

EMUGE

Threading Technology

- Strengthened threads and increased long-term resistance
- Cold forming of large threads with coarse pitch
- Cold forming of threads in difficult materials
- Production of a narrow-tolerance minor diameter without space pocket
- Smoother thread surfaces

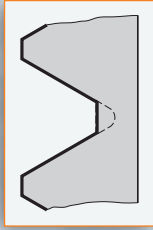
Form...

Cut...

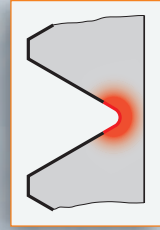


Cut&Form Production of internal threads
by a combination of machining and cold forming

Cut



Form



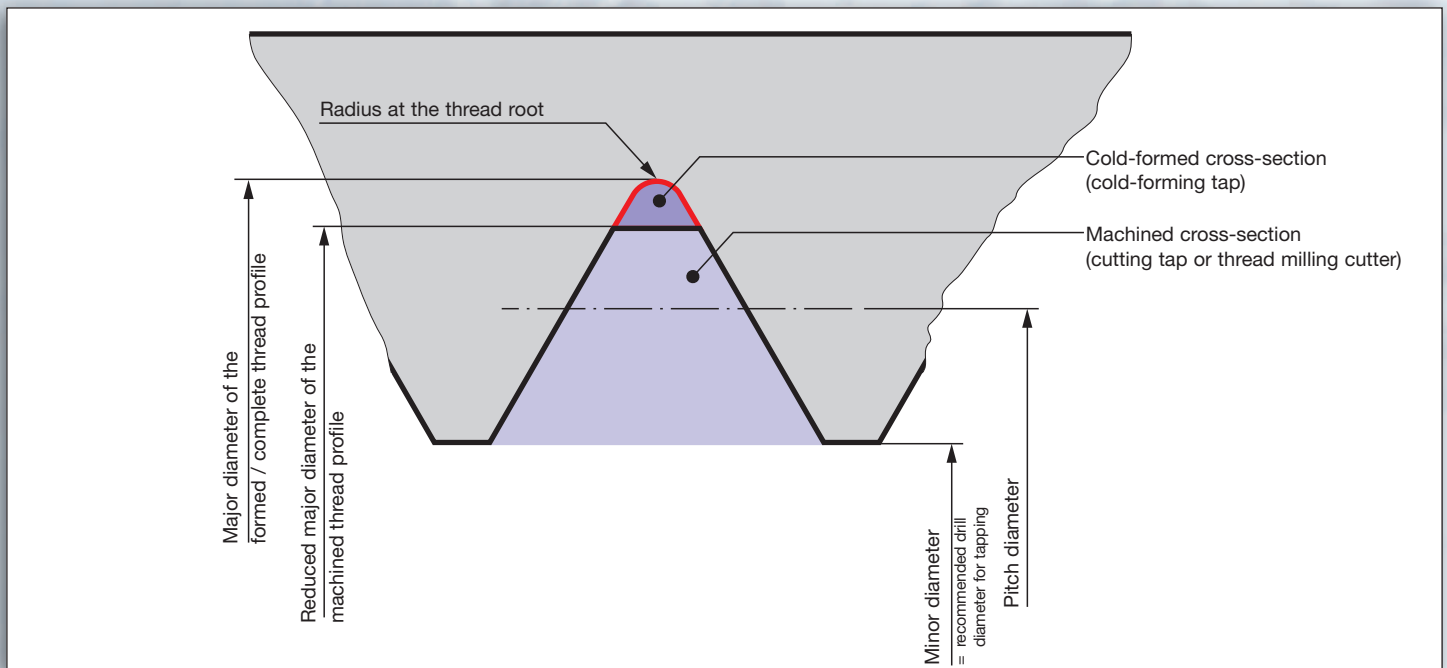
Functional principles

Combination of machining and cold forming

The internal thread production system Cut&Form is a combination of machining and cold forming processes which each produce a specific part of the thread profile.

If you look at our sketch of the cross-section of a metric thread, you will see a black contour which outlines that part of the thread profile which is produced by the cutting tap or the thread milling cutter.

