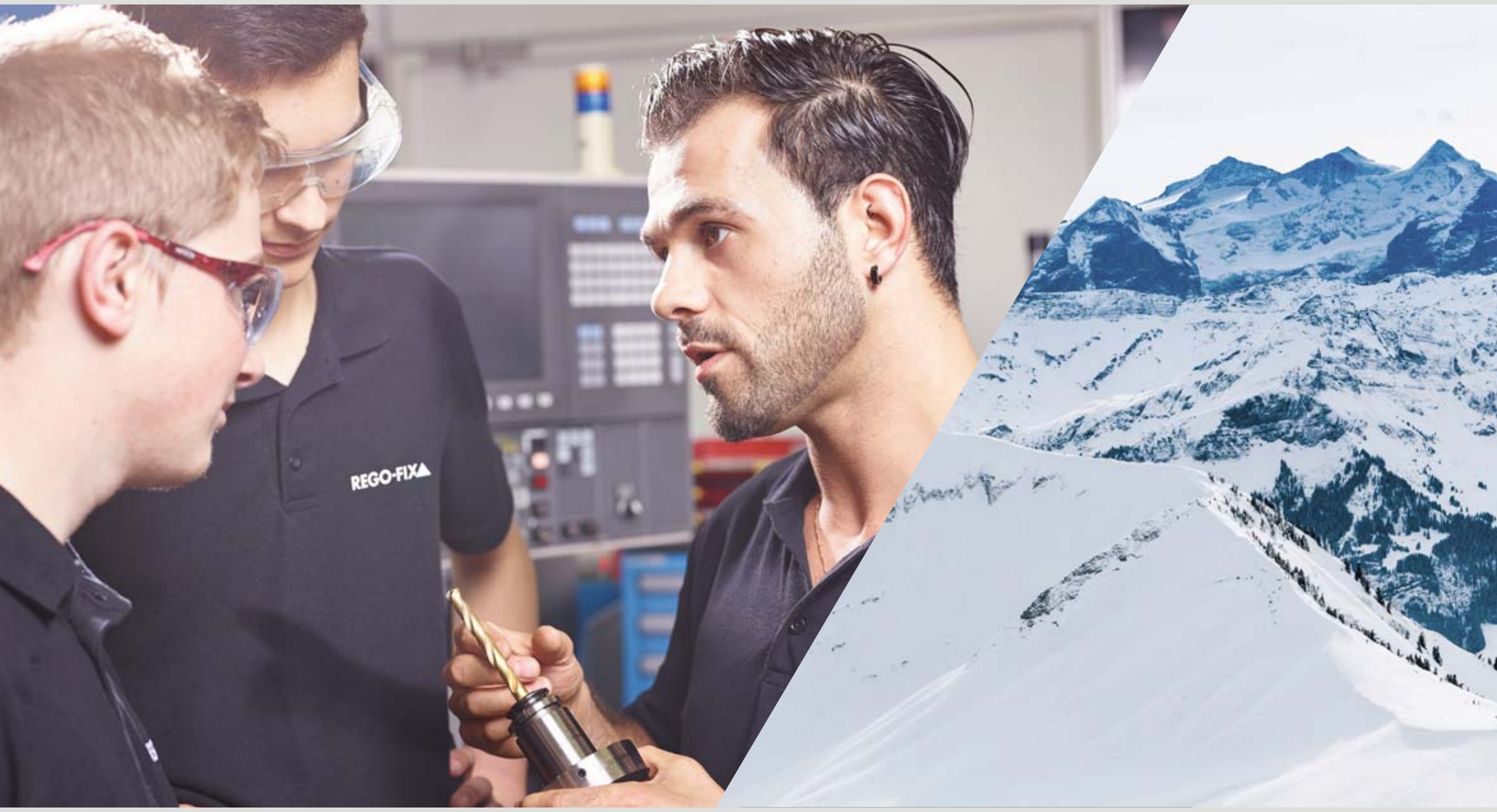
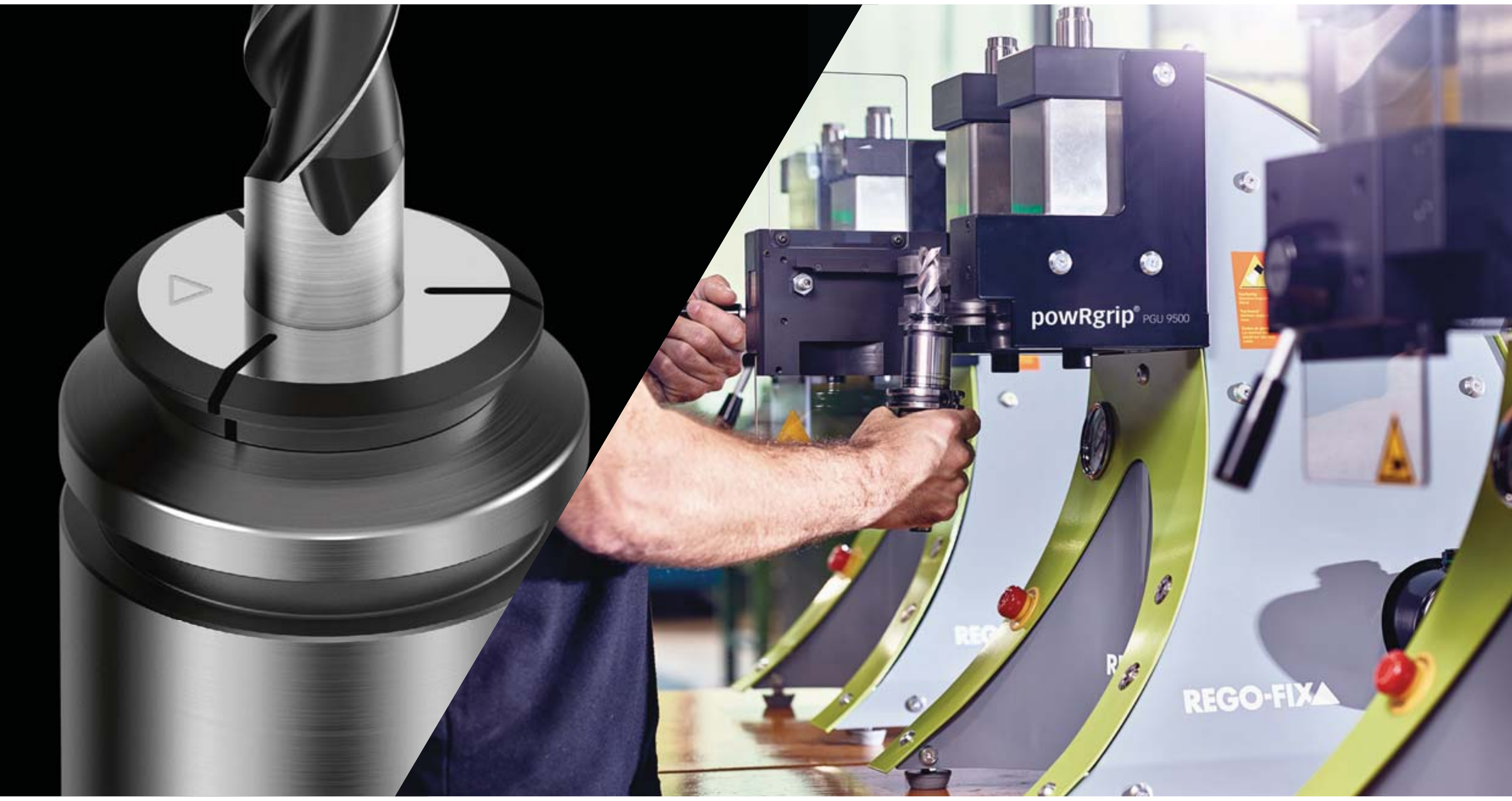

REGO-FIX



Technical information



Meeting high machining demands

The powRgrip® System provides excellent runout, high vibration damping as well as easy and secure handling for demanding high-speed milling and drilling.

Power and precision combined An outstanding tool runout is one of the most positive influences on enhancing your tool life.

SIMPLE

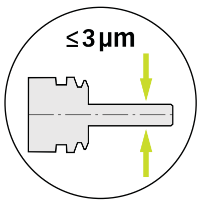
Tool is clamped in 8 seconds by pushing only one single button.

SAFE

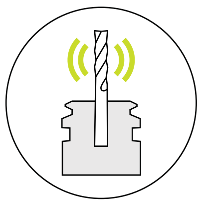
No heat up – high clamping force.

powRgrip®

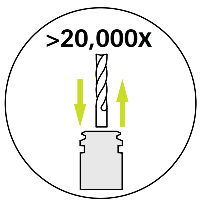
The tool clamping system of today and the future.



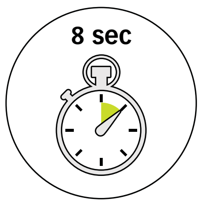
Total system runout TIR ≤3µm at 3xD.



Excellent vibration damping.



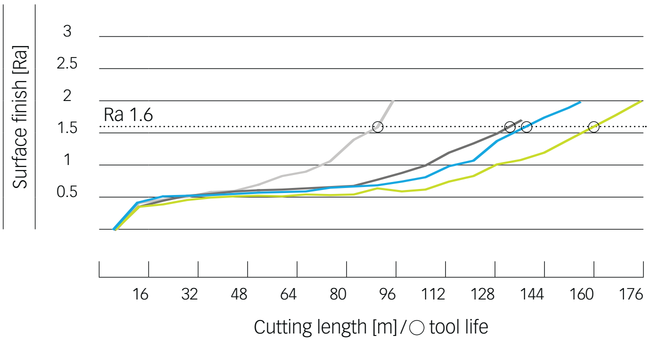
Maximum clamping force and low runout, even after 20,000 tool changes.



Tool ready for use in 8 seconds.

Increased cutter tool life with the powRgrip® System

Influence of tool runout on tool life / Source: In-house testing



- powRgrip®
- REGO-FIX ER System with Hi-Q® clamping nut
- Shrink-fit
- Hydro chuck

All tool shanks are clampable

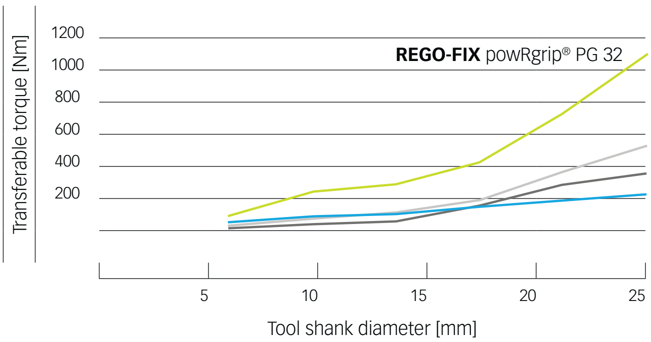
All kind of materials such as carbide or HSS as of cylindrical, WELDON or Whistle Notch can be clamped with powRgrip®.

Extensive collet range

Tools with shank diameters from 0.2 to 25.4 mm (1") can be clamped for milling, reaming, drilling and as well for turning applications.
The possibilities of MQL, peripheral or internal cooling are given.

Transferable torque of the powRgrip® System

Measured transferable torque per shank diameter / Source: In-house testing



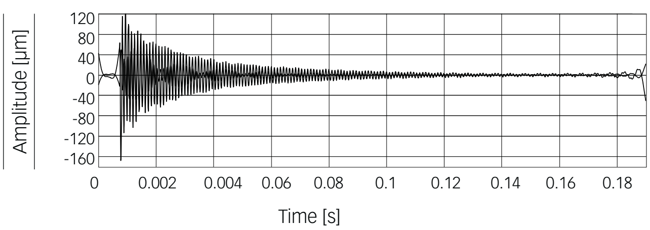
- powRgrip® PG 32
- Shrink-fit
- Hydro chuck
- REGO-FIX ER 40

Wide range of toolholders

powRgrip®-toolholders are available for many spindle interfaces e.g. REGO-FIX CAPTO, BT, BT+, SK, SK+, HSK, CAT, CAT+ or cylindrical spindle interfaces. Discover our wide product range at www.rego-fix.com.

