Ra 0.1 μm
- Cylindricity 0.002 mm
- Straightness 0.0015 mm

Challenges

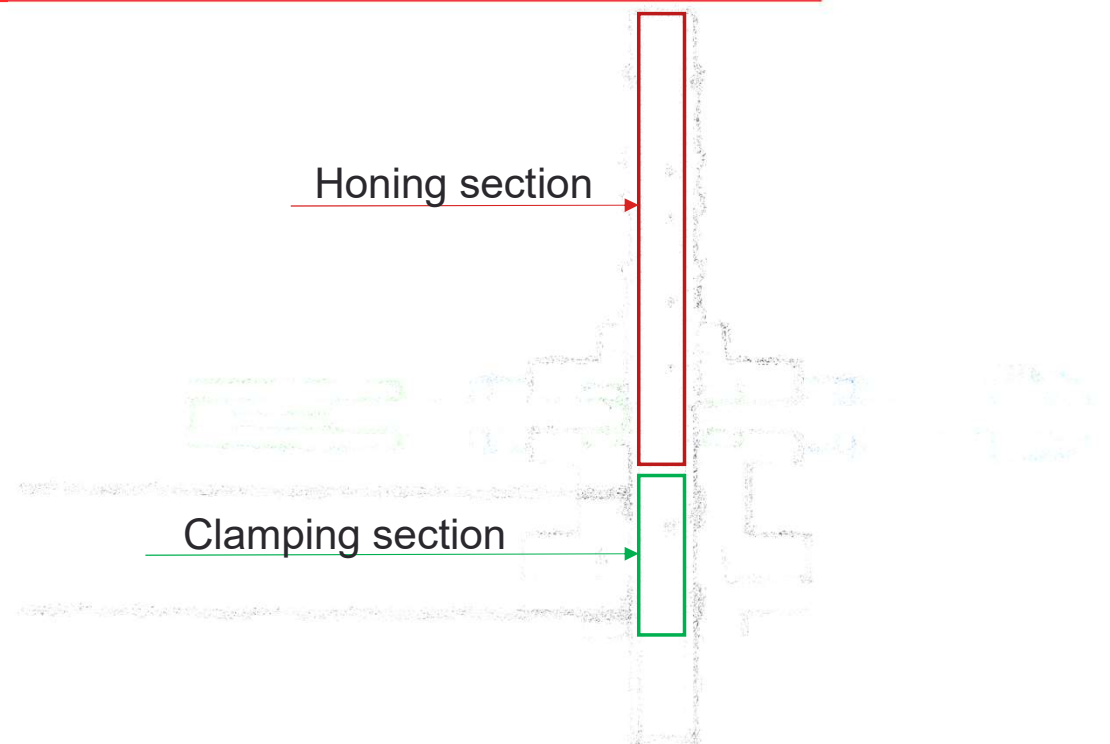
- Thinwalled honing section
- Cross holes
- Unfavorable diameter/ length ratio





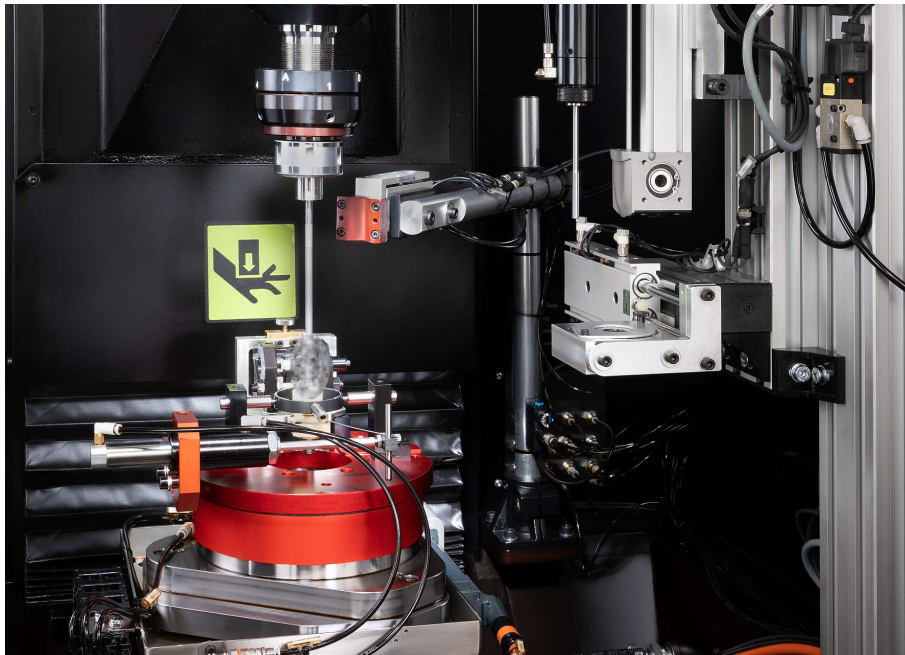
Solution

- Gimbal spring clamping fixture
 - Outside clamping area
- Adjustable counterweight
- 1-stone MMT tooling
 - MMT2624 – NMH85 (70 mm)
 - MMT2625 – NMG905 (70 mm)

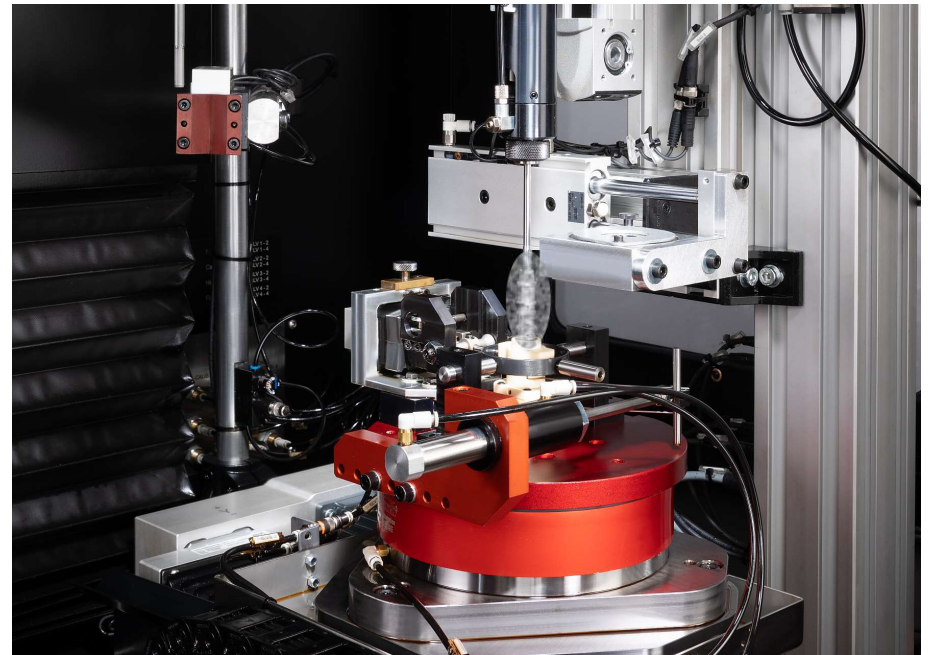




Honing with gimbal, MMT tool and stone-retractor



Automatic air-gaging with feedback to machine





Results exceeding all expectations

Ausgewertetes Element	Typ	Toleranz (µm)	Abweichung (µm)
Cylindricity		2.00	0.72
Straightness lines		1.50	0.44
line1_f		1.50	0.44
line3_f		1.50	0.40
line2_f		1.50	0.40
line4_f		1.50	0.37
Roundness		1.50	0.30
d6.5 z-3.25 mm1_f		1.50	0.26
d6.5 z-11.25 mm1_f		1.50	0.27
d6.5 z-25.25 mm1_f		1.50	0.30
d6.5 z-35.25 mm1_f		1.50	0.20
d6.5 z-45.25 mm1_f		1.50	0.25
d6.5 z-54.25mm1_f		1.50	0.19
Straightness Axis		0.00	0.05



