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CLAMPING AND GRIPPING TECHNOLOGY FOR AEROSPACE COMPONENTS

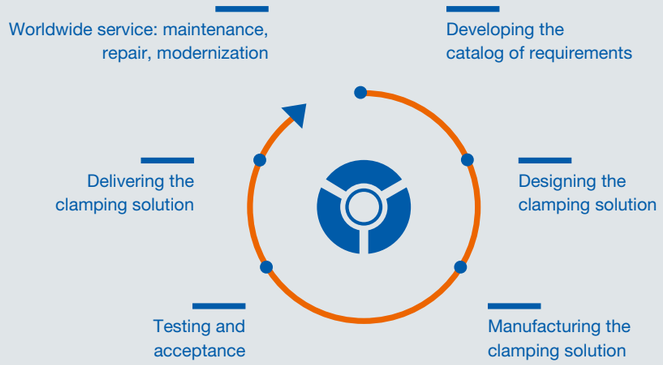
RÖHM

PERFECT HOLD FOR WORKPIECES AND COMPONENTS THAT AIM HIGH

RÖHM

RÖHM has been producing clamping, gripping and handling technology for more than 110 years. Many large machine and plant manufacturers worldwide list us as a qualitifed supplier for their machine tools and machining centers. Our products are known for their exceptional combination of robustness, precision as well as intelligent force and motion control. Most of the technology involves industry-specific special solutions. Therefore, RÖHM has also been an important partner for the aerospace industry for many years.

Defined process: Process reliability for individual solutions at RÖHM



Industry knowledge, engineering expertise and manufacturing depth

In terms of clamping and gripping technology, three aspects are particularly important to aircraft and spacecraft manufacturers and their suppliers.

The first is in-depth knowledge of the industry's requirements.

The second is the ability to develop a customized solution in close consultation with the customer, no matter how specialized the workpiece and working conditions may be.

The third is the ability to implement the solution in-house from a single source and thus offer maximum reliability.

RÖHM scores highly in all three aspects. We benefit from the experience gained from developing a wide range of series products. Ultimately, this also ensures cost efficiency for the individual solution.

With certainty to the best result

When it comes to solutions that are individually tailored to customer requirements, good coordination is important. To ensure that RÖHM quality is the end result, a process with proven individual steps is followed from the task description to delivery in which the customer always retains full control.

GOOD TO KNOW:

Approx **100** individual solutions for clamping and gripping technology that RÖHM supplies to the aerospace industry every year.

WORKPIECES WITH THE HIGHEST DEMANDS

Only demanding workpieces and components are known in the aerospace industry. Whether geometry and dimensions, materials or dimensional tolerances – the requirements are more stringent than anywhere else. This also has an effect on component machining. In many cases, the only way to achieve the desired result is with customized clamping solutions. The following pages show selected examples.

LIGHTER THAN USUAL

Aircraft and spacecraft are lightweight constructions. Components for the fuselage, tail, wings or landing gear often have to be large and thin-walled at the same time. Many also have complex asymmetrical shapes.
It is difficult to clamp such workpieces correctly – namely with minimal deformation and vibration-free.

MORE PRECISE THAN USUAL

The fact that aerospace technology has particularly low dimensional tolerances multiplies the challenges. Five-axis complete machining in a single clamping operation is therefore often required. The clamping and gripping technology must meet this requirement – with solutions that often literally embed the workpiece on the one hand, but on the other hand offer high accessibility.

CHALLENGING MATERIALS

Special materials are often used. Some are extremely delicate. Others, on the other hand, can be even more challenging to machine due to their strength and hardness. In such cases, only a carefully designed and thoroughly executed clamping concept will be the right solution.

Customized clamping solutions for the production of components for

- landing gear and brake systems
- electric motors
- fuselages
- satellite modules
- wings and tail units
- engine

RÖHM is an ITAR approved manufacturer and delivers solutions for defense industry to both aerospace and deep space fields.