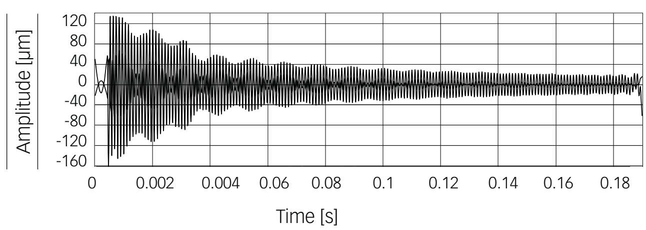
Measurement of vibrations | powRgrip®

Amplitude indication of the REGO-FIX **powRgrip® toolholder**



Measurement of vibrations | Shrink-fit holder

Amplitude indication of a standard **shrink-fit holder**

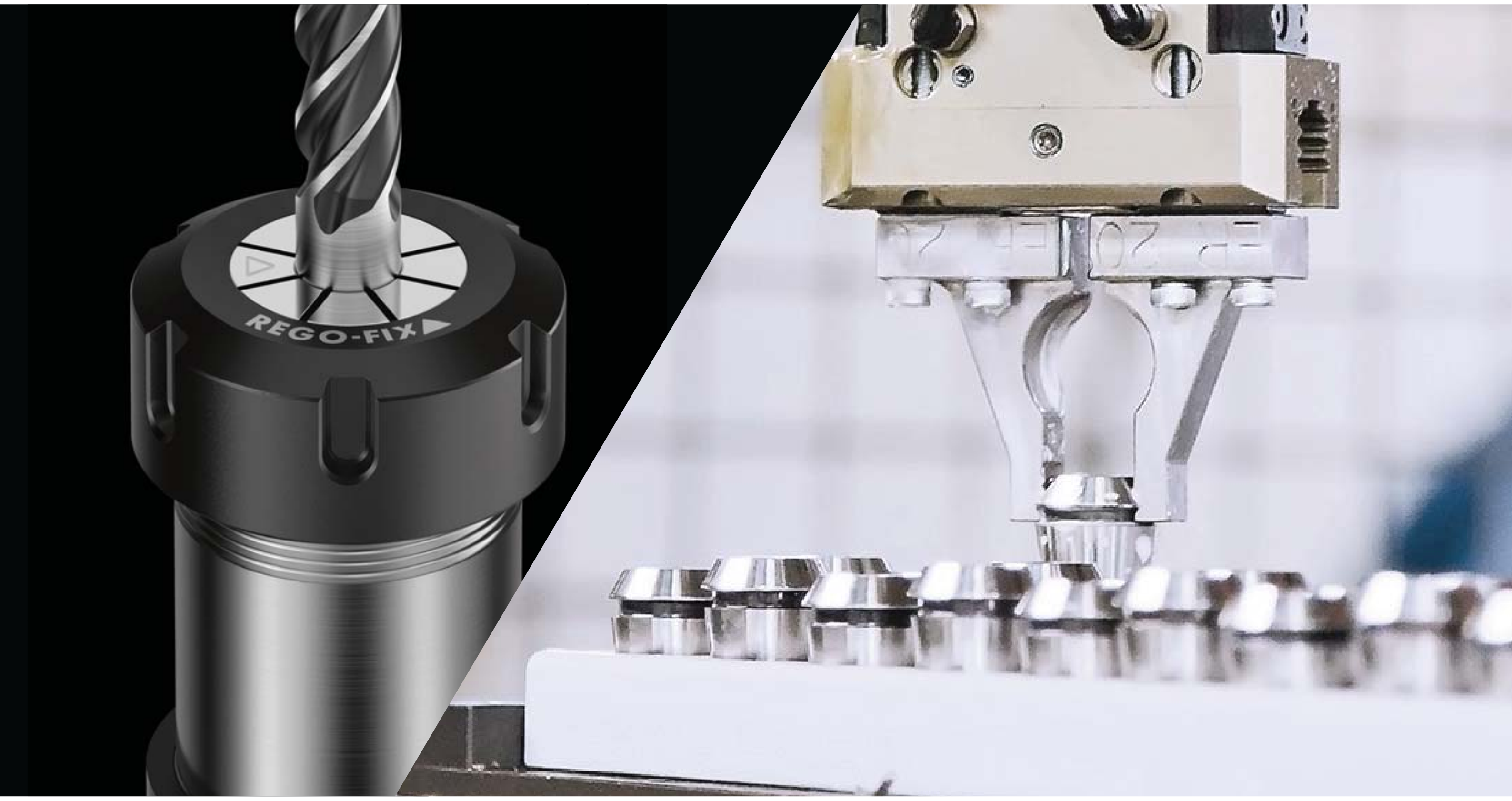


Test and comparison done by:

Institute for production and high-performance laser technology
Technical University Vienna

Expert advice

Test powRgrip® free of charge! Get more information at try.rego-fix.ch/toollife.



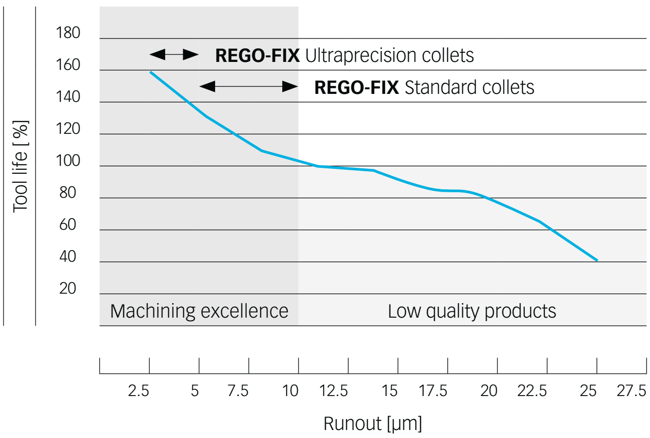
Defining toolholding standards

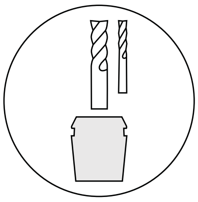
When REGO-FIX first introduced the ER System in 1972, it took the machining world by storm. With the DIN 6499 standardization twenty years later, the REGO-FIX ER collet became the industry standard. Today, the ER System is still the most used toolholding system worldwide.

High quality matters An outstanding tool runout is one of the most positive influences on enhancing your tool life.

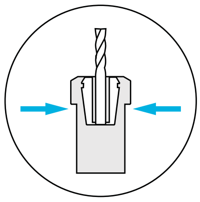
Extend tool life with the REGO-FIX ER range

Influence of tool runout on tool life / Source: In-house testing

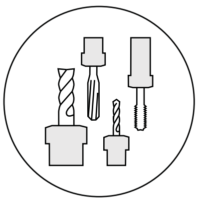




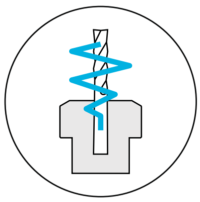
The widest ER product range: clamps all diameters from 0.2 mm – 36 mm.



Safe and accurate toolholding of all shank types and materials.



Outstanding flexibility for use with all tool types.



High vibration-damping results in longer tool life and best surface finish.

Successful clamping since 1972

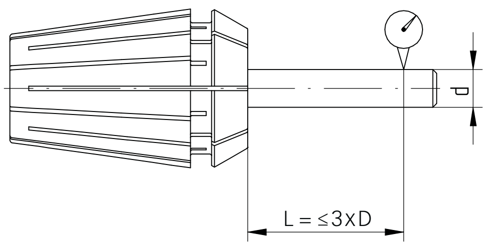
Combine our ER toolholders with our ER collets to ensure maximum precision and balance to maximize your tool life. All our products bear the REGO-FIX triangle – our seal for outstanding Swiss quality.

Meet highest requirements defined by Swiss standards Swiss people are known to be humble and conservative: All our measuring data are to be considered as maximum values. Many other manufacturers are showing the common measured total internal runout (TIR average). With us, you get maximum guaranteed values – To your advantage most of the values are even considerably lower.

Runout TIR of ER standard, ER-UP and MR collets

Clamping diameter d [mm]			TIR max. [mm]			
			DIN 6499			
>	≤	L	ISO 15488 B	△ER std.	△ER-UP	△MR
1	1.6	6	0.015	0.01	0.005	0.002
1.6	3	10	0.015	0.01	0.005	0.002
3	6	16	0.015	0.01	0.005	0.002
6	10	25	0.015	0.01	0.005	0.002
10	18	40	0.02	0.01	0.005	0.002
18	26	50	0.02	0.01	0.005	0.002
26	36	60	0.025	0.01	0.005	0.002

L = ≤3xD



Key advantages

Rely on the original

Wide clamping range

The slot design allows for a wide clamping range with best runout TIR along the entire clamping range.

Broad range of products

We offer sizes from ER 8 up to ER 50 and diameters from 0.2 mm up to 36 mm.

Up to 20% more clamping length

Improve your runout with up to 20% more clamping length in smaller diameters.

Matched tooling system for best fit

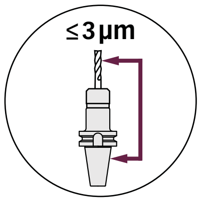
The compatibility of the entire system results in maximum precision, balance and tool life.

Every micron counts

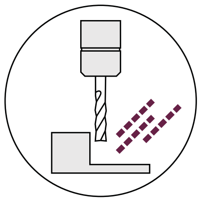
Closing the gap between the powRgrip® and the ER System, the micRun® System performs with a total system runout of ≤3 µm.

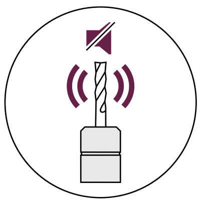
Swiss high precision An excellent runout accuracy paired with superior vibration damping, not only increases your machining quality, but enhances your overall productivity. It also increased your tool life, thus successfully lowering your cutter costs. With a total system runout of ≤3 µm at 3 x D, the micRun® System provides all the benefits of excellent runout accuracy.

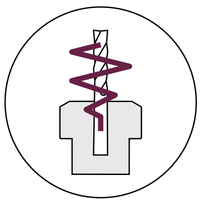
This is why micRun® is the ideal system for all micro machining applications and is successfully used in industries like watchmaking or medical engineering. In addition, our unique collet-locking system retains the collet safely inside the nut. This minimizes your risk of faulty operations or possible damages which may occur if the collet accidentally falls to the ground. Another great benefit of our collet-locking system is the tool-free removal of the collet.



Total system TIR ≤3 µm at 3 x D.


Designed for high-speed cutting.


Silent and low vibration due to grooveless clamping nut.

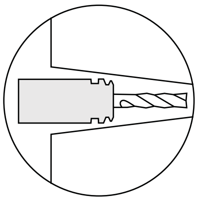

High vibration-damping results in longer tool life and best surface finish.

TC40/MR16x070
5240.11630.100
REGO-FIX
Swiss Made
micRun®System
TC40/MR11x100
5240.11150.100
REGO-FIX
Swiss Made
micRun®System

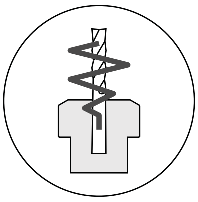
XL vibration damping

Optimize your surface finish and extend tool life by minimizing occurring vibrations during machining.

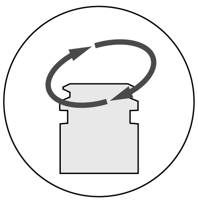
Minimize tool vibrations The MICRO-FRICTION DAMPING™ (MFD) technology (pat. pend.) by REGO-FIX allows our XL toolholders to dissipate vibrations faster than standard long-reach toolholders. Damping the vibrations faster means that your cutting tool, part and spindle will see less vibrations resulting in better surface finishes, longer tool life and less spindle wear. All REGO-FIX XL toolholders are balanced to G 2.5 @ 5,000 rpm.



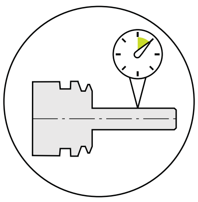
Minimal outside dimensions: long and slim design.



Exclusive vibration-damping design.



Balanced by design.

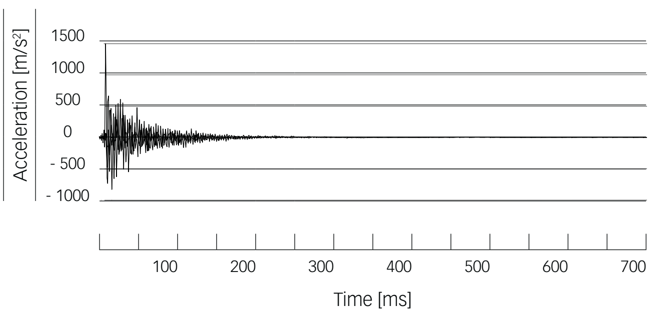


Total system runout TIR ≤ 10 µm at 3 x D.

Vibration chart

Decay of REGO-FIX XL toolholder **with vibration-damping design**

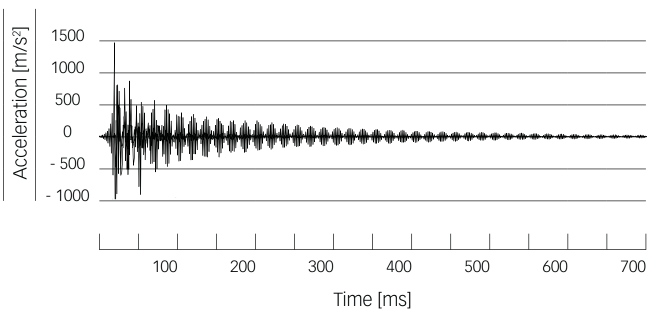
Source: In-house testing



Vibration chart

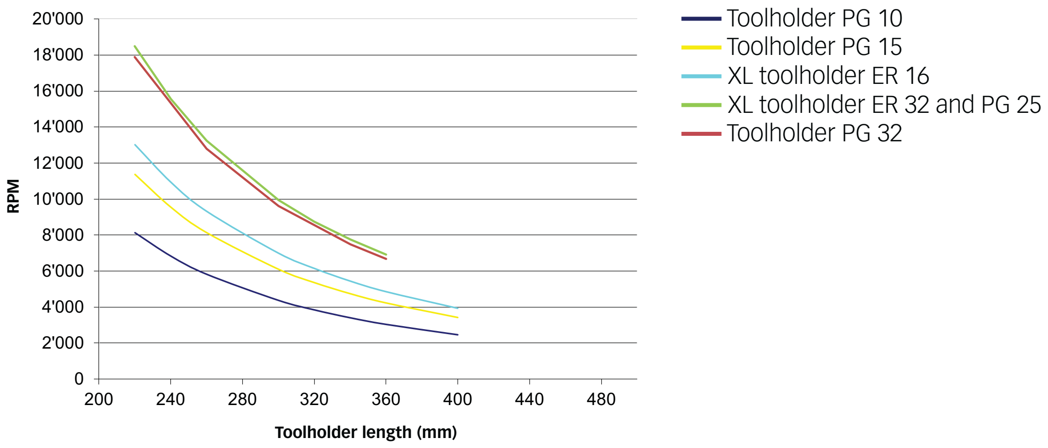
Monoblock standard toolholder **without vibration-damping design**

Source: In-house testing



RPM recommendations for XL toolholders

Thanks to a wide XL toolholder program, we offer for each of your applications the right solution. Unleash the full potential by respecting the appropriate working conditions.