2. Aluminum hydraulic body

Requirements

- Diameter \varnothing 15 mm
- Bore lengths 73 mm
- Stock removal 0.02-0.06 mm
- Surface Ra 0.2 μ m
- Cylindricity 0.002 mm

Challenges

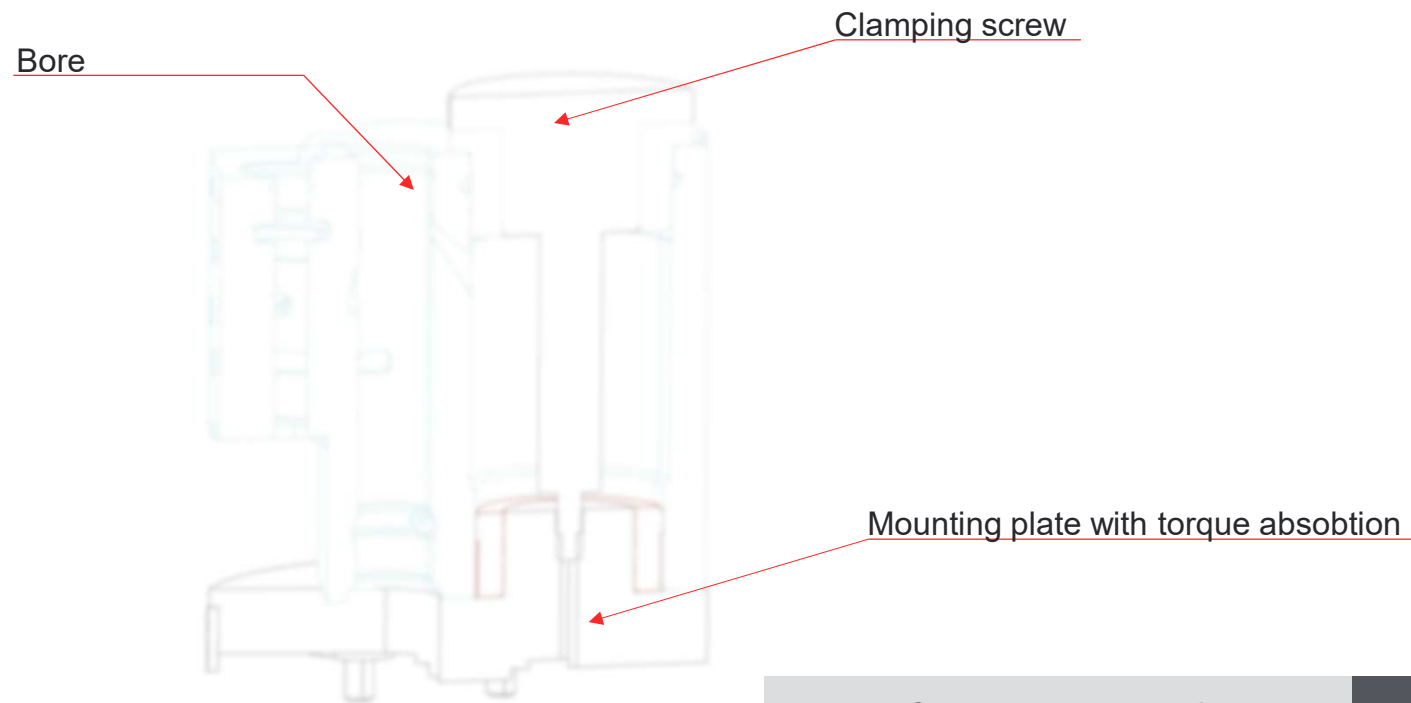
- Exact bore positioning
- Crossholes
- Cylindricity





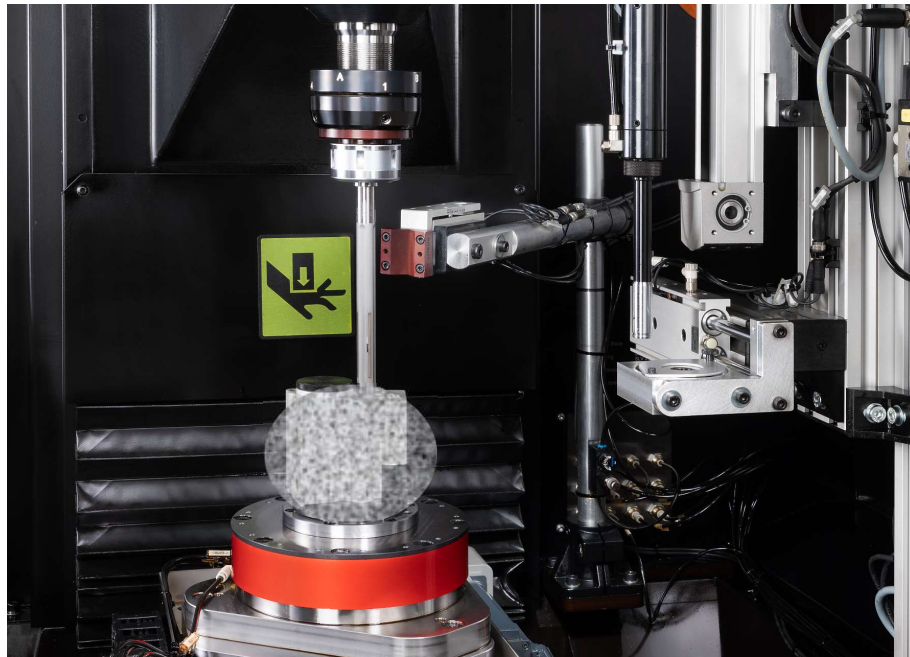
Solution

- Form locking fixture
- X/Y floating
- Automatic bore positioning
 - NC controlled x/y table
- MMT 4-stone tooling
 - MMT2322 – RMH95
 - MMT2623 – RMH005