ENGINE

TURBINE SHELL

TASK:

Low-deformation clamping for turning and milling

SOLUTION:

Power-operated diaphragm chuck

FEATURES:

- very low clamping force (approx. 10 kN)
- central workpiece stop
- twelve hydraulically actuated support elements
- additional minimization of workpiece deformation by means of centrifugal force counterweights
- workpiece dampening to minimize vibration
- repeat clamping accuracy of less than 0.005 mm
- adjustable concentricity (concentricity inaccuracy of less than 0.03 mm)

ENGINE

TURBINE BLADES

TASK:

Clamping of different workpieces in detail for milling the fir-tree structure at the base

SOLUTION:

Manually operated four-way clamping fixture

FEATURES:

- clamping of two pieces of two different blades for sequential machining
- four clamping nests that can be aligned with an accuracy of ± 0.01 mm relative to each other
- with spring-loaded pressure pads for precise positioning of the geometrically indeterminate workpiece during clamping (clamping force approx. 10 kN at 20 Nm torque)

ENGINE

COOLING PLATES IN THE TURBINE AREA

TASK:

External clamping for drilling

SOLUTION:

Power-operated collet chuck

FEATURES:

- stepped collet for two different external diameters
- clamping via springs; pneumatic release via integrated pistons
- for stationary machining; chips are removed through the clamping device

CHALLENGE: ENGINE COMPONENTS

Workpieces for engine components pose a particular challenge. They are demanding not only because of their special geometries, but also because of the materials. In the high temperature section of the engine in particular, the workpieces are made of special alloys. Machining is difficult and dangerous internal stresses can build up in the workpiece – risking fracture or failure! Mitigating such risks is one of the challenges of aerospace clamping technology.

1

FAN ROTOR

The turbofan at the engine intake is made of lightweight materials. It has a delicate and complex shape. This calls for clamping and gripping solutions that grip the workpiece gently at multiple points.

2

REDUCTION GEAR

It is located behind the fan rotor and mediates between its speed and that of the compressor and turbine. The machining of the shafts and gears must meet the highest standards of dimensional accuracy and surface quality.

3

COMPRESSOR

The asymmetrically shaped blades of the compressor wheels, with different geometries for each stage, demand a high level of customization in clamping and gripping. Blisks or integrated bladed rotors – are even more demanding.