Calculation of the maximum speed of a shaft with cantilever bearing. Calculated values without consideration of:

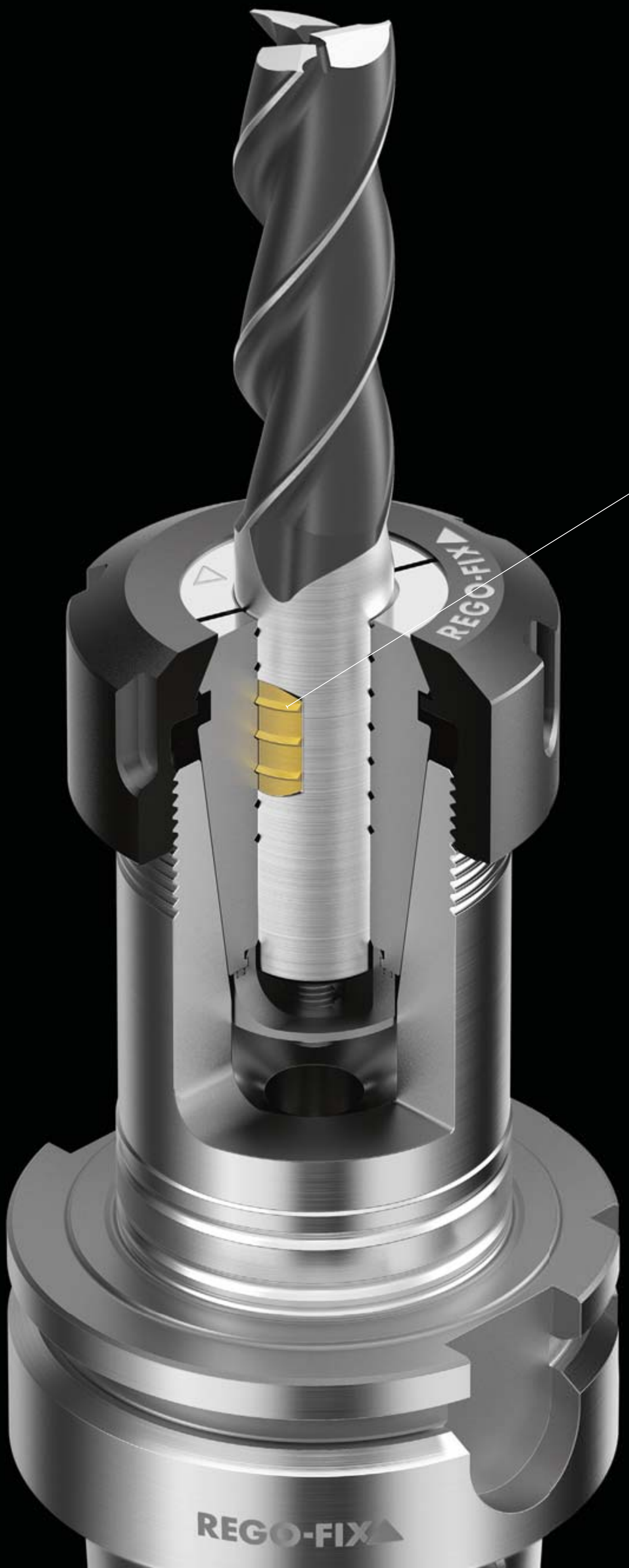
- // Balancing quality (Overall-system)
- // Machine spindle (Stability)
- // Projection length of the cutting tools

The maximum speeds are directly dependent on the properties of the spindle and the machining forces.

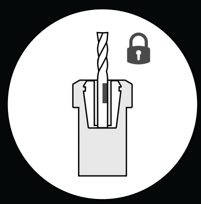
These are standard guidelines for REGO-FIX Xtended Length toolholders. No guarantee can be given for the maximum speeds of the entire system.

Form-fit for 100 % pullout protection

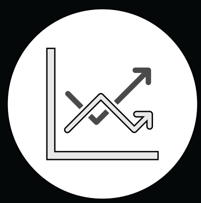
With our innovative secuRgrip® solution, we offer a total tool pullout protection for the ER and powRgrip® System.



Threaded insert for end mill flat

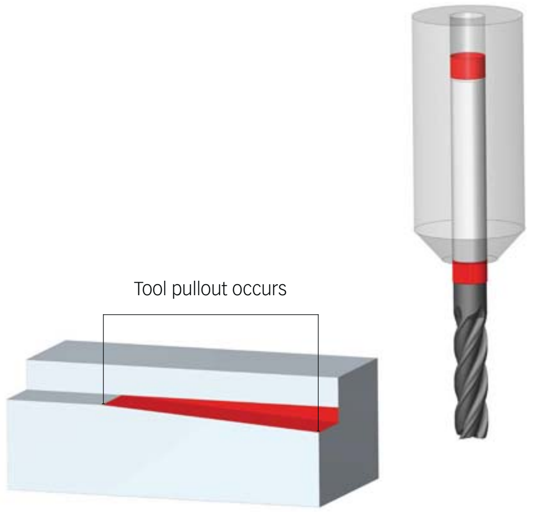


SecuRgrip® is available for all standard tools with Weldon flat (10 – 25.4 mm), without additional modifications.

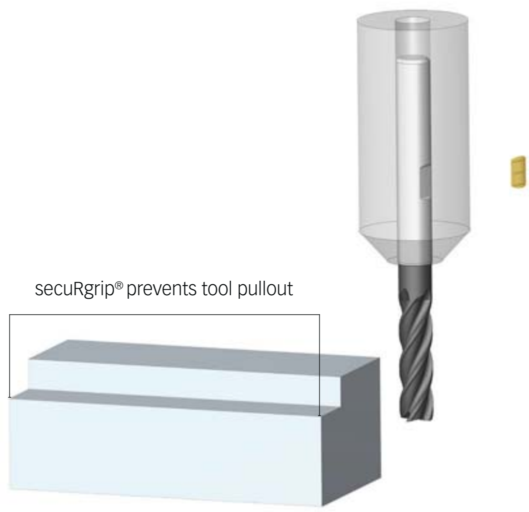


Increase productivity through process reliability.

Safe machining even for difficult-to-handle workpieces



Length alterations can lead to damage of the workpiece.



Prevent workpiece damage by using REGO-FIX secuRgrip®.

Full protection where you need it The secuRgrip® threaded insert is designed to fit in any tool with a Weldon flat. This way you can use the tool of your choice. In combination with our secuRgrip® collet, we offer the ultimate tool pullout protection at a competitive price.

Avoiding length alterations caused by tool pullout results in improved process reliability and ultimately improves your overall machining productivity. Our secuRgrip® solution is available for ER 32 and ER 40 as well as for PG 15, PG 25 and PG 32 – just the right sizes when it comes to rough machining.

// No additional costs for replacing damaged tools, thanks to ER and PG secuRgrip®
// No modification of the tool shank is required
// Extra protection for worry-free machining, especially with expensive work pieces

Expert advice

secuRgrip® is available for ER and powRgrip®.

Mastering both wet and dry applications

We offer efficient solutions for specific machining techniques and different work materials to maximize your machining.

Dry machining


Wet machining

Dry machining is mainly used for specific machining techniques and work materials, such as carbon, high-tensile plastics or wood.

Pros

- Reduced initial machine investment costs
- Simple and easy cleaning
- Clear sight on point of action between tool and workpiece

Cons

- Inadequate heat dissipation can lead to a reduced tool life
- Increased tooling costs due to earlier wear and tear
- Extended production cycles due to slower possible production speed

The cutting edge is subject to thermal strains. Wet machining thus helps to regulate the impact of high heat that occurs during milling, ultimately protecting the tool against total tool failure.

Pros

- Fast and effective heat dissipation
- Improved surfaces thanks to lubrication of cutting edge
- Clean and easy chip removal
- Production cycles can be increased leading to an overall increase of productivity
- Lowered tool costs

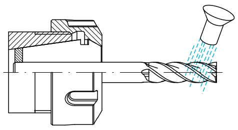
Cons

- Additional costs for the acquisition of a pump
- Limited view on point of action
- Wet surroundings may present as an ideal bacteria breeding ground

Supplying the right amount of coolant to where it matters

External flood cooling

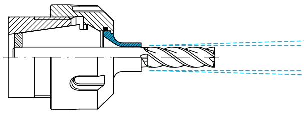
Key features of external flood cooling



- // Universal application possibilities
- // Problems may arise with deep cavities
- // Reduction of tool life because cooling is not right on the cutting edge
- // Suboptimal chip deflection
- // Limited adjustment of nozzles due to different tool lengths and diameters

Peripheral cooling

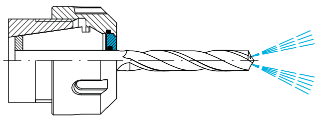
Key features of peripheral cooling



- // Coolant is fed along the side of the tool to the cutting edge
- // Can be used for moderate cavities
- // Achieve peripheral cooling with reCool® and the use of our coolant flush disk KS / ER or PG-CF collet

Internal cooling

Key features of internal cooling



- // Precise cooling at the cutting edge and improved chip removal
- // Particularly suitable for deep cavities
- // Deep hole drilling and threading
- // Lubrication of cutting edge and cooling
- // Best surface quality
- // Achieve internal cooling with reCool® and the use of our sealing disk DS / ER

Cryogen: Coolant at the right spot

COOL

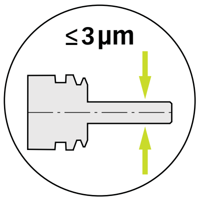
CO_2 cools the cutting edge in a safe and clean way, thanks to powRgrip® with an optimum dosage.

CLEAN

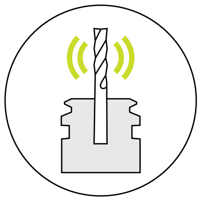
No contamination at all, therefore no necessity to do additional cleaning of the workpiece afterwards.

CRYO-powRgrip®

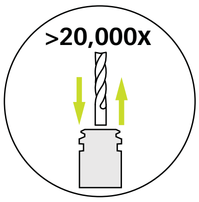
PG-CRYO collets offer the latest tool cooling technology for a clean chipping of workpieces (i.e. medical industries).



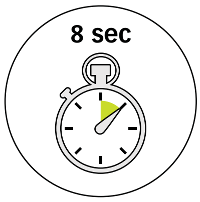
Total system runout TIR ≤3µm at 3xD.



Excellent vibration damping.



Maximum clamping forceand low runout, even after 20,000 tool changes



Tool ready for use in 8 seconds with PGU 9500.

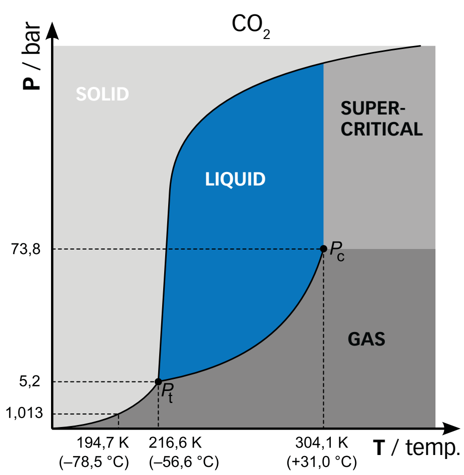
The major difference of toolholding systems

Solution: reducing of the condensation space

ER toolholder
Typical tool clamping system, with the risk of icing of the holder, due to the gaseous state behaviour of CO_2.

PG-CRYO toolholder
The cooling medium will be directly led to the cutting edge through the cutting tool. The CO_2 expands at the cutting edge and the ice snow provides an efficient and clean chipping

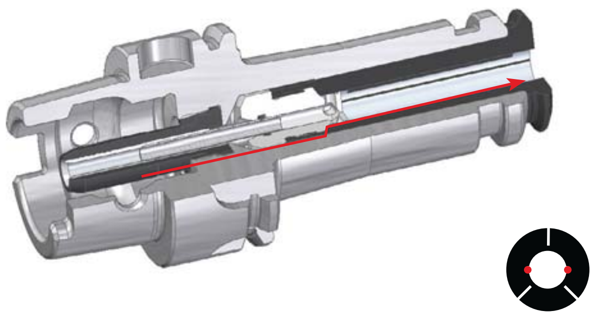
State of aggregation diagram CO_2



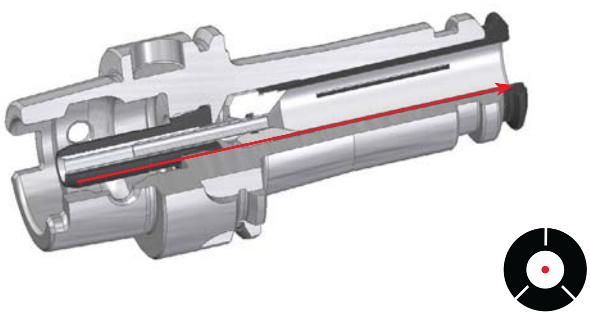
Benefit of CRYO-powRgrip®

// Perfect guidance of the cooling medium to the cutting edge
// Tool life increase
// Productivity increase, due to higher cutting parameters
// Better surface finishing
// No disposal of the cooling fluid necessary
// No necessity of workpiece cleaning
// 100 % recycling of the chips

For peripheral external cooling

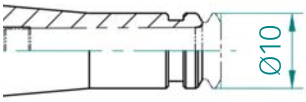


For internal cooling



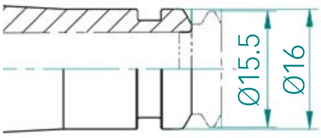
powRgrip® System and secuRgrip® nose diameter comparison

Standard nose diameter comparison



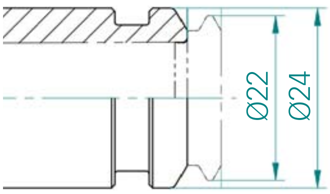
PG 6
Collet diameters:
0.2 – 4.0 mm / 1/16 – 1/8

Collet options:
Std, CF, S, MB



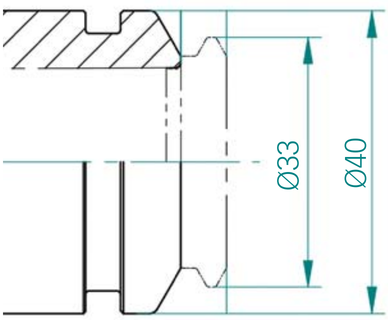
PG 10
Collet diameters:
0.2 – 6.0 mm / 1/16 – 1/4"