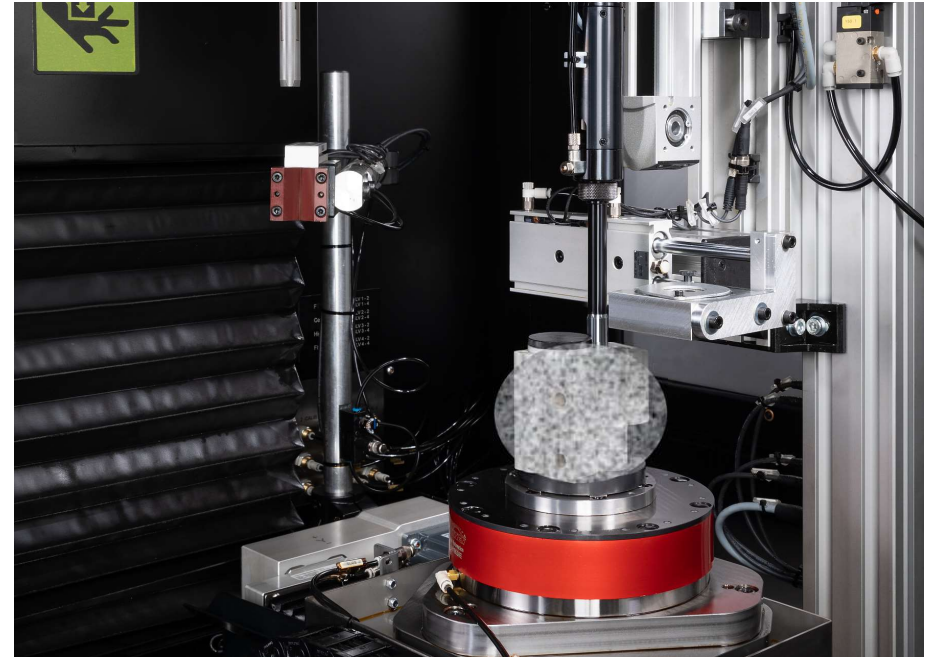




Honing on floating base with MMT tool and stone-retractor



Automatic air-gaging with feedback to machine





Results within specifications

Ausgewertetes Element	Typ	Toleranz (μm)	Abweichung (μm)
Roundness-5.6-	○	0.00	1.15
Roundness-19.70-	○	0.00	1.24
Roundness-33.80-	○	0.00	1.18
Roundness-47.90-	○	0.00	1.06
Roundness-62.0-	○	0.00	1.02
Straightness axis	—	0.00	0.32
Cylindricity	⊘	2.00	1.83

Achieved surface quality

- < Ra 0.18 μm
- < Rz 1.2 μm



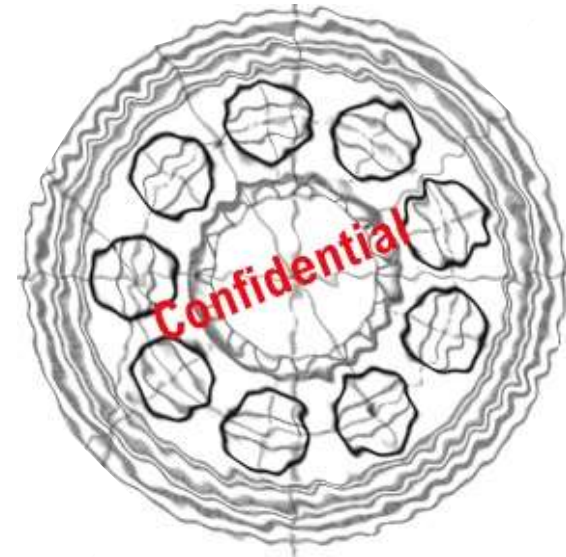
4. Wobble pump housing

Requirements

- Diameter 6.5 mm (9x)
- \varnothing tolerance 0.004 mm
- Bore length 14.8 mm
- Stock removal 0.03-0.05 mm
- Surface Ra 0.1 μm

Challenges

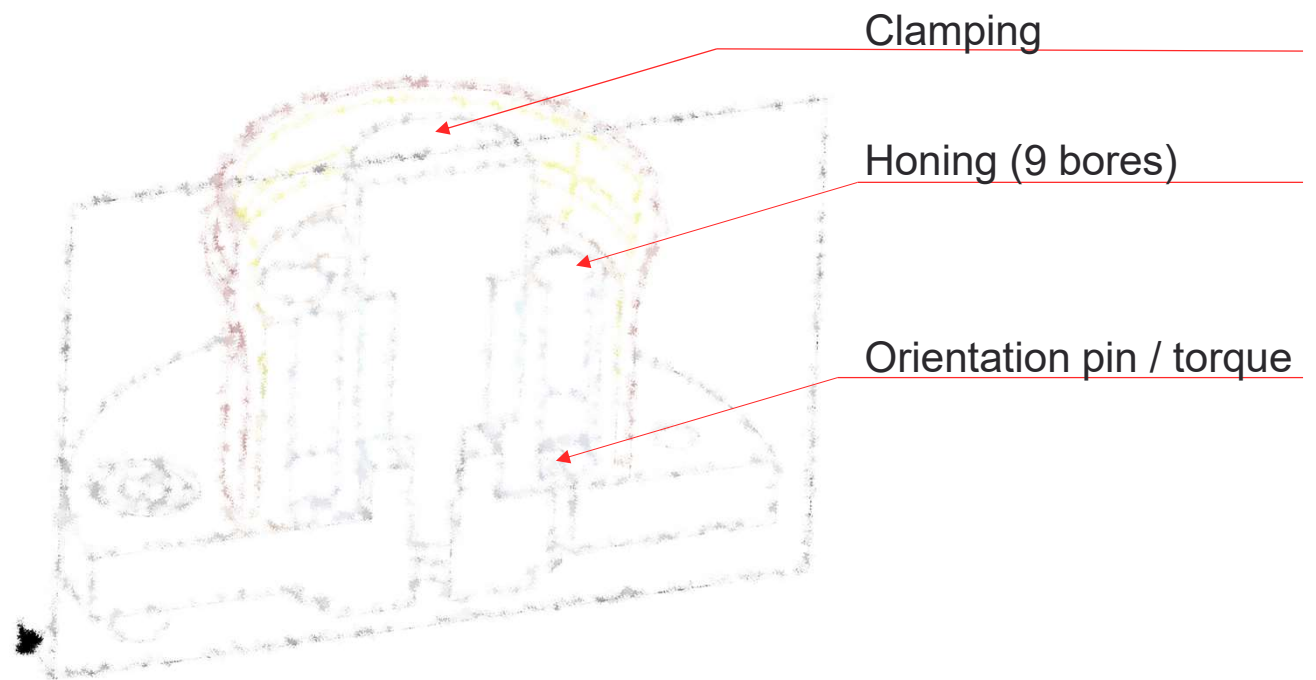
- Exact bore positioning
- Blind bore





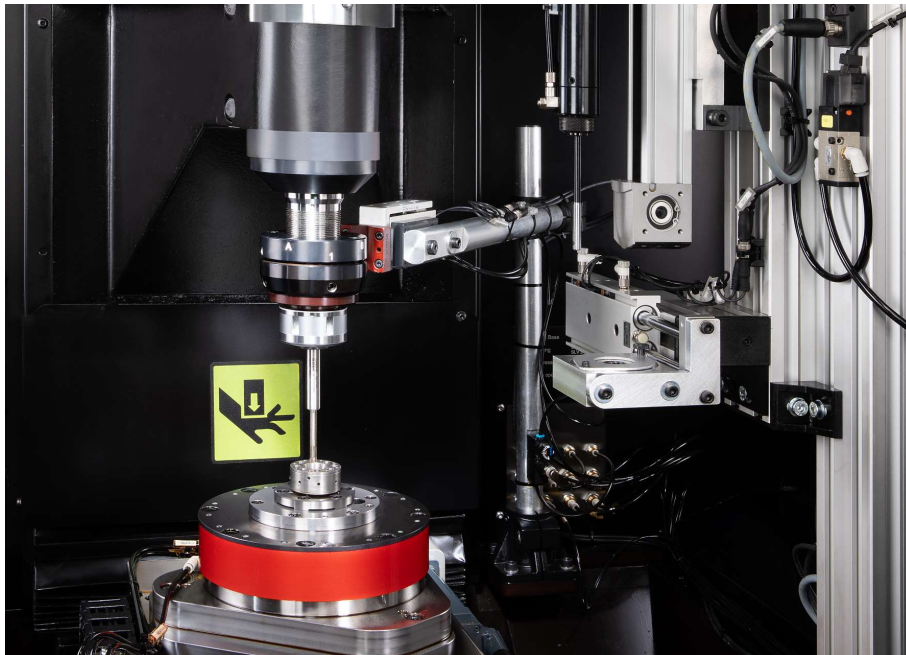
Solution

- Form locking fixture
- X/Y floating
- Automatic bore positioning
 - NC controlled x/y table
- SMT 6-stone tool
 - RMG95
 - RMH905