4

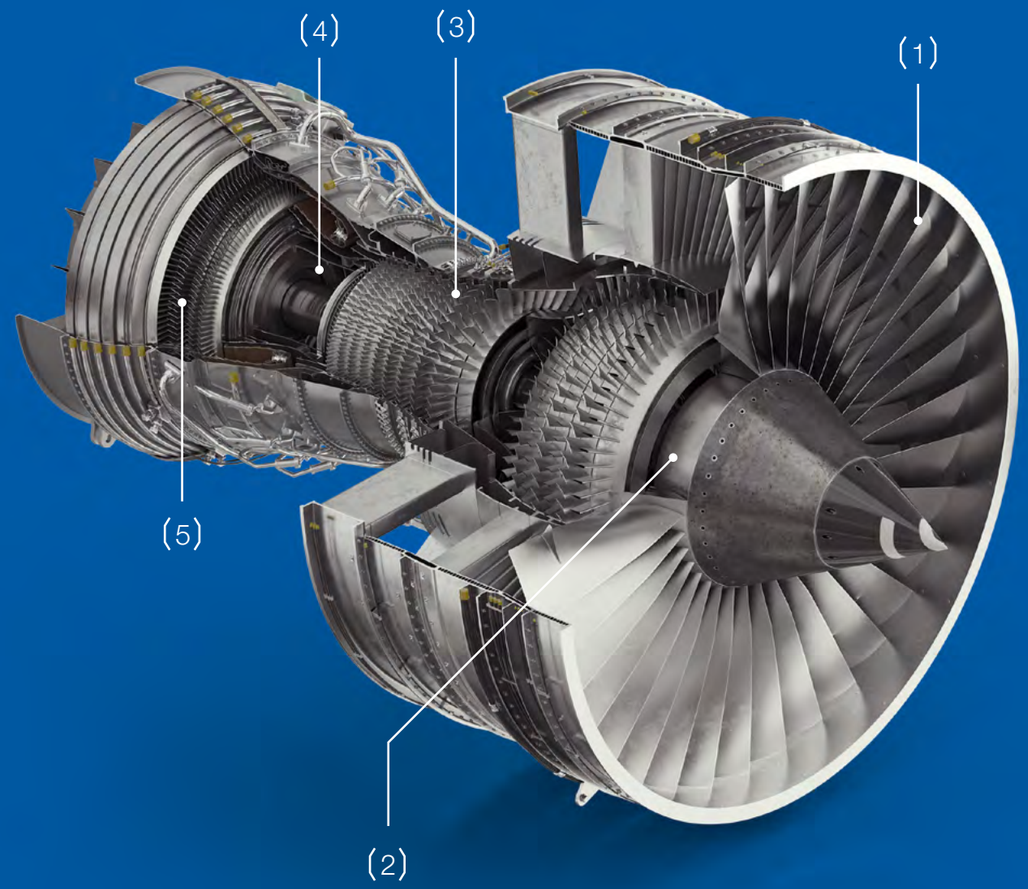
COMBUSTION CHAMBER

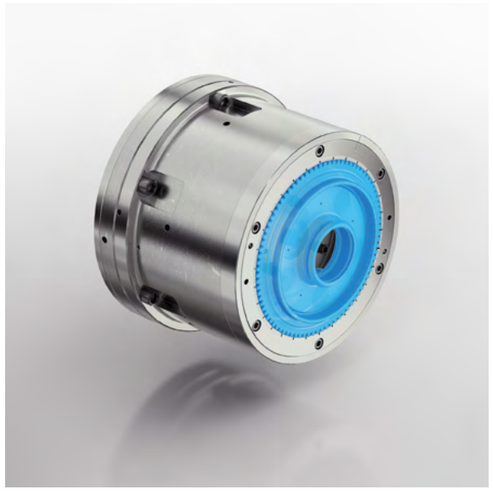
The casing is made of thin sheets of heat-resistant special materials. When machining these, it is important to ensure deformation-free clamping.

5

TURBINE

The heat-resistant special materials of the turbine blades, some of which are made of single crystals, and the sensitive surface coatings require the utmost care when clamping and gripping





ENGINE

PLANETARY GEAR

TASK:
Low-deformation external clamping for hard turning

SOLUTION:
Collet chuck that clamps in the addendum circle of the planetary gear

FEATURES:
- large clamping diameter (266.6 mm)
- without axial pull against the workpiece stop
- with central lubrication
- with cover over the shavings bell
- air-controlled workpiece centering

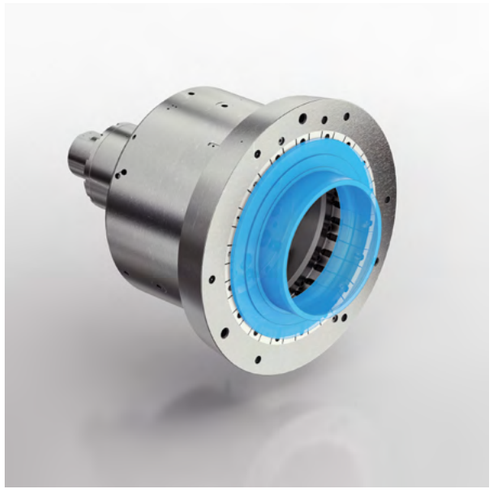
ENGINE

COMPRESSOR WHEEL

TASK:
Low-deformation clamping for turning and milling in the machining center

SOLUTION:
Spring-actuated clamping device

FEATURES:
- spring-actuated clamping via ten clamping claws
- spring-actuated workpiece centering via the central collet
- workpiece dampening to minimize vibrations
- mounted on a pallet changing system, independent of the clamping medium