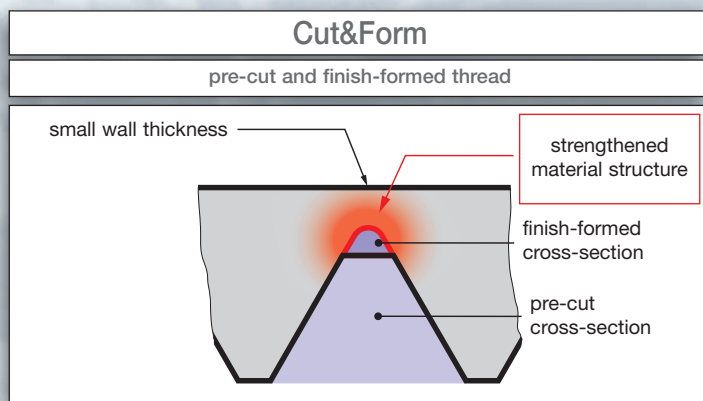
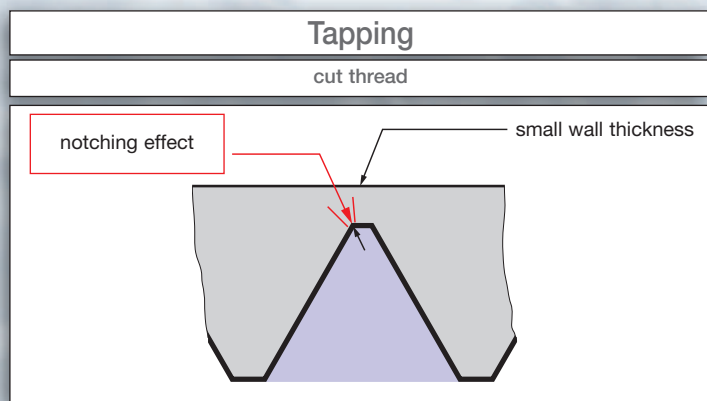
The other part of the thread profile which is marked by the red contour is produced subsequently, by the cold-forming tap: this completes the full thread profile.



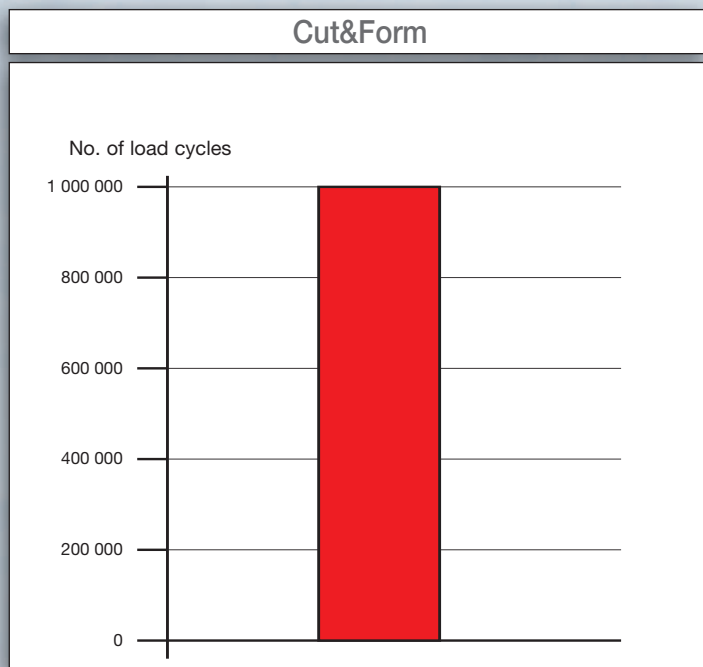
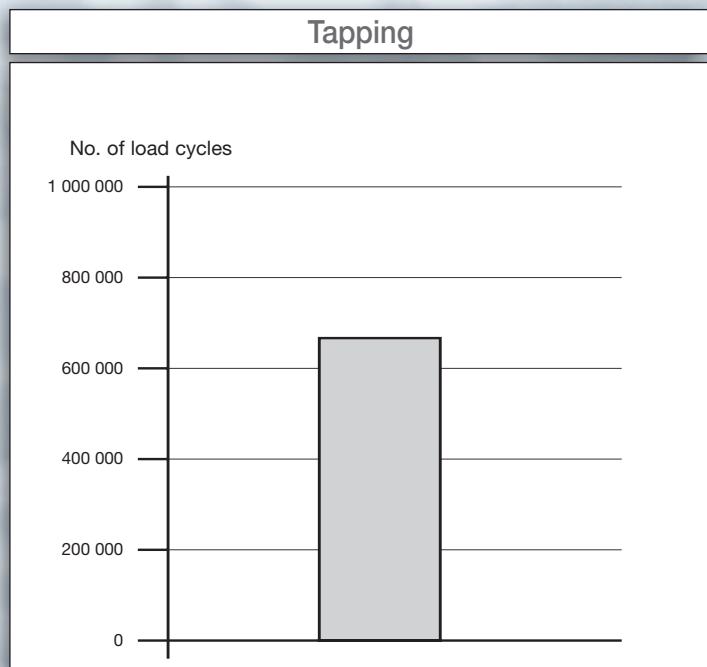
Suitable application areas