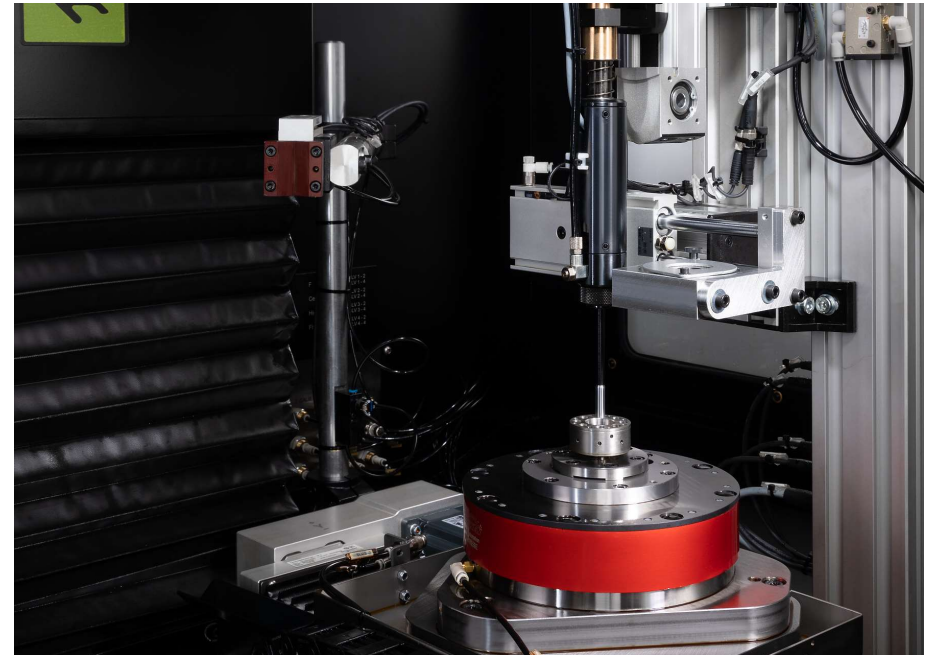




Honing on floating base with SMT tool



Automatic air-gaging with feedback to machine





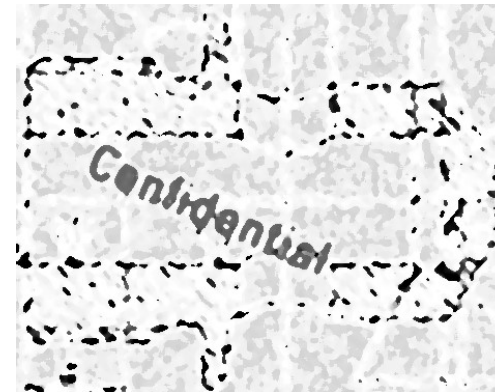
5. Valve seat

Requirements

- Diameter 6.5 mm
- Bore length 16 mm
- Stock removal 0.02-0.04 mm
- Surface Ra 0.1 μm
- Cylindricity 0.004 mm

Challenges

- Blind bore
- Crossholes
- Surface finish





Solution

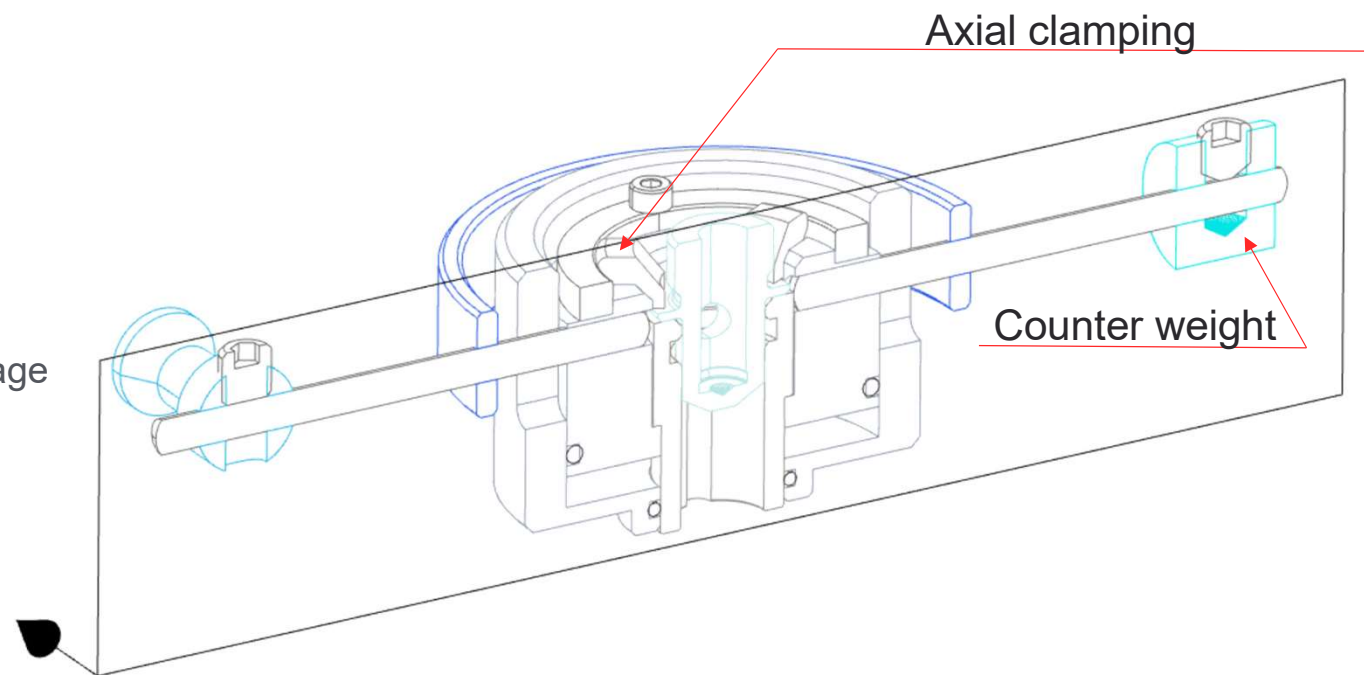
Gimbal fixture

- Axial clamping
- Counterweight

SMT 6-stone tool


- NMG95
- NMH905

Bore testing with size plug and air-gage






Measuring results on bore \varnothing 6.5 mm



SUNNEN

	GAGE	BAD	REWORK							
M 1	6.5019	6.5020	6.5020	6.5020	6.5020	6.5020	6.5020	6.5020	6.5020	6.5020
M 2	6.5017	6.5018	6.5018	6.5018	6.5018	6.5018	6.5018	6.5018	6.5018	6.5018
M 3	6.5019	6.5021	6.5021	6.5021	6.5021	6.5021	6.5021	6.5021	6.5021	6.5021
\varnothing	-0.0002	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
V/	0.00000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
) (0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003