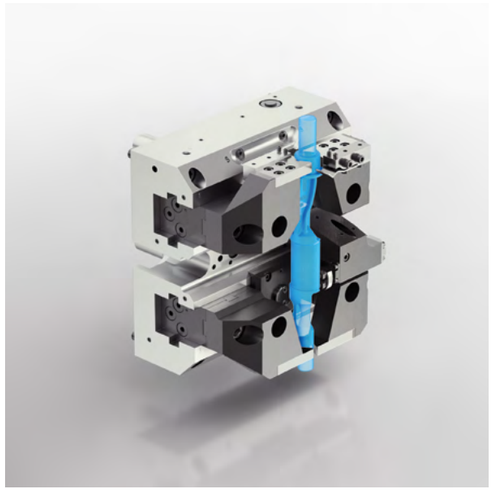
ENGINE

TURBINE WHEEL RING

TASK:
External clamping for attaching the turbine blades by friction welding

SOLUTION:
Power-operated collet chuck

FEATURES:
- large clamping diameter (600 mm)
- suitable for absorbing very high compression forces (up to 1.3 MN at up to 500 kNm torque)
- with integrated hydraulic tandem cylinder for clamping
- combination with customized tappet on the machine spindle for efficient torque transmission



ENGINE

BALANCING SHAFT

TASK:

Clamping of the sensitive lightweight component for rough milling of the shaft ends in a vertical turning machine

SOLUTION:

Double clamping vise with prismatic clamping jaws

FEATURES:

- centric clamping at both shaft ends with radial workpiece alignment
- combined with a hydraulically movable slide unit for automatic transfer of the clamped workpiece together with the tailstock center in the machining process

LANDING GEAR AND BRAKE SYSTEM

OUTER TUBE OF THE MAIN LANDING GEAR

TASK:

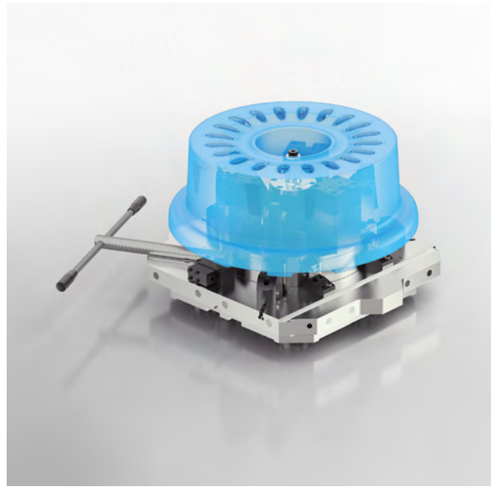
Deformation-free clamping for turning and milling operations

SOLUTION:

Clamping device based on a customized, serial, power-operated three-jaw chuck

FEATURES:

- widely projecting clamping jaws
- axial workpiece stop
- additional adjustable radial stop with manual clamping
- support via the center point of the tailstock with centering washers screwed into the workpiece



LANDING GEAR AND BRAKE SYSTEM

RIM

TASK:

First clamping of the workpiece for rough milling

SOLUTION:

Manual chuck with devices for high precision centering of the workpiece and for vibration dampening

FEATURES:

- with internal clamping pendulum top jaws
- with manually operated, central three-jaw mandrel incl. clamping unit
- with three spring-actuated, internal dampening jaws
- suitable for manual loading outside the work area
- suitable for mounting on changing machine pallets

LANDING GEAR AND BRAKE SYSTEM

SHOCK ABSORBER HOUSING

TASK:

Internal clamping for turning
external and end faces

SOLUTION:

Cartridge mandrels

FEATURES:

- Enables workpiece stop for variable inner diameters (145 mm to 147 mm)
- Without axial pull to prevent deformation of the thin-walled workpiece

LANDING GEAR AND BRAKE SYSTEM

LANDING GEAR STRUT

TASK:

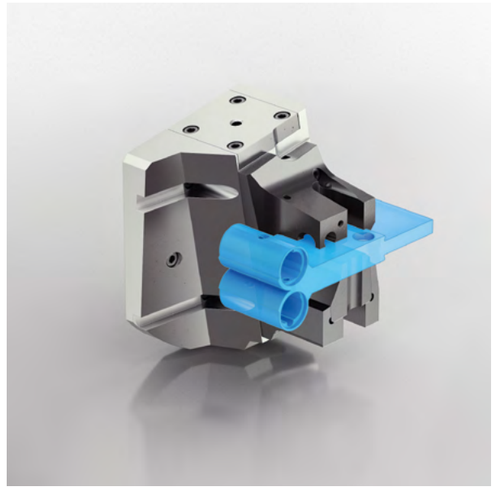
Inside and outside machining

SOLUTION:

Manually actuated cartridge mandrels

FEATURES:

- adaptation to the workpiece contour
- with two-point workpiece stop
- with axial pull against the workpiece stop
- with weights to compensate for the workpiece unbalance



WINGS AND TAIL UNITS

WING AND FRAME HINGES

TASK:

Clamping of the raw parts in the first clamping for drilling and milling in a rotary transfer machine

SOLUTION:

Hydraulically actuated console chuck with a fixed and a movable clamping jaw

FEATURES:

- design of the clamping jaws with the aim of achieving maximum accessibility from all sides
- diameter of the chuck 180 mm
- clamping force 10 kN
- jaw stroke 8 mm

FUSELAGES

MOUNTING RAIL FOR SEATS

TASK:

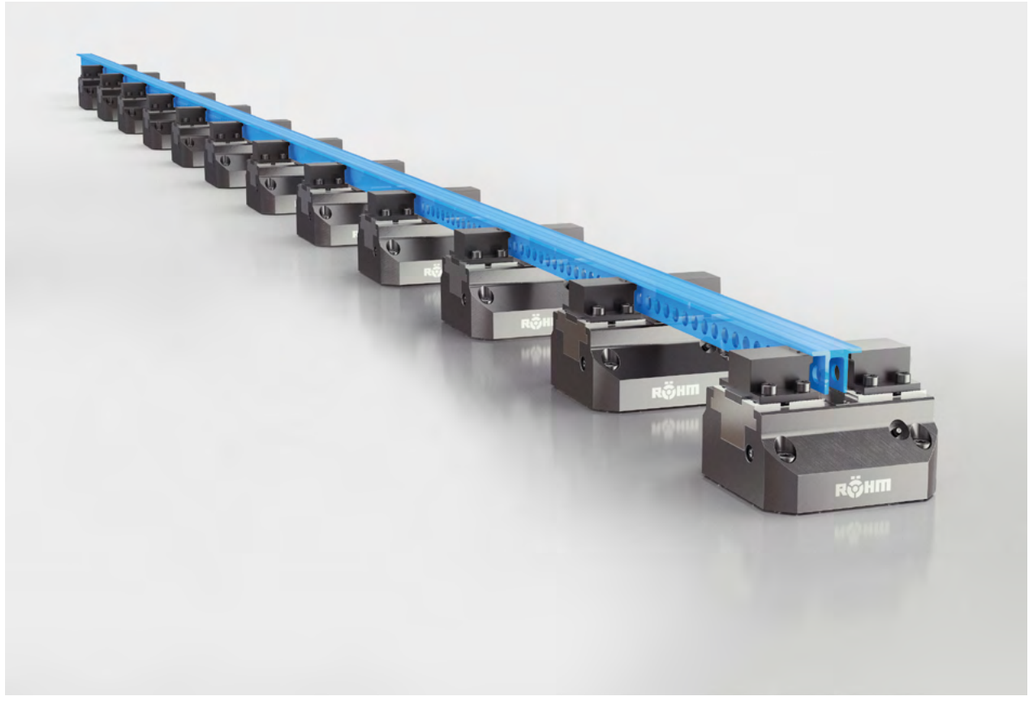
Low-deformation clamping of the ten-meter-long thin-walled titanium component for distortion-free welding to the base plate