Strengthening of the thread and increase of long-term resistance

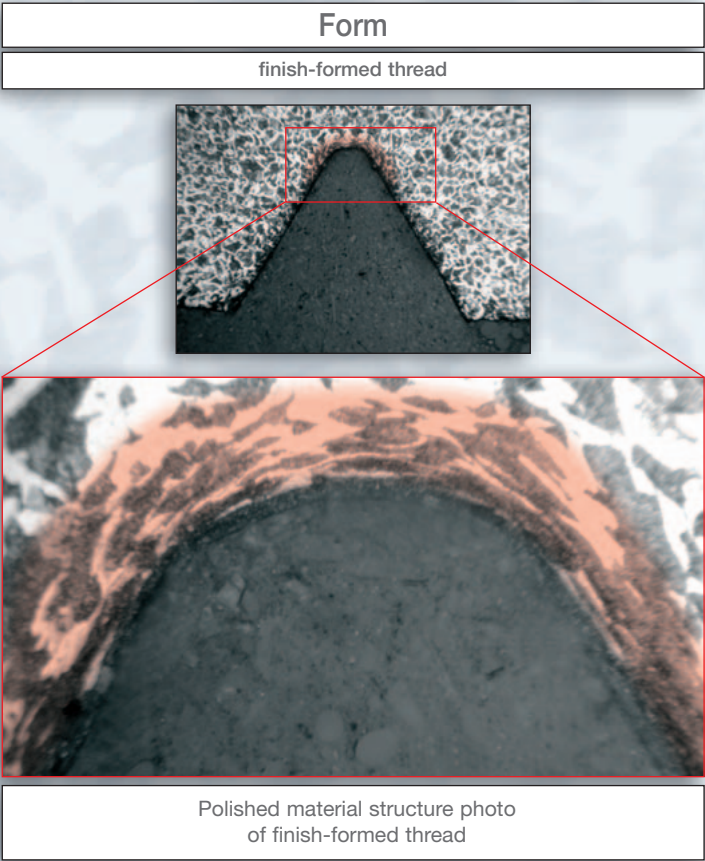
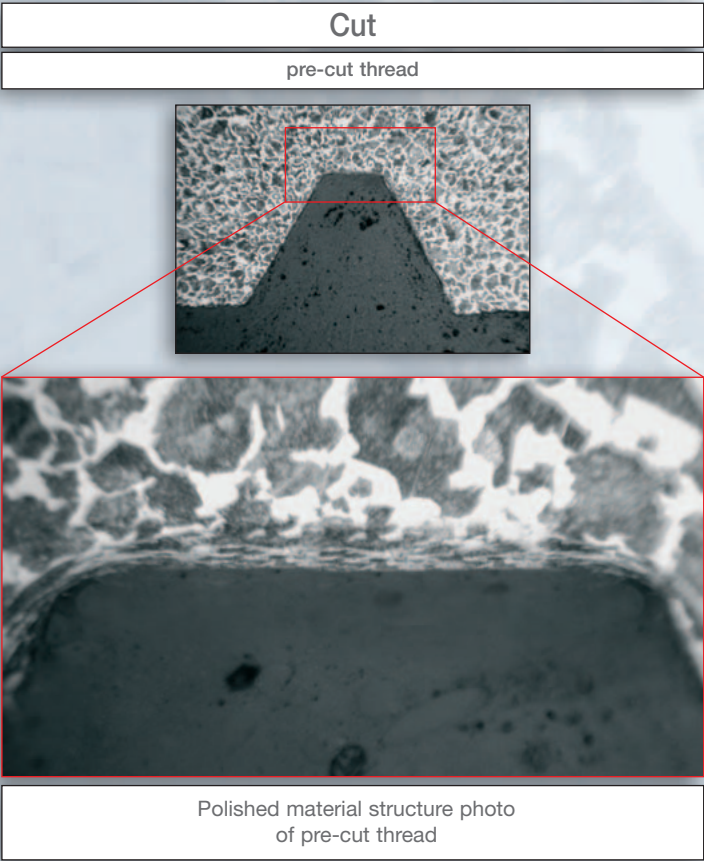
In highly stressed components, considerable notching effects may come up in the thread, depending on total stress.