Collet options:
Std, CF, S, MB



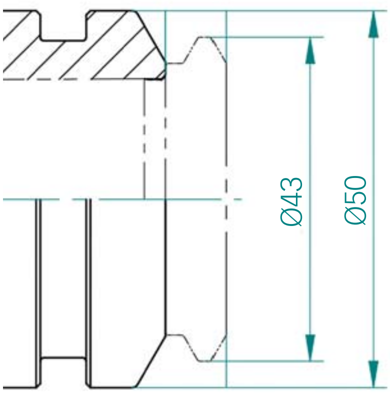
PG 15
Collet diameters:
3.0 – 12.0 mm / 1/8 – 1/2"

Collet options:
Std, CF, L, S, SG, T, TAP



PG 25
Collet diameters:
3.0 – 20.0 mm / 1/8 – 3/4"

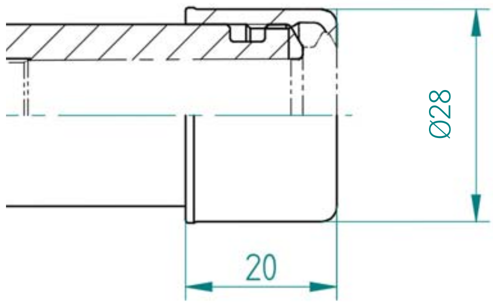
Collet options:
Std, CF, L, S, SG, T, TAP



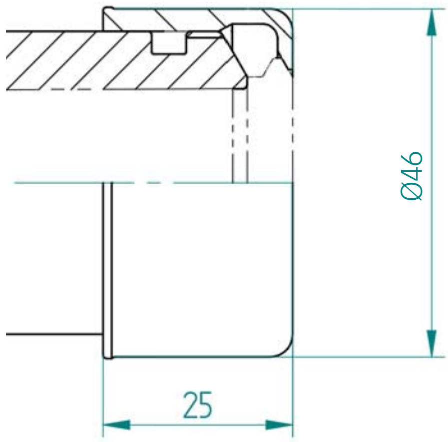
PG 32
Collet diameters:
6.0 – 25.0 mm / 1/4 – 1"

Collet options:
Std, CF, L, S, SG

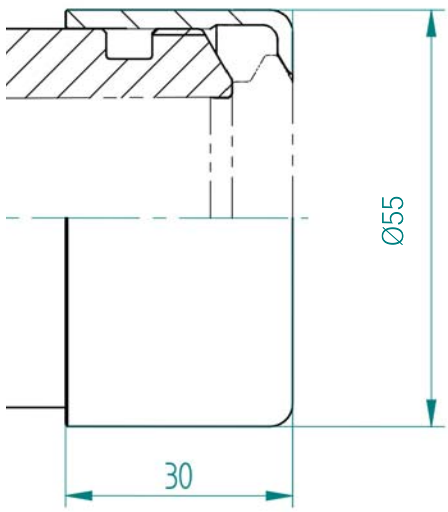
secuRgrip® nose diameter comparison



PG / SG 15



PG / SG 25



PG / SG 32

Presetting range of powRgrip® collets

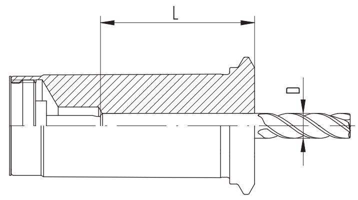
		PG 6/-CF		PG 6-S		PG 10/-CF		PG 10-S		PG 15/-CF/TW		PG 15-S		PG 15-L**		PG 25/-CF	
D	**D**	**L [mm]**		**L [mm]**		**L [mm]**		**L [mm]**		**L [mm]**		**L [mm]**		**L [mm]**		**L [mm]**	
[mm]	**[inch]**	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**
0.2–1.0	–	21.5	26.5*	–	–	20	24*	–	–	–	–	–	–	–	–	–	–
1.5	–	23.5	26.5*	–	–	16	20*	–	–	–	–	–	–	–	–	–	–
–	**1/16"**	23.5	26.5*	–	–	16	20*	–	–	–	–	–	–	–	–	–	–
2.0	–	24	26.5	–	–	25	30	–	–	–	–	–	–	–	–	–	–
2.5	–	24	26.5*	–	–	25	30	–	–	–	–	–	–	–	–	–	–
3.0	–	24	26.5	17	20	25	30	20.5	26	25	30	–	–	–	–	25	32,5
–	**1/8"**	24	26.5	17	20	25	30	20.5	26	25	30	18	25	–	–	25	32,5
3.5	–	–	–	–	–	25	30	–	–	25	30	–	–	–	–	25	32,5
4.0	–	23.5	26.5*	–	–	25	30	20.5	26	25	30	18	25	25	53	25	32,5
4.5	–	–	–	–	–	25	30	–	–	25	30	–	–	–	–	25	32,5
–	**3/16"**	–	–	–	–	25	30	20.5	26	25	30	18	25	–	–	25	32,5
5.0	–	–	–	–	–	25	30	–	–	25	30	18	25	25	53	25	32,5
5.5	–	–	–	–	–	25	30	–	–	25	30	–	–	–	–	25	32,5
6.0	–	–	–	–	–	30	35	23.5	29	33	38	26	33	33	53	33	40.5
–	**1/4"**	–	–	–	–	30	35	23.5	29	33	38	26	33	33	53	33	40.5
7.0	–	–	–	–	–	–	–	–	–	33	38	–	–	–	–	33	40.5
–	**5/16"**	–	–	–	–	–	–	–	–	33	38	26	33	33	53	33	40.5
8.0	–	–	–	–	–	–	–	–	–	33	38	26	33	33	53	33	40.5
9.0	–	–	–	–	–	–	–	–	–	33	38	–	–	–	–	33	40.5
–	**3/8"**	–	–	–	–	–	–	–	–	37	40.5	31	38	37	53	37	44.5
10.0	–	–	–	–	–	–	–	–	–	37	40.5	31	38	37	53	37	44.5
11.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	37	44.5
–	**7/16"**	–	–	–	–	–	–	–	–	–	–	–	–	–	–	37	44.5
12.0	–	–	–	–	–	–	–	–	–	41.5*	45*	–	–	–	–	42	49.5
–	**1/2"**	–	–	–	–	–	–	–	–	41.5*	45*	–	–	–	–	42	49.5
13.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	42	49.5
14.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	42	49.5
–	**9/16"**	–	–	–	–	–	–	–	–	–	–	–	–	–	–	42	49.5
15.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	42	49.5
–	**5/8"**	–	–	–	–	–	–	–	–	–	–	–	–	–	–	45.5	50
16.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	45.5	50
18.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	45.5	50
–	**3/4"**	–	–	–	–	–	–	–	–	–	–	–	–	–	–	47.5	50
20.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	47.5	50
22.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	**7/8"**	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
25.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	**1"**	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

**CF not available   **PG-L without stop screw*

Presetting range of powRgrip® collets

		PG 25-S		PG 25-L**		PG 32 / -CF		PG 32-S		PG 32-L**	
D	D	L [mm]		L [mm]		L [mm]		L [mm]		L [mm]	
[mm]	[inch]	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
0.2–1.0	–	–	–	–	–	–	–	–	–	–	–
1.5	–	–	–	–	–	–	–	–	–	–	–
–	**1/16"**	–	–	–	–	–	–	–	–	–	–
2.0	–	–	–	–	–	–	–	–	–	–	–
2.5	–	–	–	–	–	–	–	–	–	–	–
3.0	–	–	–	–	–	–	–	–	–	–	–
–	**1/8"**	18	25	–	–	–	–	–	–	–	–
3.5	–	–	–	–	–	–	–	–	–	–	–
4.0	–	18	25	–	–	–	–	–	–	–	–
4.5	–	–	–	–	–	–	–	–	–	–	–
–	**3/16"**	18	25	–	–	–	–	–	–	–	–
5.0	–	–	–	–	–	–	–	–	–	–	–
5.5	–	–	–	–	–	–	–	–	–	–	–
6.0	–	26	33	33	65	33.5	40.9	–	–	–	–
–	**1/4"**	26	33	33	65	33.5	40.9	–	–	–	–
7.0	–	–	–	–	–	33.5	40.9	–	–	–	–
–	**5/16"**	26	33	33	65	33.5	40.9	–	–	–	–
8.0	–	26	33	33	65	33.5	40.9	–	–	–	–
9.0	–	–	–	–	–	33.5	40.9	–	–	–	–
–	**3/8"**	30	38	37	65	35.5	44.9	–	–	–	–
10.0	–	30	38	37	65	35.5	44.9	–	–	–	–
11.0	–	–	–	–	–	35.5	44.9	–	–	–	–
–	**7/16"**	–	–	–	–	35.5	44.9	–	–	–	–
12.0	–	35	43	42	65	40.5	49.9	32	40.5	40.5	69
–	**1/2"**	35	43	42	65	40.5	49.9	32	40.5	40.5	69
13.0	–	–	–	–	–	40.5	49.9	–	–	–	–
14.0	–	35	43	42	65	40.5	49.9	35	43	40.5	69
–	**9/16"**	–	–	–	–	40.5	49.9	–	–	–	–
15.0	–	–	–	–	–	40.5	49.9	–	–	–	–
–	**5/8"**	38	46	45.5	65	43.5	52.9	38	46	–	–
16.0	–	38	46	45.5	65	43.5	52.9	35	43.5	43.5	69
18.0	–	–	–	–	–	43.5	52.9	–	–	–	–
–	**3/4"**	40	47.5	47.5	65	45.5	54.9	37	45.5	45.5	69
20.0	–	40	47.5	47.5	65	45.5	54.9	37	45.5	45.5	69
22.0	–	–	–	–	–	45.5	54.9	–	–	–	–
–	**7/8"**	–	–	–	–	45.5	54.9	–	–	–	–
25.0	–	–	–	–	–	49.5	58	41	49.5	49.5	69
–	**1"**	–	–	–	–	49.5	58	41	49.5	49.5	69

**CF not available **PG-L without stop screw*



PG / PG-CF / PG-S / PG-L

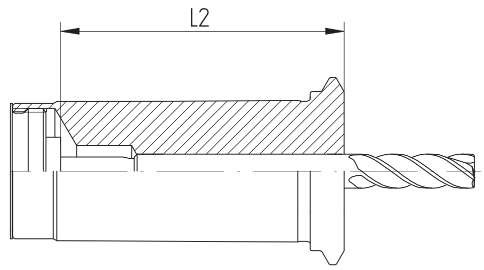
Maximum presetting range for powRgrip® standard collets and PG-CF collets

Sizes	PG 6	PG 10	PG 15	PG 25	PG 32
L2 max.	26.5	35	40.5	50	58

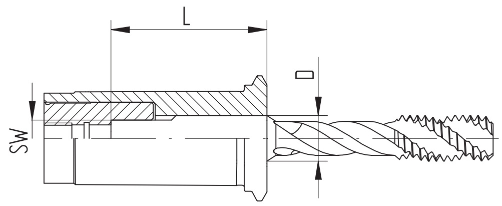
L2: maximum depth (without stop screw)

Presetting range of PG-TAP collets with internal square

Dimensions [mm/inch]		PG 15-TAP [mm]		PG 25-TAP [mm]	
D	**□**	**L min.**	**L max.**	**L min.**	**L max.**
3.5	2.7	27	29	–	–
0.141″	0.110″	27	29	–	–
0.168″	0.131″	27	29	–	–
4.5	3.4	27	29	–	–
0.194″	0.152″	29	31	–	–
0.220″	0.165″	29	31	–	–
6	4.9	29	31	29	31
0.255″	0.191″	29	31	–	–
7	5.5	29	31	29	31
8	6.2	33.5	36	33.5	36
0.318″	0.238″	–	–	33.5	36
9	7	34.5	37	34.5	37
0.367″	0.275″	–	–	34.5	37
0.381″	0.286″	–	–	34.5	37
10	8	35.5	38	38.5	41
11	9	–	–	39.5	42
12	9	–	–	39.5	42
14	11	–	–	41.5	44
16	12	–	–	42.5	45



PG / PG-CF



PG-TAP

Recommended tightening torque for secuRgrip® safety nuts

Safety nut type	Nut Ø [mm]	Recommended torque	Freewheel wrench head	TORCO-FIX
PG 15 / SGN 15	28.00	50 Nm	A-FLS Ø 28,0 / SG 15	II
PG 25 / SGN 25	46.00	70 Nm	A-FLS Ø 46,0 / SG 25	II
PG 32 / SGN 32	55.00	80 Nm	A-FLS Ø 55,0 / SG 32	II

The unbeatable advantages from the inventor of the ER collet

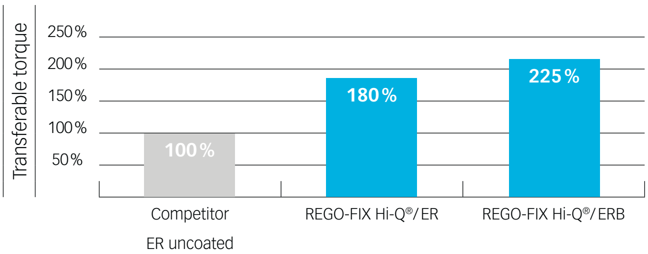
Wide selection available

// Includes friction-bearing for higher clamping force
// Available with sealing disk for coolant through tools
// Mini nut with minimal external diameter
// Clamping nut for high rpm
// Externally threaded clamping nut for floating chucks, ERA Zero-Z® toolholder and live tooling
// Slip-off proof mini clamping nut intRlox® for safe assembling

Torque comparison of different clamping nuts

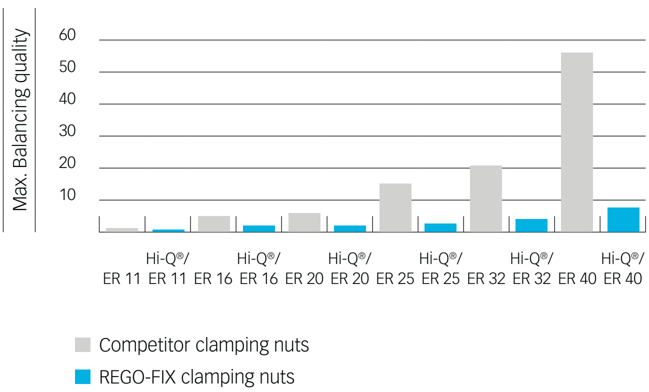
REGO-FIX Hi-Q® / ER andHi-Q® / ERB vs. competitor nuts

Source: In-house testing



Balancing quality overview

REGO-FIX clamping nuts vs. competitor nuts / Source: In-house testing



Key advantages

ER System

Collet locking system

Retains collet in nut for easier assembly.