SUNNEN
SWISS GAGE SYSTEM



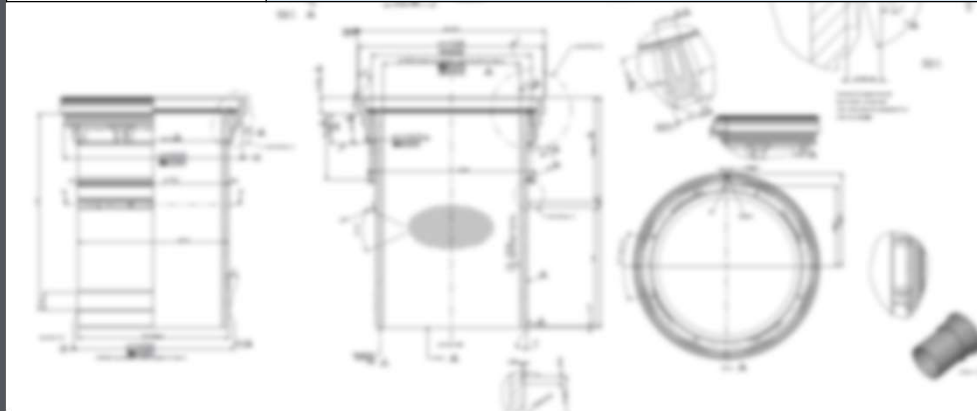
Customer request – compressor liners



Task definition

- 11 different parts
- \varnothing 85/110/160 mm
- Thin walled
- Plateau finish
- Short setup time (< 5 min)
- Prepared for automation

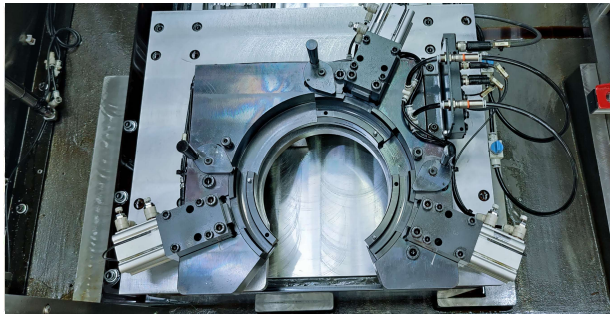
	Part1	Part2	Part3
Description:			
Drwg. No.:			
Material:	Grey cast iron	Grey cast iron	Grey cast iron
Hardness:	230		
Bore \varnothing :	85.0		
Bore length:	~ 132 mm	~ 132 mm	~ 132 mm
Parallelity:			
Cylindricity	no specification	no specification	no specification
Cross hatch:			50°
Plateau:			0.55
?			35 %
tp2:			%
Corr.			07 mm
Stock removal:			ification
Cylindricity			
Rpk			
Rk			
Rvk			
MR1			
MR2			
Tool			with CK -
Stone Set Roughing operation			
Stone Set Finishing operation			
Adjustable size plug			





SV2410 with two stage tooling & plug size control





Special fixture

- Versatile
- Short setup time
- Distortion free clamping



Two stage hone head

- Short cycle time
- Less setup effort



Size plug

- High precision
- Repeatability



Cylinder liners

Requirements

- Diameter 85/110/160 mm
- Tolerance 0.005 mm
- Bore lengths 130/190/250 mm
- Stock removal 0.05-0.07 mm
- Surface Plateau
- Parallelism 0.02 mm

Challenges

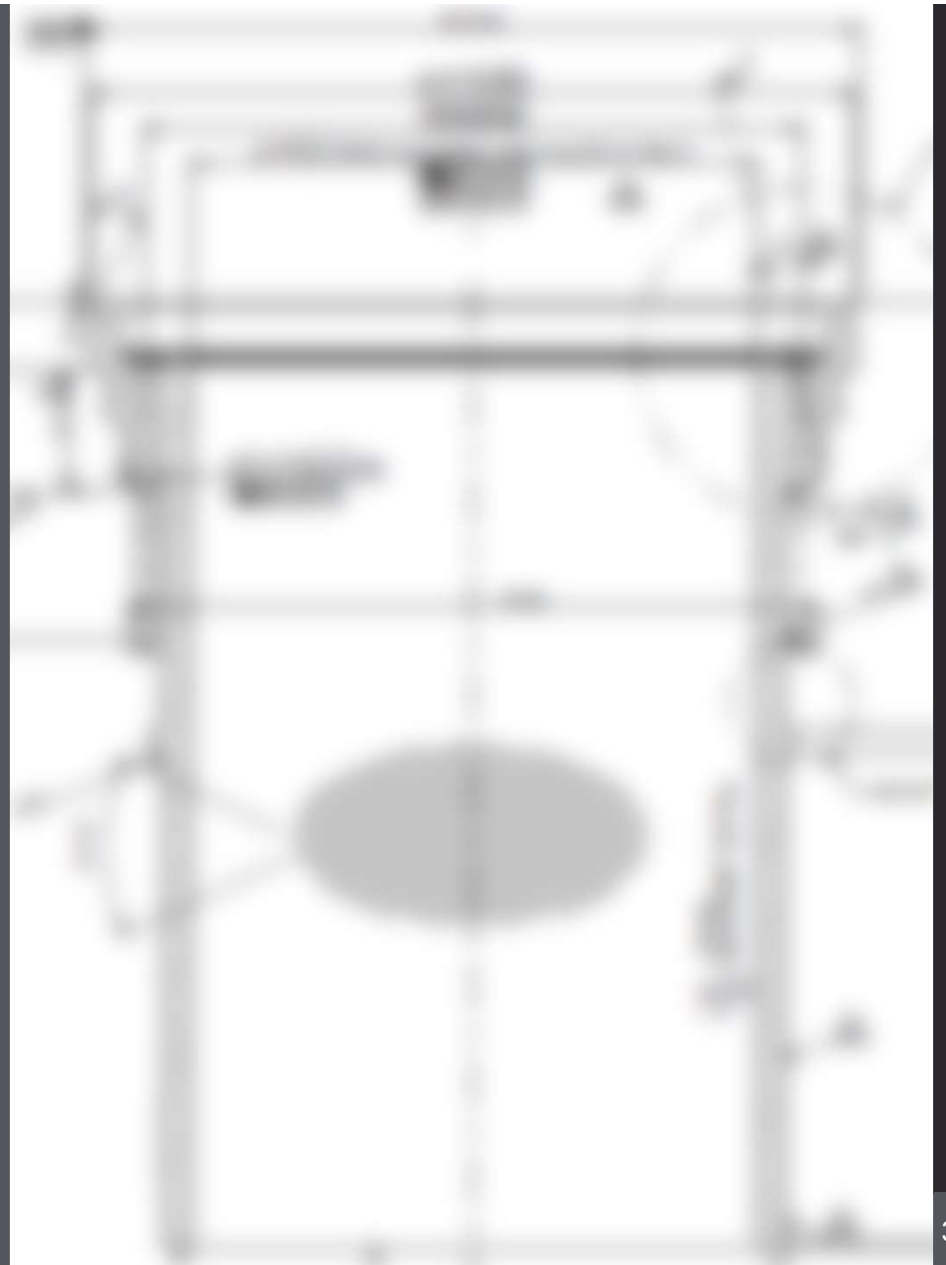
- Thin walled parts
- Different clamping situations
- Small size tolerance
- Plateau finish
- Prepared for automation





Example part

- Diameter 160 mm
- Tolerance 0.005 mm
- Bore lengths 250 mm
- Stock removal 0.05-0.07 mm
- Parallelism 0.02 mm