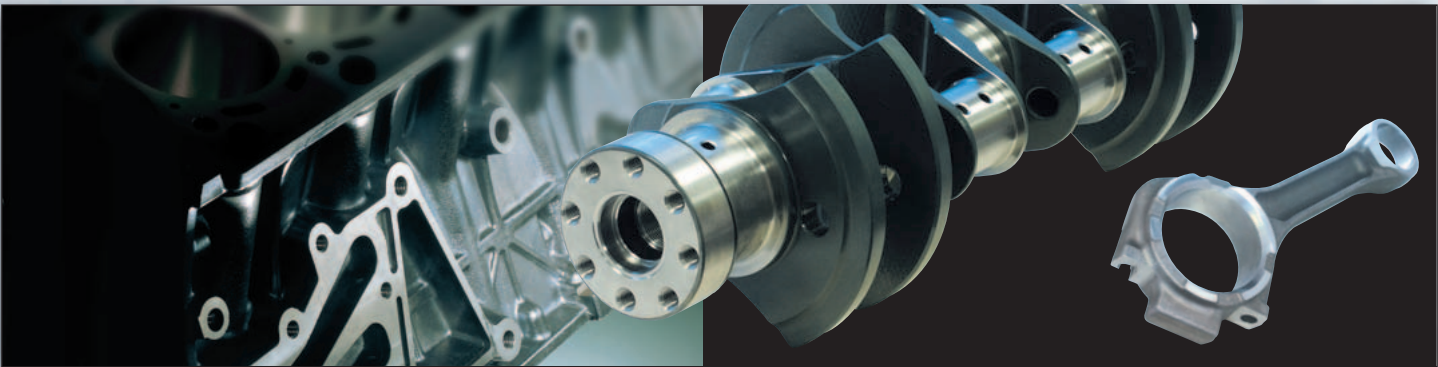
In the following diagrams you can see the number of load cycles which a cut thread and a thread produced by the Cut&Form system were able to withstand in practical tests. With a record of 1.000.000 load cycles, the Cut&Form-produced nut was able to withstand 45% more load cycles than a nut with a cut thread. This confirms the statement that the part-formed thread offers a higher dynamic strength than a cut thread.



In the following illustrations you can see the material structure of a thread in C45. The left-hand picture shows the thread after the first production step of a Cut&Form process; the picture on the right side shows the material structure of the finished thread after completion of both production processes.



In the finish-formed thread, you can recognize a visible deformation of the material structure in the area of the thread root, resulting in a strengthening of the material. In addition, the radius in the thread root helps to relieve the material as far as stress concentration is concerned. The distribution of load is improved, and the danger of notching clearly reduced, resulting in an increase of dynamic resistance.