Balancing

Ideal for high-speed applications.

Higher transferable torque

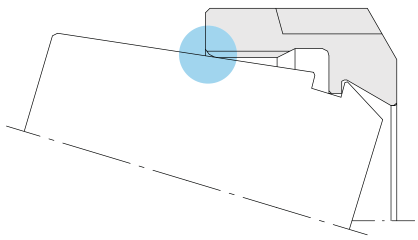
Lower frictional forces resulting in up to 80 % higher gripping force over standard non-treated clamping nuts. With friction bearing nut up to 125 %.

Protection against corrosion

With a special surface treatment for longer life.

Optimal contour

Rounded thread start prevents damaging of collets on tool changes.



Swiss quality standard

Our products marked Swiss made are manufactured at our headquarters in Tenniken, Switzerland.

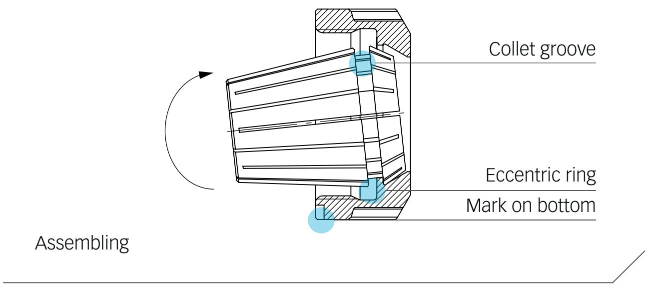
Assembly instructions for ER and MR collets

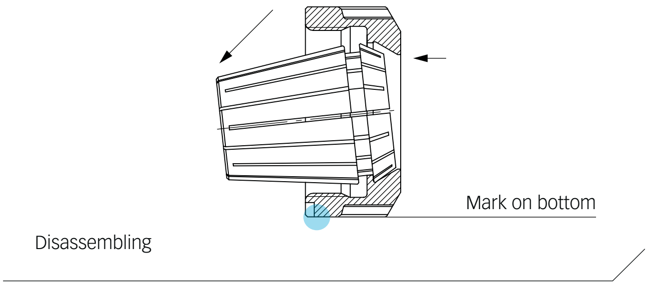
Collets ER 11–ER 50 and MR 11–MR 32 (with collet locking system)

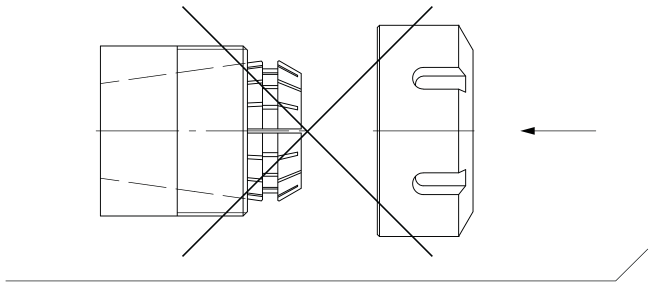
Assembling Insert groove of the collet into eccentric ring of the clamping nut at the mark on the bottom of the nut. Push collet in the direction of the arrow until it clicks in. Insert tool. Screw nut with collet onto toolholder.

Disassembling After the nut is unscrewed from the toolholder, press on the face of the collet while simultaneously pushing sideways on the back of the collet opposite the mark until it disengages from the clamping nut.

Important Improper assembly can permanently damage the runout TIR of the collet and may result in the destruction of the clamping nut. Only mount nuts with correctly inserted collets. Never place the collet into the holder without first assembling into the nut.





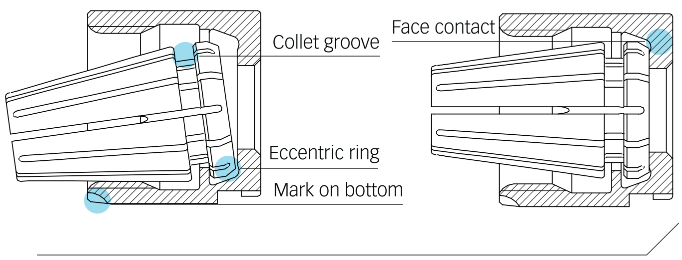


Collets ER 8 (without collet locking system)

Assembling Insert groove of the collet into eccentric ring of the clamping nut at the mark on the bottom of the nut. Insert tool. Hold nut with collet in horizontal position and screw onto toolholder.

Important The face of the ER 8 collet chuck must fit cleanly against the inner surface of the clamping nut. (ER 8 collets do not feature a 30° cone.)

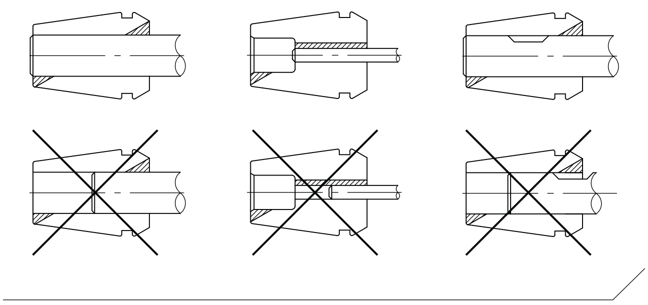
Disassembling After unscrewing the clamping nut from the tool holder, the collet can easily be removed from the clamping nut.



Expert advice

Never insert the tool less than ⅔ of the collet length. We recommend tightening the clamping nuts with our TORCO-BLOCK or torque wrench.

*For more information on TORCO-BLOCK, see page 262.
For tightening torque recommendations, please refer to page 293.*



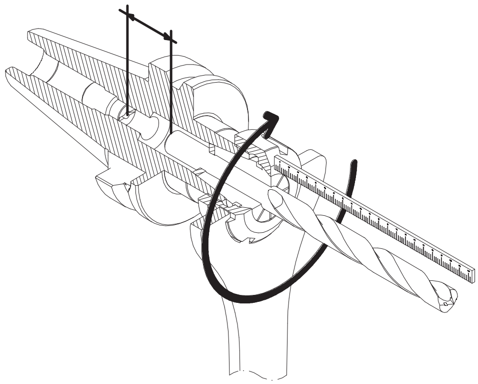
Instructions for correct clamping of tool shanks

Note

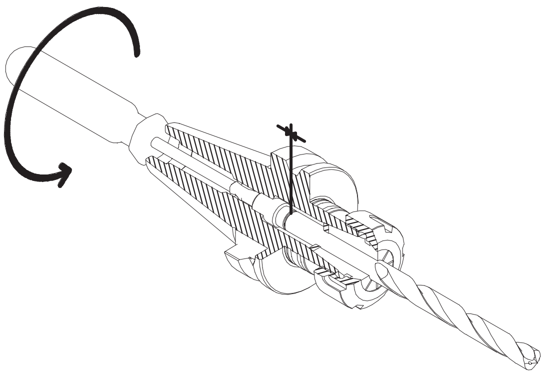
- ER collet chucks – Exception: Toolholders with cylindrical shanks – are supplied without stop screws
- Stop screws are supplied upon request
- If ordering stop screw, specifying part no. (XXXX.XXXXX) and LOT no. (YYY). YYY of the toolholder is mandatory

Advice

- Stop screws are used to secure tool shanks against axial displacement and may not be used as length adjustment screws
- For trouble-free operation of the ER collet system, clamp tool shank first, then set stop screw
- Incorrect handling of the stop screw may reduce runout accuracy and clamping force of the collet system
- The use of stop screws may increase imbalance of the collet system



Set tool length with clearance to the stop screw, then clamp tool.



Apply stop screw to tool shank.

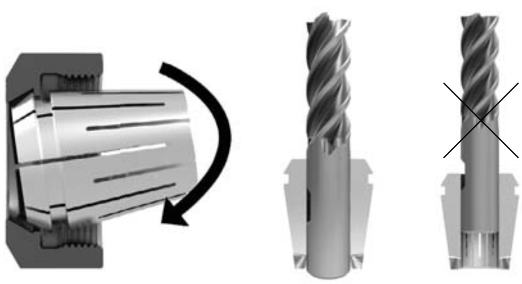
Increase collet and tool life

Optimize your surface finishes and extend tool life
by minimizing occurring vibrations during machining.

Always assemble correctly

First, clip the collet in the nut. Second, insert the tool shank more than ⅔ into the collet.

1. 2.



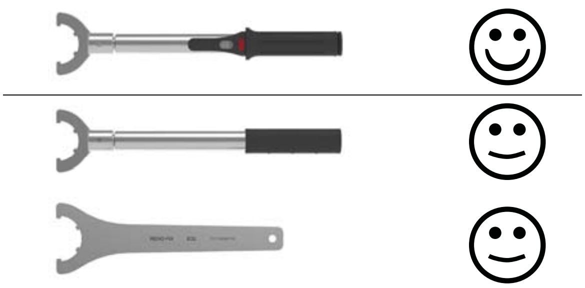
Listen to the click

Do not tighten the torque wrench further after the first click is heard.

Get your TORCO-FIX. Check page 258 for order details.

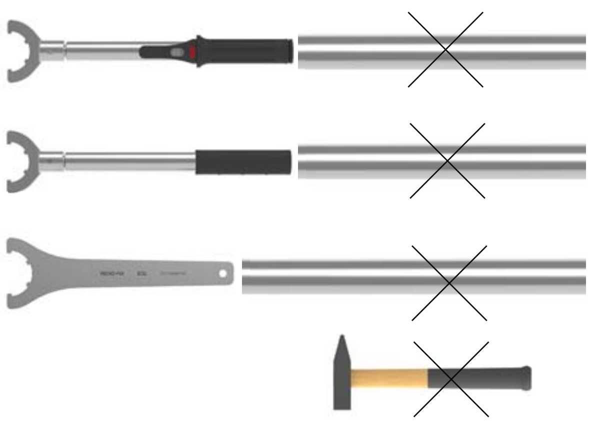
Only use REGO-FIX wrenches

To mount the collet in the toolholder please use one of these special wrenches- preferably the torque wrench, since it displays the amount of applied force.



Regular wrenches can also be used. Be aware that only the torque wrench will display the exact amount of applied force, making it the most exact tool to mount toolholders professionally.

Never use any extensions or hammers



Recommended tightening torque for ER and MR clamping nuts
Maximum torques for retention knobs (Nm)

			Hi-Q®/ER clamping nuts											
			ER/ERC		ERB/ERBC		ERM/ERMC		ERMX/ERMXC		ERAX/ERAXC		ER MS	
											Collets [Nm]		Collets [Nm]	
Collet size	**Ø [mm]**	**Ø [decimal inch]**	**ER***	**ER-GB**	**ER***	**ER-GB**	**ER***	**ER-GB**	**ER***	**ER-GB**	**ER***	**ER-GB**	**ER***	**TORCO-FIX**
ER 8 MB	0.2–0.9	0.0078–0.035	–	–	–	–	6	–	6	–	–	–	6	0
ER 8	1.0–5.0	0.039–0.196	–	–	–	–	6	–	6	–	–	–	6	0
ER 11 MB	0.2–0.9	0.0078–0.035	8	–	–	–	8	–	8	–	8	–	8	0, I
ER 11	1.0–2.9	0.039–0.098	8	8	–	–	8	8	8	8	8	8	10	0, I
	3.0–7.0	0.118–0.256	24	16	–	–	16	13	16	13	24	21	10	0, I
ER 16 MB	0.2–0.9	0.0078–0.035	8	–	–	–	8	–	8	–	8	–	12	0, I
ER 16	1.0	0.039	8	–	6.4	–	8	–	8	–	8	–	12	0, I
	1.5–3.5	0.059–0.138	20	–	16	–	20	–	20	–	20	–	20	0, I
	4.0–4.5	0.157–0.177	40	40	32	32	24	–	24	–	40	40	20	I, II
	5.0–10.0	0.197–0.394	56	44	56	44	24	–	24	–	40	40	20	II
ER 20	1.0	0.039	16	–	12	–	16	–	16	–	16	–	12	0, I
	1.5–6.5	0.059–0.256	32	32	24	24	28	28	28	28	52	35	20	I, II
	7.0–13.0	0.276–0.512	80	35	80	24	28	28	28	28	52	35	20	I, II
ER 25	1.0–3.5	0.059–0.138	24	–	20	–	24	–	24	–	24	–	–	I, II
	4.0–4.5	0.157–0.177	56	56	48	48	32	32	32	32	56	56	–	I, II
	5.0–7.5	0.196–0.295	80	80	72	72	32	32	32	32	80	80	–	II, III
	8.0–17.0	0.315–0.669	104	80	104	79	32	32	32	32	80	80	–	II, III
ER 32	2.0–2.5	0.078–0.098	24	24	20	–	–	–	–	–	24	–	–	I, II
	3.0–7.5	0.118–0.291	136	136	128	90	–	–	–	–	104	90	–	II, III
	8.0–22.0	0.315–0.787	136	136	136	90	–	–	–	–	104	90	–	II, III
ER 40	3.0–26.0	0.118–1.023	176	176	176	176	–	–	–	–	128	128	–	II, III
ER 50	6.0–36.0	0.236–1.417	240	300	240	300	–	–	–	–	–	–	–	III

**Includes ER standard and ER-UP*

			micRun® clamping nuts			
			MR/MRC		MRM/MRMC	
			micRun® collets [Nm]			
Collet size	**Ø [mm]**	**Ø [decimal inch]**	**MR**	**MRC**	**MRM**	**MRMC**
MR 11	1.0–2.9	0.039–0.098	8	8	–	–
	3.0–7.0	0.118–0.256	16	16	–	–
MR 16	1.0	0.039	8	8	8	8
	1.5–3.5	0.059–0.138	20	20	20	20
	4.0–4.5	0.157–0.177	40	40	24	24
	5.0–10.0	0.197–0.394	56	56	24	24
MR 25	1.0–3.5	0.059–0.138	24	24	–	–
	4.0–4.5	0.157–0.177	56	56	–	–
	5.0–7.5	0.196–0.295	80	80	–	–
	8.0–17.0	0.315–0.669	104	80	–	–
MR 32	2.0–2.5	0.078–0.098	24	24	–	–
	3.0–22.0	0.118–0.2917	136	136	–	–

Steep taper	**maximum tightening torque**
SK, BT, CAT 30	25 Nm
SK, BT, CAT 40	50 Nm
SK, BT, CAT 50	100 Nm

Higher tightening torques can lead to deformation of the steep taper!