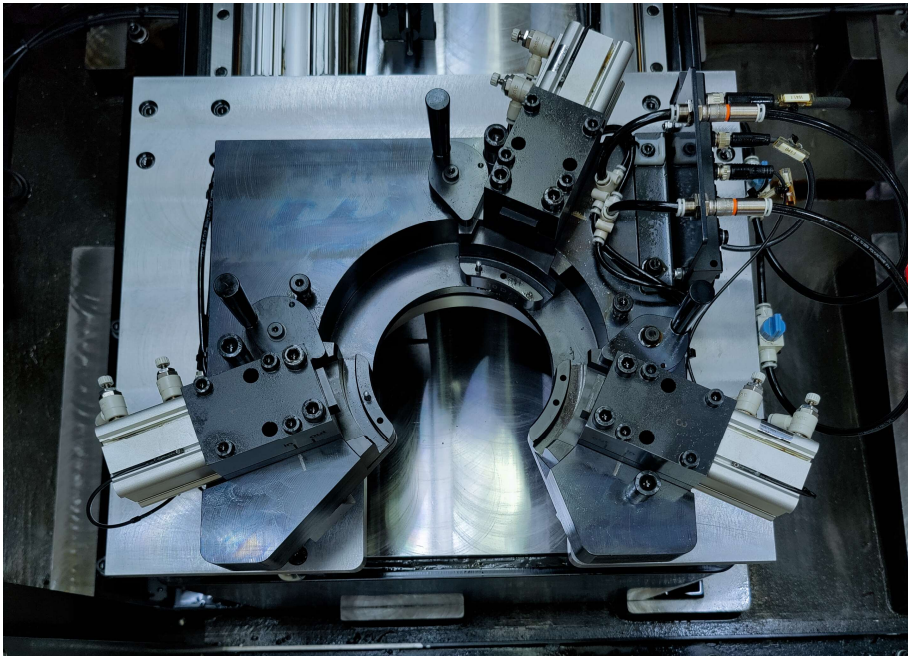


Solution

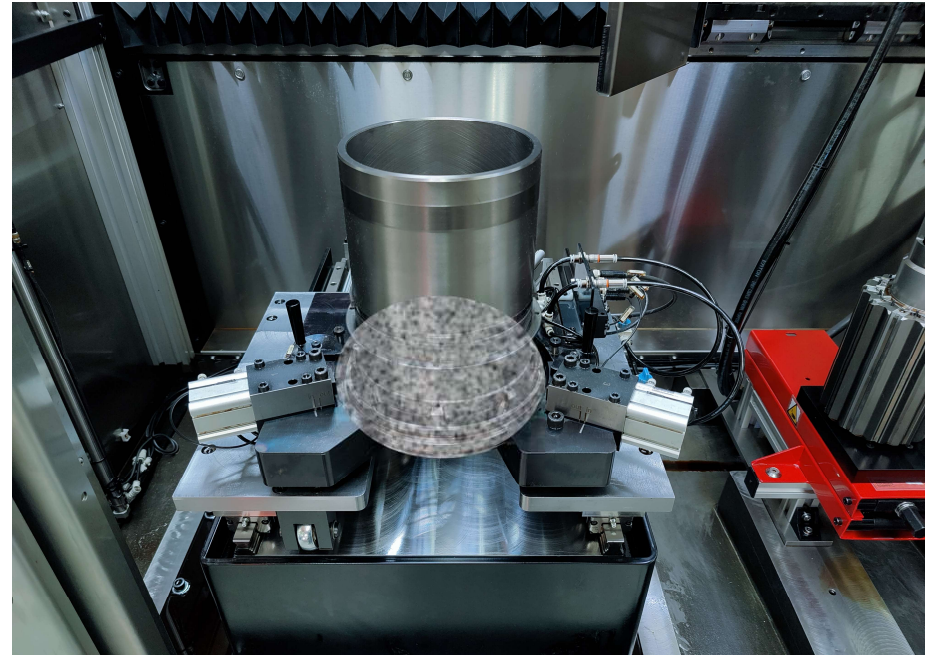
- Slide for easy manual part exchange
- Axial clamping fixture with pins for torque
- Two stage hone head
- Adjustable size plug