Typical workpieces for a successful application of Cut&Form

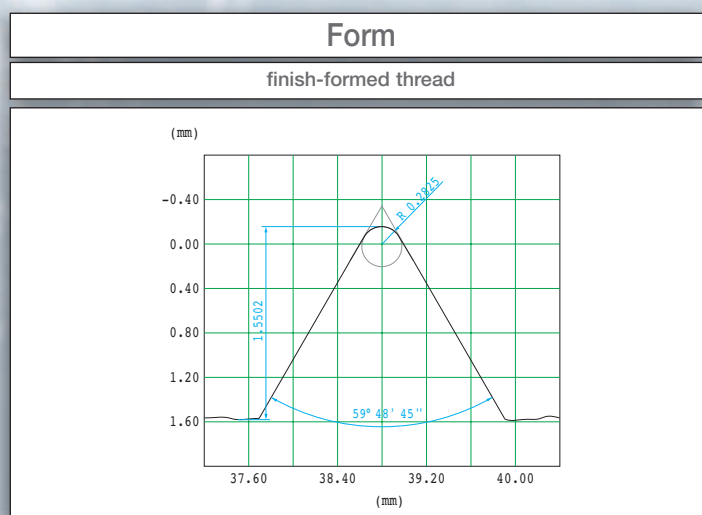
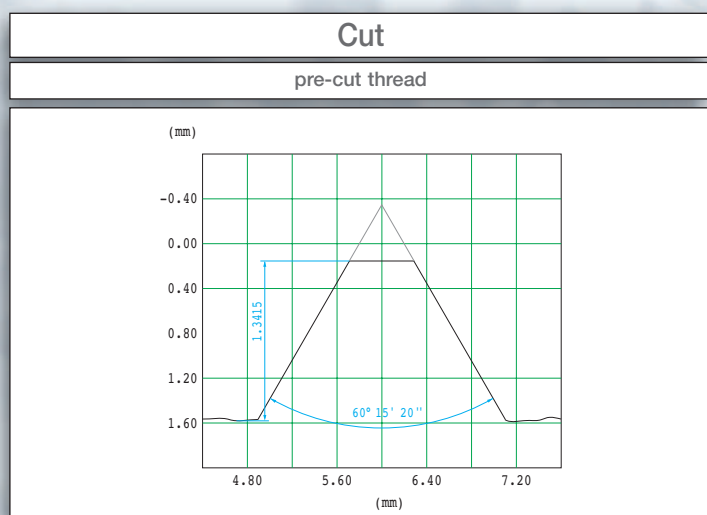
Suitable application areas

Thread profiles with a pitch of up to 6 mm

Thanks to the combination of production processes in the Cut&Form system, the process forces exerted in the cold forming of a full thread profile can be drastically reduced. This means that large threads with a coarse pitch and large machining cross-sections can now be produced with a finish-forming process.

In the following illustrations, you can see the process steps in relation to the formation of the thread profile.

Workpiece material: steel 42CrMoV
Tensile strength: approx. 1100 MPa
Thread depth: 2xD
Thread hole type: blind hole
Thread pitch: 3 mm

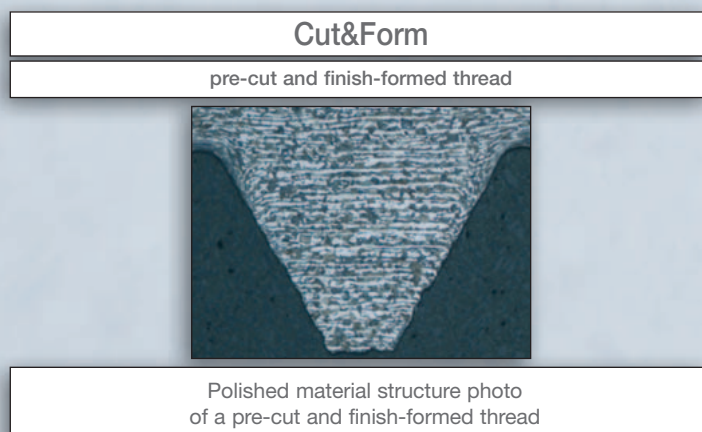
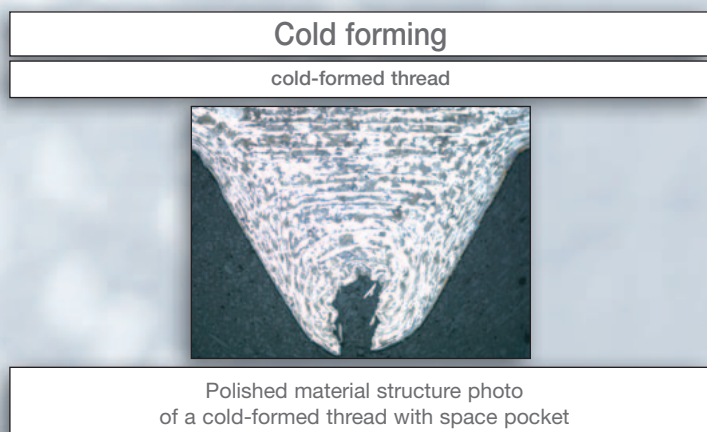