Expert advice

We recommend tightening the clamping nuts with our TORCO-BLOCK or torque wrench.

Original REGO-FIX accessories can be found on page 237.

Recommended tightening torque for ER and MR clamping nuts
Maximum torques for retention knobs (ft-lbs)

			Hi-Q®/ER clamping nuts											
			ER/ERC		ERB/ERBC		ERM/ERMC		ERMX/ERMXC		ERAX/ERAXC		ER MS	
											Collets [ft-lbs]		Collets [ft-lbs]	
Collet size	**Ø [mm]**	**Ø [decimal inch]**	**ER***	**ER-GB**	**ER***	**ER-GB**	**ER***	**ER-GB**	**ER***	**ER-GB**	**ER***	**ER-GB**	**ER***	**TORCO-FIX***
ER 8 MB	0.2–0.9	0.0078–0.035	–	–	–	–	4	–	4	–	–	–	4	Micro
ER 8	1.0–5.0	0.039–0.196	–	–	–	–	4	–	4	–	–	–	4	Micro
ER 11 MB	0.2–0.9	0.0078–0.035	6	–	–	–	6	–	6	–	6	–	6	Micro, S
ER 11	1.0–2.9	0.039–0.098	6	6	–	–	6	6	6	6	6	6	7	Micro, S
	3.0–7.0	0.118–0.256	24	16	–	–	16	13	16	13	24	21	7	Micro, S
ER 16 MB	0.2–0.9	0.0078–0.035	6	–	–	–	6	–	6	–	6	–	9	Micro, S
ER 16	1.0	0.039	6	–	5	–	6	–	6	–	6	–	9	Micro, S
	1.5–3.5	0.059–0.138	15	–	12	–	15	–	15	–	15	–	15	Micro, S
	4.0–4.5	0.157–0.177	30	30	25	25	18	–	18	–	30	30	15	S, M
	5.0–10.0	0.197–0.394	46	32	40	21	18	–	18	–	30	30	–	M
ER 20	1.0	0.039	12	–	10	–	12	–	12	–	12	–	9	Micro, S
	1.5–6.5	0.059–0.256	25	25	20	20	21	21	21	21	40	25	14	S, M
	7.0–13.0	0.276–0.512	60	60	60	60	21	21	21	21	40	25	14	S, M
ER 25	1.0–3.5	0.059–0.138	18	–	15	–	18	–	18	–	18	–	–	S, M
	4.0–4.5	0.157–0.177	40	40	35	35	24	24	24	24	40	40	–	S, M
	5.0–7.5	0.196–0.295	60	60	55	55	24	24	24	24	60	60	–	M, L
	8.0–17.0	0.315–0.669	80	60	80	60	24	24	24	24	60	60	–	M, L
ER 32	2.0–2.5	0.078–0.098	18	18	15	–	–	–	–	–	20	–	–	S, M
	3.0–7.5	0.118–0.291	100	100	95	65	–	–	–	–	80	65	–	M, L
	8.0–22.0	0.315–0.787	100	100	100	65	–	–	–	–	80	65	–	M, L
ER 40	3.0–26.0	0.118–1.023	130	130	130	130	–	–	–	–	95	95	–	M, L
ER 50	6.0–36.0	0.236–1.417	180	220	180	220	–	–	–	–	–	–	–	L

Includes ER standard and ER-UP

			micRun® clamping nuts			
			MR/MRC		MRM/MRMC	
					micRun® collets	
Collet size	**Ø [mm]**	**Ø [decimal inch]**	**MR**	**MRC**	**MRM**	**MRMC**
MR 11	1.0–2.9	0.039–0.098	6	6	–	–
	3.0–7.0	0.118–0.256	12	12	–	–
MR 16	1.0	0.039	6	6	6	6
	1.5–3.5	0.059–0.138	15	15	15	15
	4.0–4.5	0.157–0.177	30	30	18	18
	5.0–10.0	0.197–0.394	41	41	18	18
MR 20	1.0	0.039	12	12	–	–
	1.5–6.5	0.059–0.256	24	24	–	–
	7.0–13.0	0.276–0.512	60	60	–	–
MR 25	1.0–3.5	0.059–0.138	18	18	–	–
	4.0–4.5	0.157–0.177	42	42	–	–
	5.0–7.5	0.196–0.295	60	60	–	–
	8.0–17.0	0.315–0.669	78	78	–	–
MR 32	2.0–2.5	0.078–0.098	18	18	–	–
	3.0–22.0	0.118–0.2917	100	100	–	–

Steep taper	**maximum tightening torque**
SK, BT, CAT 30	18 ft-lbs
SK, BT, CAT 40	36-ft-lbs
SK, BT, CAT 50	72 ft-lbs

Higher tightening torques can lead to deformation of the steep taper and therefor to bad runout!

Expert advice

We recommend tightening the clamping nuts with our TORCO-BLOCK or torque wrench.

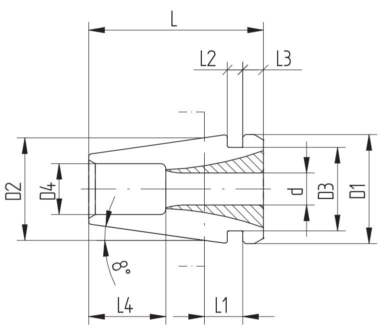
Original REGO-FIX accessories can be found on page 237.

ER collets dimensions

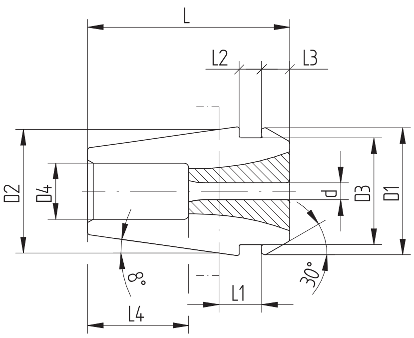
Size [mm]											Measurements [mm]	
D2	d	D1	D2	D3	D4	L	L1**	L2	L3	L4	Drawing
ER 8	1.0–2.5	8.5	8	6.5	4	13.6	2.98	1.2	1.5	6	1
ER 8	3.0–5.0	8.5	8	6.5	–	13.6	2.98	1.2	1.5	–	2
ER 11	1.0–2.5	11.5	11	9.5	5	18	3.8	2	2.5	9	3
ER 11	3.0–7.0	11.5	11	9.5	–	18	3.8	2	2.5	–	4
ER 16	1.0–1.59	17	16	13.8	7.5	27.5	6.26	2.7	4	13	3
ER 16	2.0–4.76	17	16	13.8	7.5	27.5	6.26	2.7	4	10	3
ER 16	5.0–10.0	17	16	13.8	–	27.5	6.26	2.7	4	–	4
ER 16	9.5–10.0	17	16	13.8	–	26*	6.26	2.7	4	–	4
ER 20	1.0–1.59	21	20	17.4	9	31.5	6.36	2.8	4.8	16	3
ER 20	2.0–6.50	21	20	17.4	9	31.5	6.36	2.8	4.8	13	3
ER 20	7.0–13.0	21	20	17.4	–	31.5	6.36	2.8	4.8	–	4
ER 25	1.0–1.59	26	25	22	12	34	6.66	3.1	5	18	3
ER 25	2.0–7.50	26	25	22	12	34	6.66	3.1	5	15	3
ER 25	8.0–17.0	26	25	22	–	34	6.66	3.1	5	–	4
ER 32	2.0–4.76	33	32	29.2	15	40	7.16	3.6	5.5	20	3
ER 32	5.0–7.5	33	32	29.2	15	40	7.16	3.6	5.5	15	3
ER 32	8.0–22.0	33	32	29.2	–	40	7.16	3.6	5.5	–	4
ER 40	3.0–4.76	41	40	36.2	20	46	7.66	4.1	7	24	3
ER 40	5.0–8.5	41	40	36.2	20	46	7.66	4.1	7	18	3
ER 40	9.0–30.0	41	40	36.2	–	46	7.66	4.1	7	–	4
ER 50	6.0–10.0	52	50	46	20	60	12.6	5.5	8.5	32	3
ER 50	12.0–36.0	52	50	46	–	60	12.6	5.5	8.5	–	4

**Up to 27.5 available, depending on production*

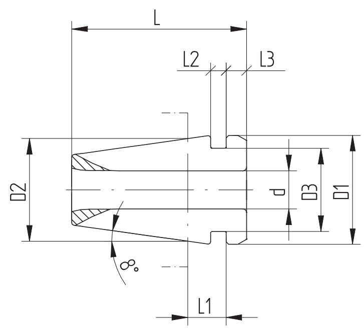
***L1 references to the top lenght of the ER collet in the toolholder.*



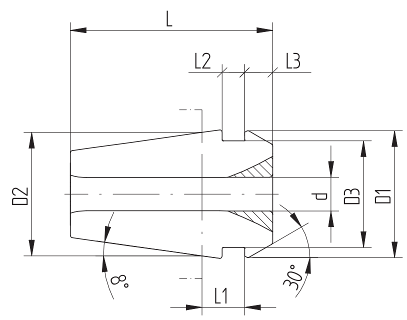
Drawing 1



Drawing 3



Drawing 2

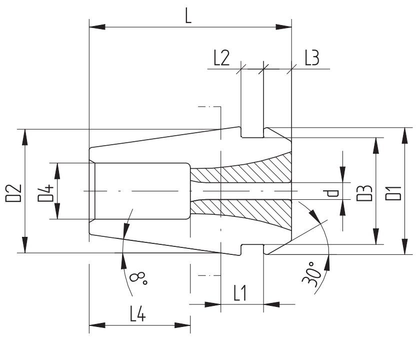


Drawing 4

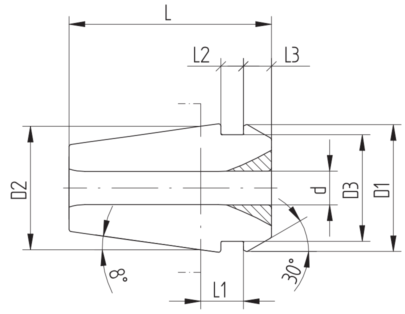
MR collets dimensions

Size [mm]											Measurements [mm]	
D2	**d**	**D1**	**D2**	**D3**	**D4**	**L**	**L1**	**L2**	**L3**	**L4**		**Drawing**
MR 11	1.0 – 2.0	11.5	11	9.5	5	18	3.8	2	2.5	9		1
MR 11	3.0 – 6.35	11.5	11	9.5	–	18	3.8	2	2.5	–		2
MR 16	1.0	17	16	13.8	7.5	27.5	6.26	2.7	4	13		1
MR 16	2.0 – 4.0	17	16	13.8	7.5	27.5	6.26	2.7	4	10		1
MR 16	5.0 – 10.0	17	16	13.8	–	26*	6.25	2.7	4	–		2
MR 25	1.0	26	25	22	12	34	6.66	3.1	5	18		1
MR 25	2.0 – 6.35	26	25	22	12	34	6.66	3.1	5	15		1
MR 25	8.0 – 16.0	26	25	22	–	34	6.66	3.1	5	–		2
MR 32	2.0 – 4.0	33	32	29.2	15	40	7.2	3.6	5.5	20		1
MR 32	5.0 – 6.35	33	32	29.2	15	40	7.2	3.6	5.5	15		1
MR 32	8.0 – 20.0	33	32	29.2	–	40	7.2	3.6	5.5	–		2