SOLUTION:

Clamping fixture based on serial power-operated centric vises KZS 200

FEATURES:

- 19 centric vises in a highly precise, straight arrangement on the fixture
- fixture enables particularly gentle clamping



WINGS AND TAIL UNITS

CLADDING COMPONENTS

TASK:

Manual clamping of drill bits for drilling at high speed

SOLUTION:

P10M serial key-type drill chuck in application-specific adaptation

FEATURES:

- hard metal inserts in the clamping jaws reduce wear to a minimum
- fixing and clamping of the drill, for maximum hold, is effected via three keyholes
- lightweight design for ergonomic working with pneumatic drilling machines

RÖHM ALSO DOES CLEANROOM.

RÖHM also regularly supplies industries that demand a cleanroom compatible design of our products. Cleanroom-compatible production has been set up in-house for this purpose. This is good news for the aerospace industry.

CLEANROOM-COMPATIBLE DESIGN

If products for clamping, gripping and handling technology are to work under cleanroom conditions, then they themselves must be designed to be cleanroom-compatible. Most-important criteria: They must neither attract dirt particles nor generate them through abrasion. This places the highest demands on the choice of materials, design and manufacturing conditions.

RÖHM offers an interactive development process together with the customer. The execution takes place completely in-house. RÖHM is prepared for the fact that its customers have individual requirements for material quality and suppliers.

Quality control of a component manufactured for cleanroom use at RÖHM

CASE EXAMPLE:

COMPONENTS FOR SATELLITE ASSEMBLY

TASK:

Cleanroom-compatible production and delivery of components for clamping, gripping and handling technology for the assembly of satellite modules

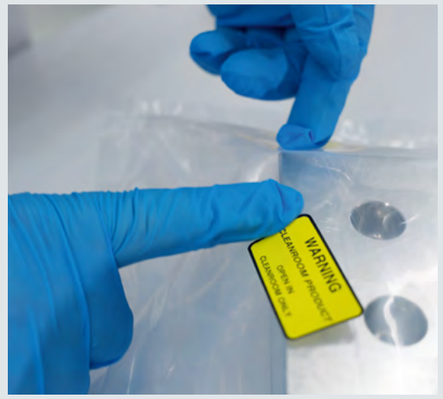
SOLUTION:

- Cleanroom-compatible production of components according to customer drawings at RÖHM (special steel according to the requirements of ground support equipment)
- Corrosion protection coating of components by a specialist provider
- Cleaning and packaging of components under the conditions of cleanroom class ISO 7 at RÖHM and delivery to the customer

CLEANROOM-COMPATIBLE DELIVERY

The final assembly of products that are to work in the cleanroom, their final cleaning and also the packaging for delivery must already be carried out in the cleanroom.

Its class must at least correspond to that of the cleanroom at the customer's premises. This is precisely how RÖHM offers it. A high-quality cleanroom environment is available for this purpose.



Packaging and sealing of a cleanroom-compatible produced component made of stainless steel

THE CLEANROOM ENVIRONMENT AT RÖHM

Planning and setup	MCRT, Heuchelheim
Cleanroom class	ISO 7
Maximum manageable component volumes	approx. 2 m^3
Maximum manageable component mass	1,000 kg
Upstream cleanroom	with material and personnel airlock, with cleaning baths for incoming and outgoing material
Other features	ESD protection floor, darkroom with particle measuring technology

You can find more information about the cleanroom at RÖHM here.

roehm.biz/reinraum

RÖHM has the right answer for all clamping problems, both in workpiece and tool clamping. For the manufacture of products to the highest standards, all requirements are met from customer consultation, design and production through to service. Our specialised consultants will be happy to give you any more detailed information.

Lathe chucks
Independent chucks

Power chucks

Mandrels

Vises

Automation
engineering

Center points

Drill Chucks

Tool clamping systems

Cylinder

Steady rests

Collet chucks

Face drivers

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