Sliding base plate with exchangeable clamping inserts

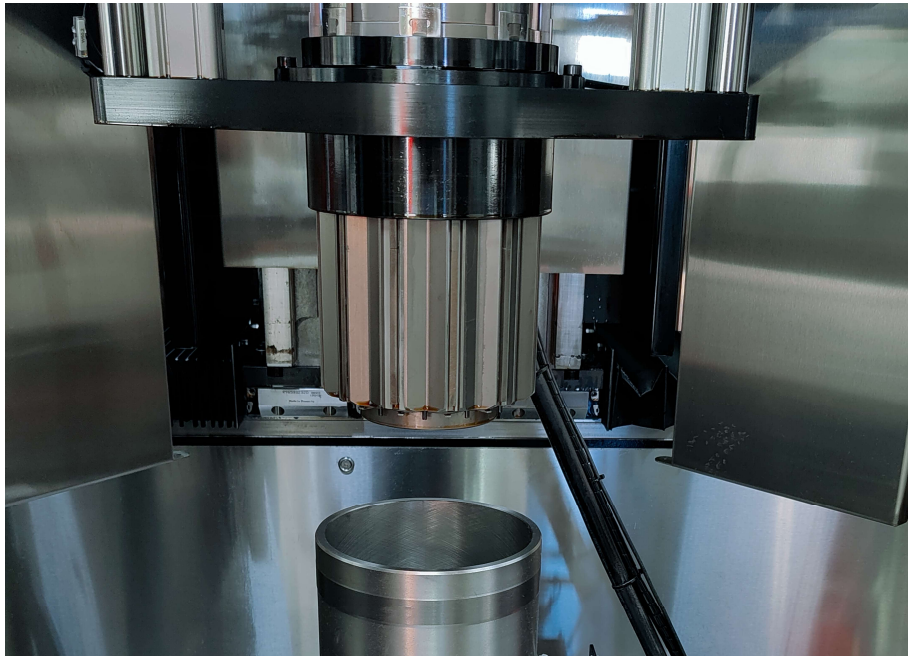


Torque fixturing with pins, axially weakly held

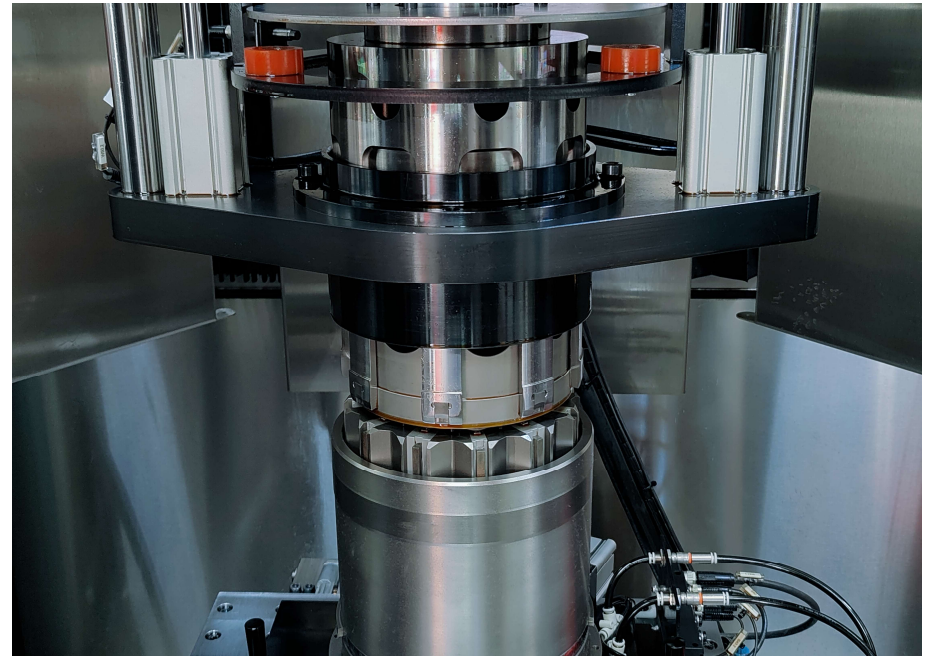




Two stage head in guide pot

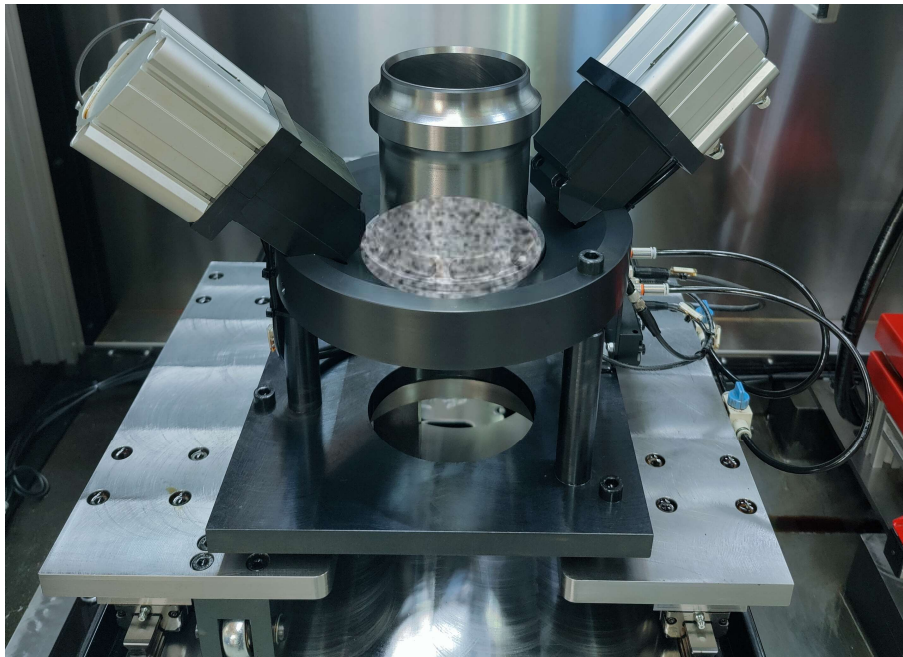


Size plug with carbide pads, adjustable

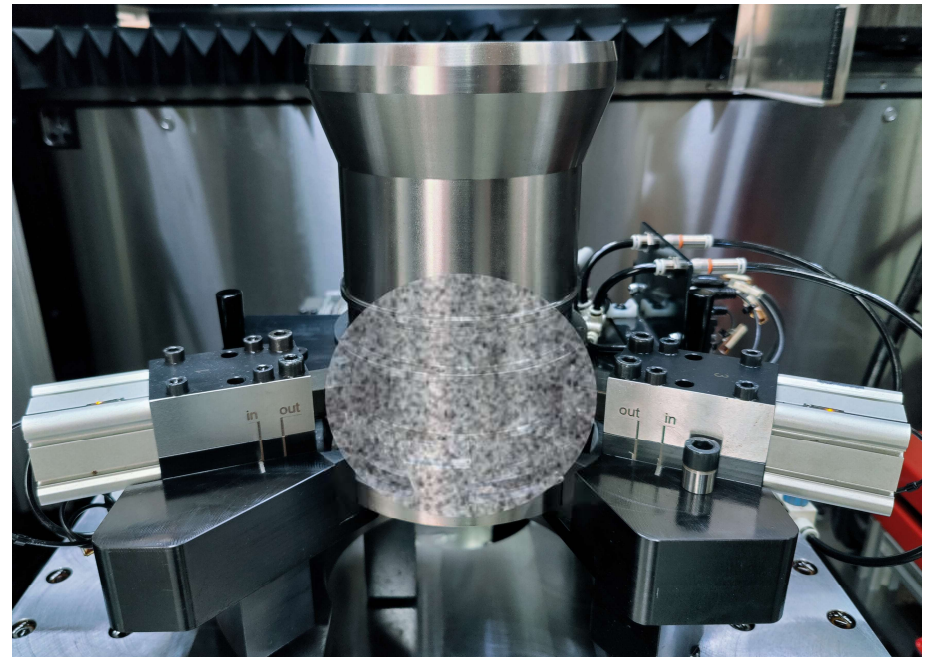




Clamping on 45° face



Clamping example





Customer Request – Bushing



Task definition

- $\text{Ø } 6 + 13 \text{ mm}$
- 2.500.000/ 1.500.000 parts/a
- 24/7
- Large running autonomy





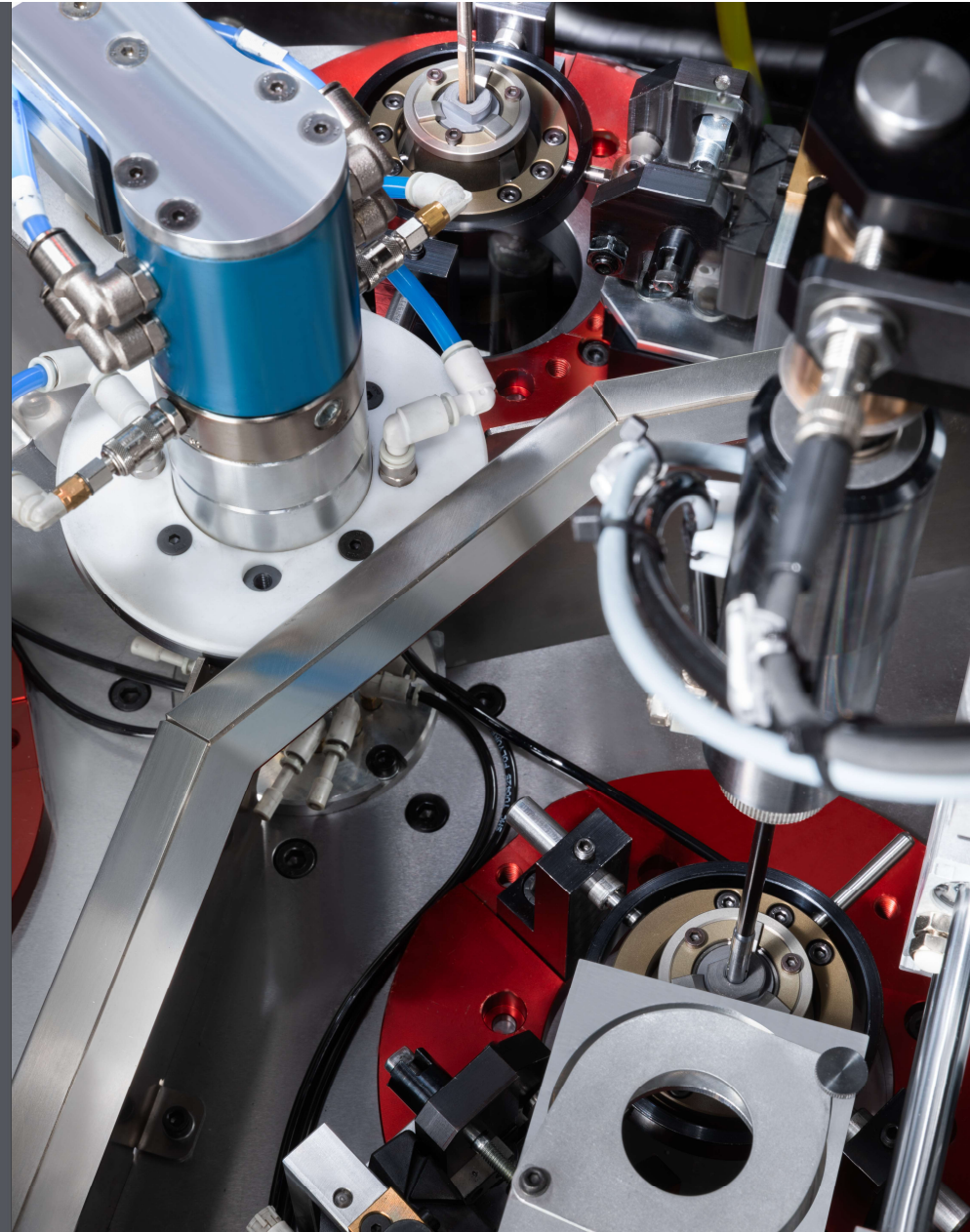
SV3015 with pick+place portal loading system with pallet stacker