**Up to 27.5 available, depending on production*



Drawing 1

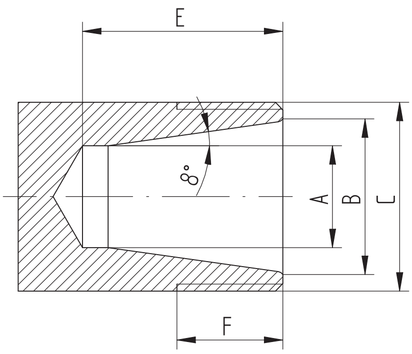


Drawing 2

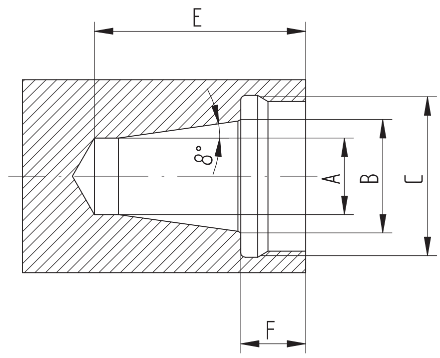

REGO-FIX

Dimensions for ER collet cavities in machine spindles and matching clamping nuts

ER	Diameter	Hi-Q®										Measurements [mm]				
size	range [mm]	ER	ERC	ERB	ERBC	ERM	ERMC	ERMX	ERMXC	AX	AXC	A	B	C	E	F
11	0.5–7.0	•	•	–	–	–	–	–	–	–	–	7.5	11	M 14 x 0.75	17	10
16	0.5–10.0	•	•	•	•	–	–	–	–	–	–	10.5	16	M 22 x 1.5	22	13
20	0.5–13.0	•	•	•	•	–	–	–	–	–	–	13.5	20	M 25 x 1.5	26.5	13.5
25	0.5–17.0	•	•	•	•	–	–	–	–	–	–	18.0	25	M 32 x 1.5	29	14
32	1.0–22.0	•	•	•	•	–	–	–	–	–	–	23.5	32	M 40 x 1.5	34	16
40	2.0–30.0	•	•	•	•	–	–	–	–	–	–	30.5	40	M 50 x 1.5	38	17
50	4.0–36.0	•	•	•	•	–	–	–	–	–	–	38	50	M 64 x 2	48	24
8	0.5–5.0	–	–	–	–	•	–	•	–	–	–	5.2	8	M 10 x 0.75	13	8
11	0.5–7.0	–	–	–	–	•	•	•	•	–	–	7.5	11	M 13 x 0.75	17	8.5
16	0.5–10.0	–	–	–	–	•	•	•	•	–	–	10.5	16	M 19 x 1	22	13
20	0.5–13.0	–	–	–	–	•	•	•	•	–	–	13.5	20	M 24 x 1	26.5	13.5
25	0.5–17.0	–	–	–	–	•	•	•	•	–	–	18	25	M 30 x 1	29	14
11	0.5–7.0	–	–	–	–	–	–	–	–	•	–	7.5	11	M 18 x 1	23	7
16	0.5–10.0	–	–	–	–	–	–	–	–	•	•	10.5	16	M 24 x 1	32	10
20	0.5–13.0	–	–	–	–	–	–	–	–	•	•	13.5	20	M 28 x 1.5	37.5	11
25	0.5–17.0	–	–	–	–	–	–	–	–	•	•	18	25	M 32 x 1.5	41	12
32	1.0–22.0	–	–	–	–	–	–	–	–	•	•	23.5	32	M 40 x 1.5	48	12
40	2.0–30.0	–	–	–	–	–	–	–	–	•	•	30.5	40	M 50 x 1.5	54	16



All other standard ER cavities



ER AX and ER AXC cavities

Technical information for tapping collets ER-GB

			ER 11-GB		ER 16-GB		ER 20-GB		ER 25-GB		ER 32-GB		ER 40-GB		ER 50-GB	
x: not available			L = 18.0 L1 = 2.0 D1 = 11.3 D2 = 11.0		L = 27.5 L1 = 2.7 D1 = 16.8 D2 = 16.0		L = 31.5 L1 = 2.8 D1 = 20.8 D2 = 20.0		L = 34.0 L1 = 3.1 D1 = 25.8 D2 = 25.0		L = 40.0 L1 = 3.6 D1 = 32.8 D2 = 32.0		L = 46.0 L1 = 4.1 D1 = 40.8 D2 = 40.0		L = 60.0 L1 = 8.75 D1 = 51.8 D2 = 51.0	
d	**SW**	**L2**	**L3**	**D3**	**L3**	**D3**	**L3**	**D3**	**L3**	**D3**	**L3**	**D3**	**L3**	**D3**	**L3**	**D3**
[mm]	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**
2.5	2.1	12	2.8	4.0	x	x	x	x	x	x	x	x	x	x	x	x
2.8	2.1	12	2.8	4.0	x	x	x	x	x	x	x	x	x	x	x	x
3.5	2.7	14	1.8	4.5	x	x	x	x	x	x	x	x	x	x	x	x
4	3	14	–	–	x	x	x	x	x	x	x	x	x	x	x	x
4	3.15 / 3.2	ER 11=14 ER 16–32 =15	–	–	4.8	7.5	9.8	9	11.8	12	17.8	15	x	x	x	x
4.5	3.4	ER 11=14 ER 16–32 =15	–	–	4.8	7.5	9.8	9	11.8	12	17.8	15	x	x	x	x
5	4	ER 11=14 ER 16–32 =18	–	–	4.8	7.5	9.8	9	11.8	12	17.8	15	x	x	x	x
5.5	4.3	18	–	–	4.8	7.5	9.8	9	11.8	12	17.8	15	x	x	x	x
5.5	4.5	18	–	–	4.8	7.5	9.8	9	11.8	12	17.8	15	x	x	x	x
6	4.5	18	–	–	4.8	7.5	8.8	9	10.8	12	16.8	15	22.8	20	x	x
6	4.9	ER 11=14 ER 16–40 =18	–	–	4.8	7.5	8.8	9	10.8	12	16.8	15	22.8	20	x	x
6.2	5	18	x	x	4.8	7.5	8.8	9	10.8	12	16.8	15	22.8	20	x	x
6.3	5	18	x	x	4.8	7.5	8.8	9	10.8	12	16.8	15	22.8	20	x	x
7	5.5	18	x	x	3.8	8.0	7.8	9	9.8	12	15.8	15	21.8	20	x	x
7.1	5.6	18	x	x	3.8	8.0	7.8	9	9.8	12	15.8	15	21.8	20	x	x
8	6.2 / 6.3	22	x	x	–	–	2.8	10	4.8	12	10.8	15	16.8	20	x	x
8.5	6.5	22	x	x	–	–	2.8	10	4.8	12	10.8	15	16.8	20	x	x
9	7 / 7.1	22	x	x	–	–	2.8	10	3.8	12	9.8	15	15.8	20	x	x
10	8	25	x	x	x	x	–	–	–	–	6.8	15	12.8	20	x	x
10.5	8	25	x	x	x	x	–	–	–	–	6.8	15	12.8	20	x	x
11	9	25	x	x	x	x	–	–	–	–	5.8	15	11.8	20	x	x
11.2	9	25	x	x	x	x	–	–	–	–	5.8	15	11.8	20	x	x
12	9	25	x	x	x	x	–	–	–	–	5.8	15	11.8	20	x	x
12.5	10	25	x	x	x	x	x	x	–	–	4.8	15	10.8	20	x	x
14	11 / 11.2	25	x	x	x	x	x	x	–	–	3.8	17	9.8	20	x	x
15	12	25	x	x	x	x	x	x	–	–	3.8	17	9.8	20	x	x
16	12 / 12.5	25	x	x	x	x	x	x	–	–	2.8	18	8.8	20	x	x
17	13	25	x	x	x	x	x	x	x	x	2.8	19.5	8.8	20	x	x
18	14.5	25	x	x	x	x	x	x	x	x	2.8	21	7.8	21	x	x
20	16	28	x	x	x	x	x	x	x	x	2.8	21.5	3.8	22	x	x
22	18	ER 40 = 28 ER 50 = 41	x	x	x	x	x	x	x	x	–	–	3.8	24	x	x
25	20	41	x	x	x	x	x	x	x	x	x	x	–	–	–	–
28	22	41	x	x	x	x	x	x	x	x	x	x	x	x	–	–
32	24	41	x	x	x	x	x	x	x	x	x	x	x	x	–	–

Technical information for tapping collets PCM ET1

	Measurements [mm]							
Type	**d**	**D1**	**D2**	**L**	**L1**	**L2**	**L3**	**L4**
PCM ET1-12	3.55	7	11.5	18	16.5	2.5	5	5.5
PCM ET1-16	6.3	11	17	22	20	2.8	7	7
PCM ET1-20	7.1	14	21	24	23	2.8	8	7
PCM ET1-25	10	19	26	26	24	3	10	8
PCM ET1-32	12.5	23	33	33	32	3	1	10
PCM ET1-40	17	28	41	42	42	3	12	13

Expert advice

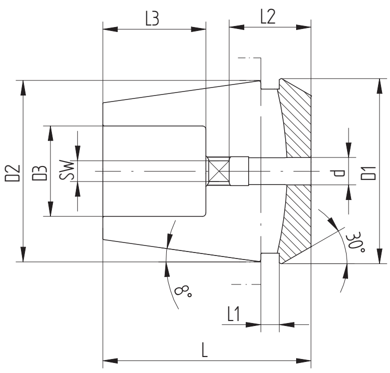
Do not use for coolant through tools and for applications with sealing disks.

Technical information for microbore collets

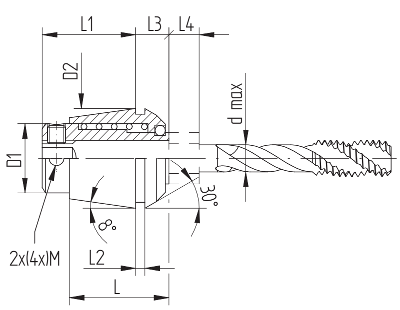
	Measurements [mm]									
Type	**d**	**D1**	**D2**	**D3**	**D4**	**L**	**L1**	**L2**	**L3**	**L4**
ER 8-MB	0.2–0.9	8.5	8	6.5	4	13.5	1.2	1.2	1.5	6
ER 11-MB	0.2–0.9	11.5	11	9.5	5	18	2	2	2.5	9
ER 16-MB	0.2–0.9	17	16	13.8	7.5	27.5	6.3	2.7	4	13

Expert advice

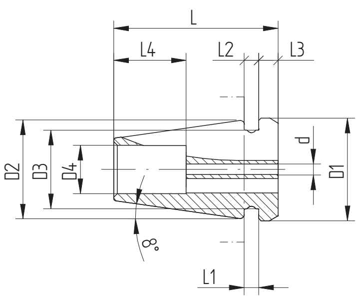
ER-MB collets have no clamping range. Only nominal diameters h7 can be clamped.



ER-GB, page 150



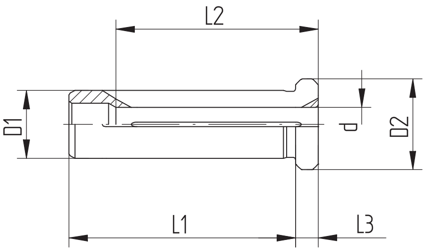
PCM ET1



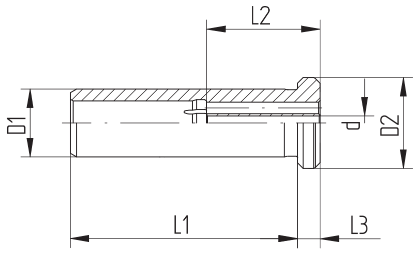
ER-MB

Reduction sleeves

	Measurements [mm]						
Type	d	d	D1	D2	L1	L2	L3
HS 12 HS 12-CF							
Ø 3.0	3	–	12	16	40	29	4
Ø 1/8"	3.175	1/8	12	16	40	29	4
Ø 4.0	4	–	12	16	40	29	4
Ø 3/16"	4.763	3/16	12	16	40	29	4
Ø 5.0	5	–	12	16	40	29	4
Ø 6.0	6	–	12	16	40	36	4
Ø 1/4"	6.35	1/4	12	16	40	36	4
Ø 7.0	7	–	12	16	40	37	4
Ø 5/16"	7.938	5/16	12	16	40	37	4
Ø 8.0	8	–	12	16	40	37	4
Ø 9.0	9	–	12	16	40	37	4
Ø 3/8"	9.525	3/8	12	16	40	40	4
Ø 10.0	10	–	12	16	40	40	4
HS 12-MB							
Ø 1.0	1	–	12	16	40	20	4
Ø 1.5	1.5	–	12	16	40	20	4
Ø 2.0	2	–	12	16	40	20	4
Ø 2.5	2.5	–	12	16	40	20	4
HS 20 HS 20-CF							
Ø 3.0	3	–	20	25	50	28	4
Ø 1/8"	3.175	1/8	20	25	50	28	4
Ø 4.0	4	–	20	25	50	28	4
Ø 3/16"	4.763	3/16	20	25	50	28	4
Ø 5.0	5	–	20	25	50	28	4
Ø 6.0	6	–	20	25	50	36	4
Ø 1/4"	6.35	1/4	20	25	50	36	4
Ø 7.0	7	–	20	25	50	38	4
Ø 5/16"	7.938	5/16	20	25	50	37	4
Ø 8.0	8	–	20	25	50	37	4
Ø 9.0	9	–	20	25	50	38	4
Ø 3/8"	9.525	3/8	20	25	50	36	4
Ø 10.0	10	–	20	25	50	40	4
Ø 11.0	11	–	20	25	50	40	4
Ø 12.0	12	–	20	25	50	45	4
Ø 1/2"	12.7	1/2	20	25	50	45	4
Ø 13.0	13	–	20	25	50	45	4
Ø 14.0	14	–	20	25	50	45	4
Ø 15.0	15	–	20	25	50	45	4
Ø 5/8"	15.875	5/8	20	25	50	48	4
Ø 16.0	16	–	20	25	50	48	4



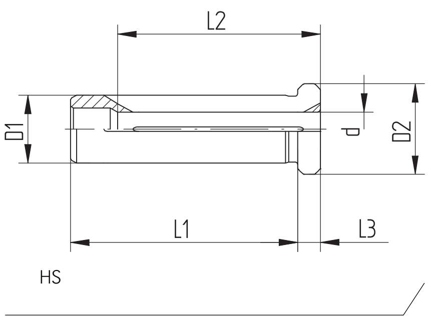
HS / HS-CF



HS 12-MB

Reduction sleeves

	Measurements [mm]						
Type	**d**	**d**	**D1**	**D2**	**L1**	**L2**	**L3**
HS 25							
Ø 3.0	3	–	25	30	56	29	4
Ø 1/8"	3.175	1/8	25	30	56	29	4
Ø 4.0	4	–	25	30	56	29	4
Ø 3/16"	4.763	3/16	25	30	56	29	4
Ø 5.0	5	–	25	30	56	29	4
Ø 6.0	6	–	25	30	56	37	4
Ø 1/4"	6.35	1/4	25	30	56	37	4
Ø 7.0	7	–	25	30	56	37	4
Ø 5/16"	7.938	5/16	25	30	56	37	4
Ø 8.0	8	–	25	30	56	37	4
Ø 9.0	9	–	25	30	56	38	4
Ø 3/8"	9.525	3/8	25	30	56	38	4
Ø 10.0	10	–	25	30	56	40	4
Ø 7/16"	11.112	7/16	25	30	56	40	4
Ø 12.0	12	–	25	30	56	46	4
Ø 1/2"	12.7	1/2	25	30	56	46	4
Ø 14.0	14	–	25	30	56	47	4
Ø 9/16"	14.288	9/16	25	30	56	47	4
Ø 5/8"	15.875	5/8	25	30	56	48	4
Ø 16.0	16	–	25	30	56	48	4
Ø 11/16"	17.461	11/16	25	30	56	48	4
Ø 18.0	18	–	25	30	56	48	4
Ø 3/4"	19.05	3/4	25	30	56	48	4
Ø 20.0	20	–	25	30	56	50	4
Ø 13/16"	20.638	13/16	25	30	56	50	4

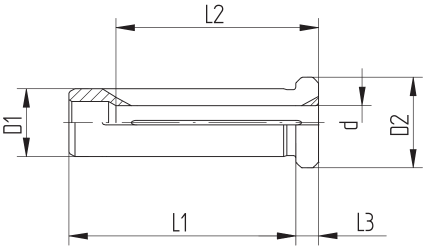


Expert advice

Reduction sleeve may be damaged,
if clamped without a tool.