The left-hand illustration of a profile in an axial cut shows the thread after the thread cutting process. You can easily recognize that part of the thread flank and thread root are not yet fully formed.

The right-hand illustration shows the finish-formed thread with external radius in the thread root and with a fully formed thread flank.

Production of a minor nut diameter with a narrow tolerance

The following illustrations show you a Cut&Form-produced thread on the right-hand side, and a normal cold-formed thread on the left-hand side. As in traditional tapping, the minor diameter is produced by a preparatory drilling tool. You can easily recognize that in spite of the finish-forming process there are no "fish lips", and that the minor diameter has not been changed.



Materials with bad cold-forming properties

Materials with bad cold-forming properties, like cast iron, can be machined in a Cut&Form process with a high degree of reliability. Especially the minor diameter area of the thread can be formed to a high degree of perfection.

Smoother thread surfaces

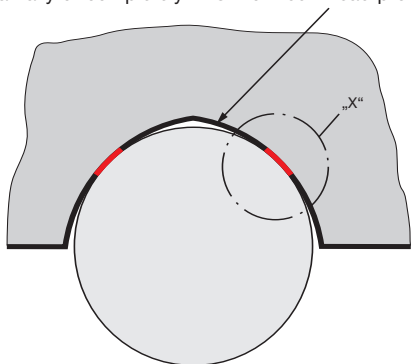
Thread applications which require an elevated surface quality, like ball-screw threads, can be produced safely and reliably with Cut&Form.

Thanks to the cold-forming process, peak-to-valley height values of 0.4 micron, with good lubrication even better, can be achieved.

Application example: 100Cr6 ball-screw nut

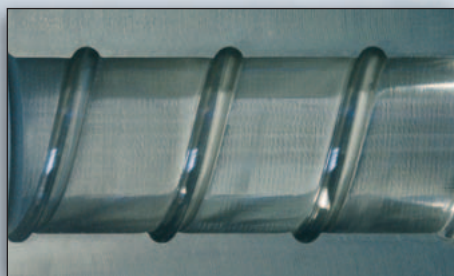
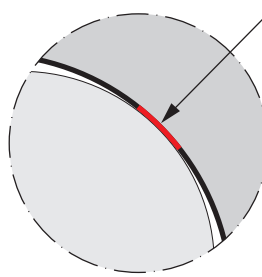
In the illustrations below, you can see the radii of the ball-screw grooves. The pre-cutting tap works with a defined undersize. The thread profile is produced partially or completely by a cold-forming process.

Partially or completely finish-formed thread profile

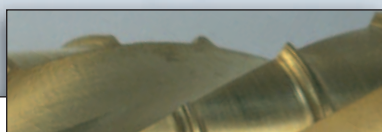


Detail "X"

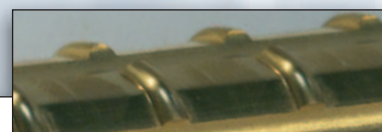
Running track of the balls: In this contact area, a better thread surface than can be achieved by traditional tapping is required.



pre-cut and finish-formed
ball-screw thread



cutting tap (pre-cutting tool)
for ball-screw thread



cold-forming tap (finish-former)
for ball-screw thread

Tool technology

Threading tools

Taps or thread milling cutters which are to be used for Cut&Form must be provided with a special geometry in the thread profile. For finish-forming, cold-forming taps with a thread profile specially adjusted to the pre-cutting tool are used. Only those areas of the thread profile which have not been machined by the pre-cutting tool are cold-formed. A special patented finish-former design was developed for that task. This design features guiding parts which are situated in the lower part of the thread profile, and finish-forming surfaces which are positioned on the upper part. In addition to this design, we can offer you special combined tools which unite both functions of Cut&Form in one single tool.