Solution

- Pick+place portal loading system with up to 15 pallet stacker
6 mm - 156 x 15 pallets = 2'350
>19 h autonomy
- 13 mm - 108 x 13 pallets = 1'404
>10.5 h autonomy
- Integrated air gaging system
- 3 gimbal axial clamping fixtures





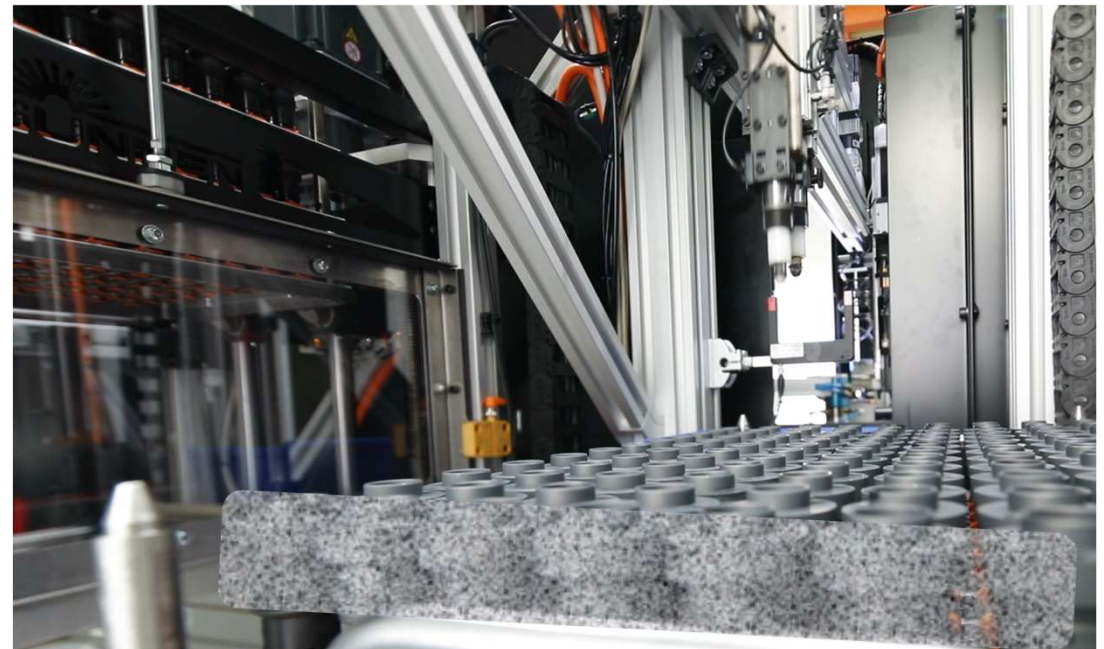
Bushing

Requirements

- Diameter 6/13 mm
- Bore lengths 42/31 mm
- Stock removal 0.04-0.05 mm
- Tolerance 0.006 mm
- Surface Rz 3
- Roundness 0.002 mm
- Parallelism 0.004 mm

Challenges

- Short cycle time, <30 s
- High running autonomy
- Small size tolerance

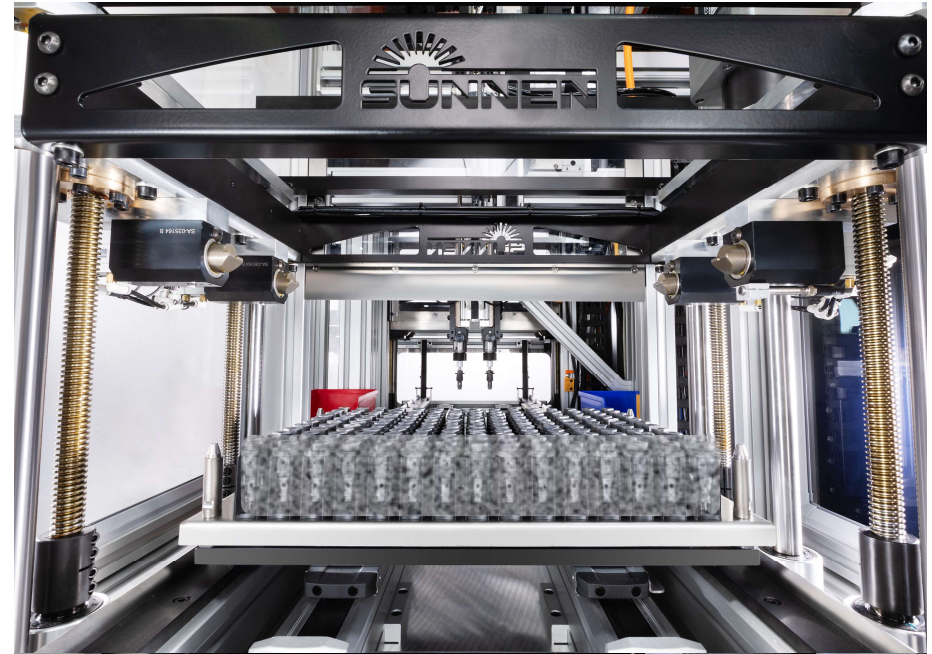




Empty pallet on loading side (front)



Full pallet with xx parts





Partnership • Precision • Performance

- Only Sunnen offers multiple bore finishing processes depending on the customers needs:
Deep hole drilling, skiving/roller burnishing, honing and lapping
- Complete package, one source:
Machine, tooling, coolant system, chip management, consumables, coolant
- Global support and field service
- 3-year base machine warranty



- Worldwide over 700 Tube Hone-Systems installed & active
- Thousands of turning spindles of standard machines
- More than 350 special systems delivered
- All in use at global market leaders, for example:
Bosch, Collins Aerospace, Dassault, Eaton, Husqvarna,
Hydraforce, KLM, Parker Hannifin, Renault, Stihl, etc...



Thank you for your attention