Cut

Pre-cutting – taps, or thread milling cutters



Form

Finish-forming – cold-forming taps



Inspections

After each production step, inspections are possible for increasing process safety. Such inspections are usually performed with go and no-go thread gauges which must be specially adjusted to the profile division realized in the separate work processes.

Gauges for Cut



Gauges for Form



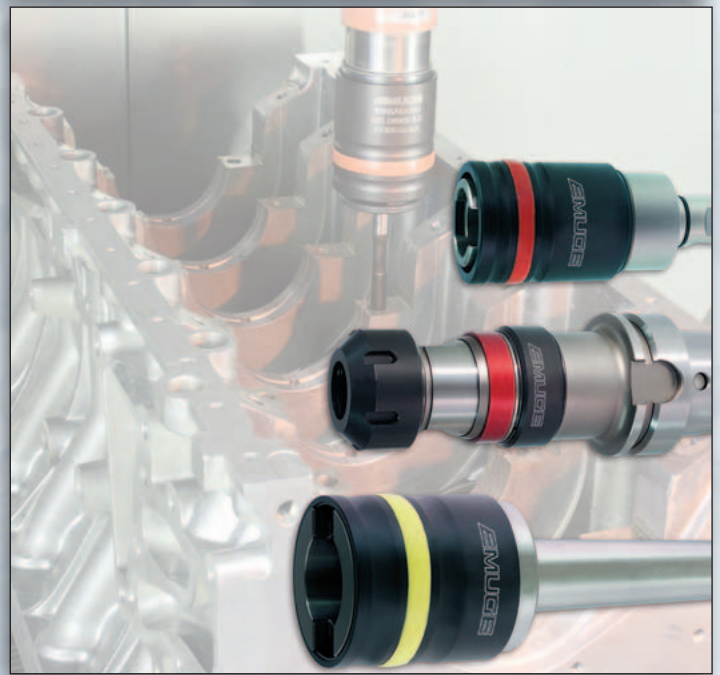
Tool holders

Special clamping of the threading tools with specially adjusted tap holders is a necessary precondition for a safe Cut&Form process sequence. Process monitoring will add the last touch, and give the highest degree of reliability to the system.

Cut



Form



Process monitoring



Special engineering for the application case

It is a fundamental strategy of EMUGE to always adjust tool parameters like cutting material, surface coating and geometry to specific application conditions like material, lubrication, hole type, work position etc.

The construction of the tools is especially critical when blind holes must be machined, and the greatest importance lies in the observation of the necessary machining depths.

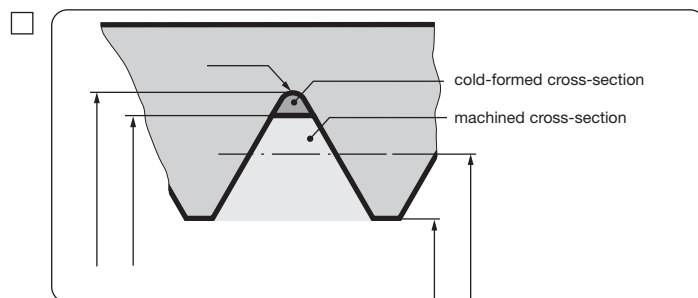
These requirements result in specifically designed tools which can be produced as custom-made specials only. For communicating to us your own technical conditions, it would be best to use the questionnaire which you will find on the following pages.

Company:
.....
Contact:
Phone:
Fax:
E-mail:

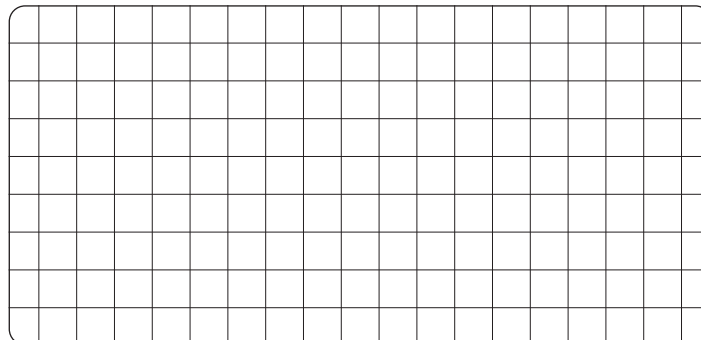
Size:
Design:
Article no.:
Project:

Thread profile division:

☐ Standard



Sketch:



Workpiece material:

Description:
Condition during work:
Tensile strength: N/mm²

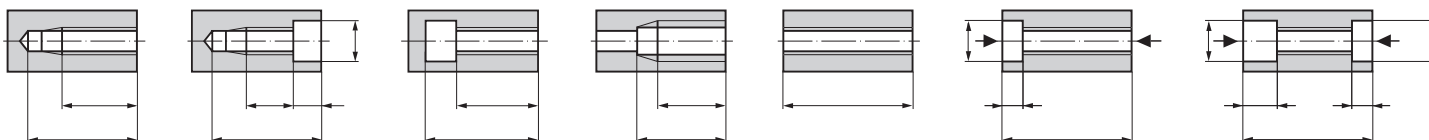
Hardness: Elongation: %
☐ Short-chipping
☐ Long-chipping

Thread hole:

Thread hole diameter:

☐ Drilled ☐ Reamed ☐ Stamped ☐ Cast ☐ Drawn

Thread hole type – please enter dimensional specifications



Cut

Form

Preferred work process:

☐ Tapping ☐ Thread milling

☐ Cold forming of threads

Machine:

Manufacturer:
Type:
Spindle power: kW
☐ Horizontal ☐ Rotating tool
☐ Vertical ☐ Stationary tool

Machine:

Manufacturer:
Type:
Spindle power: kW
☐ Horizontal ☐ Rotating tool
☐ Vertical ☐ Stationary tool

Cutting data:

Speed/rpm n: min⁻¹
Cutting speed v_c: m/min

Cutting data:

Speed/rpm n: min⁻¹
Circumference speed v_c: m/min

Cut

Feed:

- ☐ Pressure cam ☐ Others
☐ Hydraulic
☐ Lead screw
☐ NC control
☐ Synchronous spindle
☐ Gear wheels

Feed for thread milling:

f_z : f_s : f_b :

Tool holder:

- ☐ Rigid ☐ Collet ☐ Thermic ☐ powRgrip®
☐ Tapping attachment } Manufacturer:
☐ Tap holder } Type:
☐ With overload clutch
☐ With length compensation
☐ With axial-parallel floating
☐ With internal coolant-lubricant supply Pressure: bar
☐ DIN 1835 B / DIN 6535 HB
☐ DIN 1835 E / DIN 6535 HE

Spindle adaptation:

MT / ISO taper / HSK / TR / Others
 DIN / ANSI / JIS / Others

Cooling:

- ☐ Oil ☐ Emulsion % ☐ Dry
☐ Circulation ☐ Brush ☐ Mist
☐ Minimum quantity lubrication ☐ Others:

Tool information:

Design:
 Article no.:
 Shank diameter: DIN:
 Special features:

 Tools used until now (manufacturer):

 Tool life: (No. of threads)

Form

Feed:

- ☐ Pressure cam ☐ Others
☐ Hydraulic
☐ Lead screw
☐ NC control
☐ Synchronous spindle
☐ Gear wheels

Tool holder:

- ☐ Tap holder with length compensation on compression
 Manufacturer:
 Type:
☐ With overload clutch
☐ With additional length compensation on tension
☐ With axial-parallel floating
☐ With internal coolant-lubricant supply Pressure: bar

Spindle adaptation:

MT / ISO taper / HSK / TR / Others
 DIN / ANSI / JIS / Others

Cooling:

- ☐ Oil ☐ Emulsion % ☐ Dry
☐ Circulation ☐ Brush ☐ Mist
☐ Minimum quantity lubrication ☐ Others:

Tool information:

Design:
 Article no.:
 Shank diameter: DIN:
 Special features:

 Tools used until now (manufacturer):

 Tool life: (No. of threads)

Filled in by:

Date/signature:



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