Reduction sleeves

Type	d	d	D1	D2	L1	L2	L3
	Measurements [mm]						
HS 32 HS 32-CF							
Ø 3/16"	4.763	3/16	32	36	60	29	4
Ø 5.0	5	–	32	36	60	29	4
Ø 6.0	6	–	32	36	60	36	4
Ø 1/4"	6.35	1/4	32	36	60	36	4
Ø 7.0	7	–	32	36	60	37	4
Ø 5/16"	7.938	5/16	32	36	60	36	4
Ø 8.0	8	–	32	36	60	36	4
Ø 9.0	9	–	32	36	60	37	4
Ø 3/8"	9.525	3/8	32	36	60	37	4
Ø 10.0	10	–	32	36	60	40	4
Ø 11.0	11	–	32	36	60	40	4
Ø 7/16"	11.112	7/16	32	36	60	45	4
Ø 12.0	12	–	32	36	60	45	4
Ø 1/2"	12.7	1/2	32	36	60	45	4
Ø 13.0	13	–	32	36	60	45	4
Ø 14.0	14	–	32	36	60	46	4
Ø 9/16"	14.288	9/16	32	36	60	46	4
Ø 15.0	15	–	32	36	60	46	4
Ø 5/8"	15.875	5/8	32	36	60	46	4
Ø 16.0	16	–	32	36	60	48	4
Ø 17.0	17	–	32	36	60	48	4
Ø 11/16"	17.461	11/16	32	36	60	48	4
Ø 18.0	18	–	32	36	60	49	4
Ø 19.0	19	–	32	36	60	49	4
Ø 3/4"	19.05	3/4	32	36	60	50	4
Ø 20.0	20	–	32	36	60	50	4
Ø 13/16"	20.638	13/16	32	36	60	50	4
Ø 22.0	22	–	32	36	60	50	4
Ø 7/8"	22.225	7/8	32	36	60	50	4
Ø 15/16"	23.813	15/16	32	36	60	52	4
Ø 25.0	25	–	32	36	60	56	4
Ø 1"	25.4	1	32	36	60	56	4

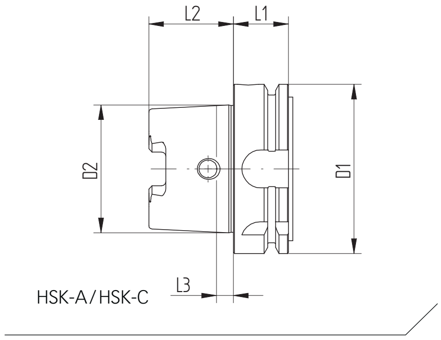


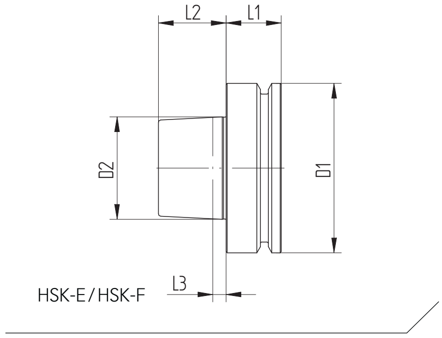
HS / HS-CF

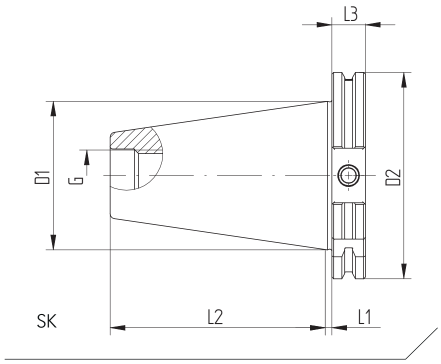
Spindle interface norms

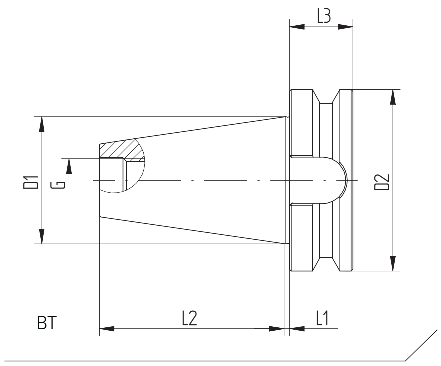
HSK	SK	BT	CAPTO
DIN 69893	DIN 69871	MAS 403	ISO 26623

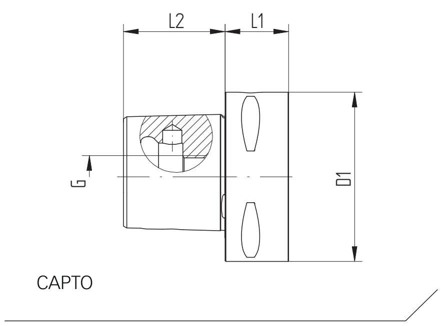
Type	Measurements [mm] D1	D2	L1	L2	L3	G
HSK DIN 69893						
HSK-A 25	25	19	10	13	2.5	–
HSK-C 25	25	19	8	13	2.5	–
HSK-E 25	25	19	10	13	2.5	–
HSK-A 32	32	24	20	16	3.2	–
HSK-C 32	32	24	10	16	3.2	–
HSK-E 32	32	24	20	16	3.2	–
HSK-A 40	40	30	20	20	4	–
HSK-C 40	40	30	10	20	4	–
HSK-E 40	40	30	20	20	4	–
HSK-A 50	50	38	26	25	5	–
HSK-C 50	50	38	12.5	25	5	–
HSK-E 50	50	38	26	25	5	–
HSK-F 50	50	30	26	20	4	–
HSK-A 63	63	48	26	32	6.3	–
HSK-C 63	63	48	12.5	32	6.3	–
HSK-E 63	63	48	26	32	6.3	–
HSK-F 63	63	38	26	25	5	–
HSK-A 80	80	60	26	40	8	–
HSK-C 80	80	60	16	40	8	–
HSK-F 80	80	48	26	32	6.3	–
HSK-A 100	100	75	29	50	10	–
HSK-C 100	100	75	16	50	10	–
HSK-E 100	100	70	29	50	10	–
SK DIN 69871						
SK 30	31.75	50	3.2	47.8	15.85	M 12
SK 40	44.45	63.55	3.2	68.4	15.85	M 16
SK 50	69.85	97.5	3.2	101.75	15.85	M 24
BT MAS 403						
BT 30	31.75	46	2	48.4	20	M 12
BT 40	44.45	63	2	65.4	25	M 16
BT 50	69.85	100	3	101.8	35	M 24
Polygon shank CAPTO ISO 26623						
Polygon shank C3	32	–	15	19	–	M 12 x 1.5
Polygon shank C4	40	–	20	24	–	M 14 x 1.5
Polygon shank C5	50	–	20	30	–	M 16 x 1.5
Polygon shank C6	63	–	22	38	–	M 20 x 2
Polygon shank C8	80	–	30	48	–	M 20 x 2



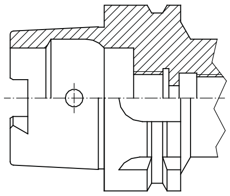






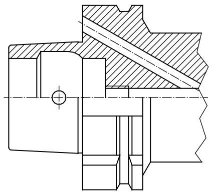


HSK forms and their key characteristics



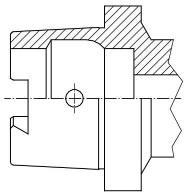
Form A*
- // Standard type for machining centers and milling machines
- // For automatic tool change
- // Coolant supply through center via coolant tube
- // Drive keys at the end of HSK taper
- // Hole for data carrier DIN STD 69873 in the flange is available on request

**Also usable in form C applications with side hole for manual tool change*

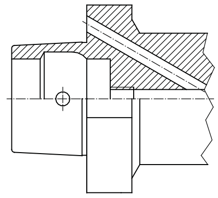


Form B
- // For machining centers, milling and turning machines
- // With enlarged flange size for higher radial rigidity
- // For automatic tool change
- // Coolant supply through the flange
- // Drive keys at the flange

Available on request

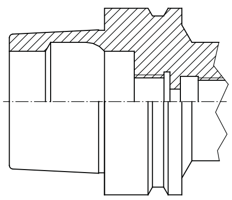


Form C
- // For transfer lines, special machines and modular tooling systems
- // For manual tool change
- // Drive keys at the end of HSK taper

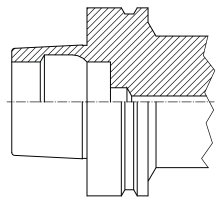


Form D
- // For special machines
- // With enlarged flange size for higher radial rigidity
- // For manual tool change
- // Coolant supply through the flange
- // Drive keys at the flange

Available on request

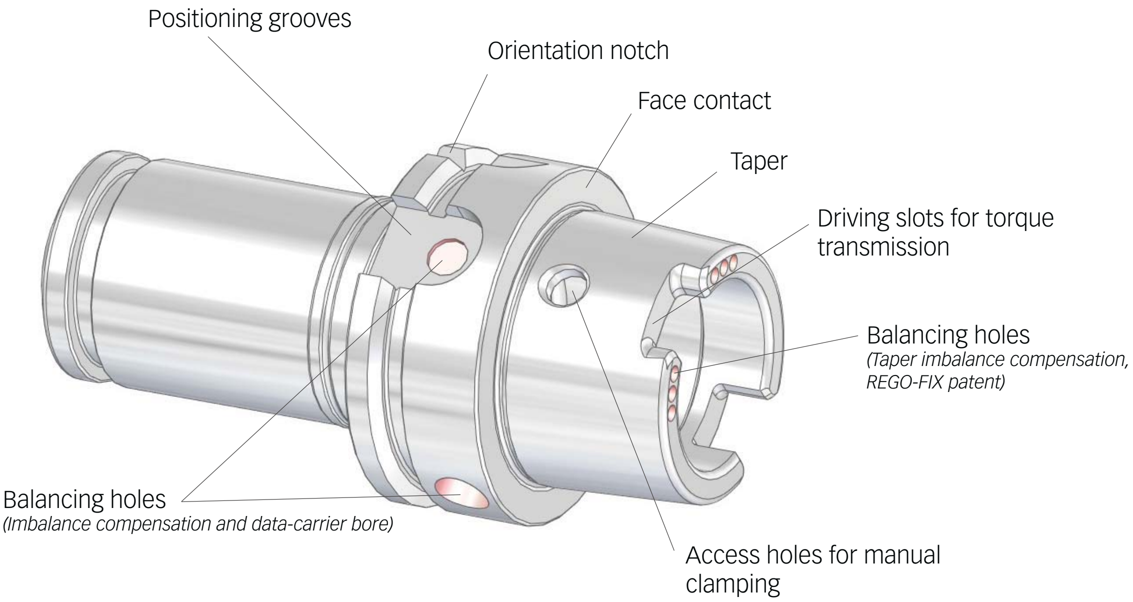


Form E
- // For high-speed applications
- // For automatic tool change
- // Coolant supply through center via coolant tube
- // Without any drive keys for absolute symmetry

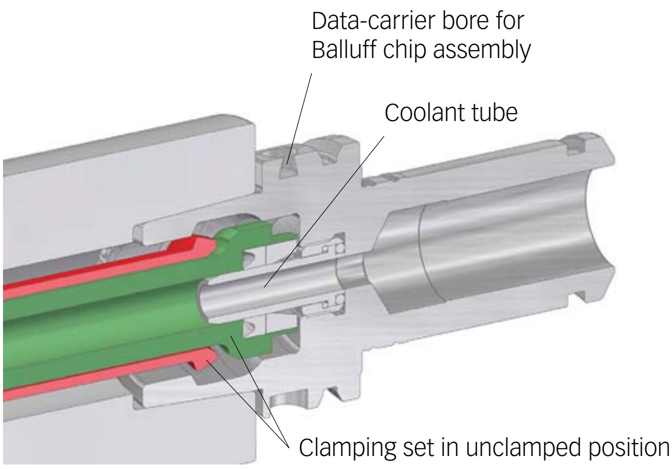


Form F
- // For high-speed applications
- // With enlarged flange size for higher radial rigidity
- // For automatic tool change
- // Without any drive keys for absolute symmetry

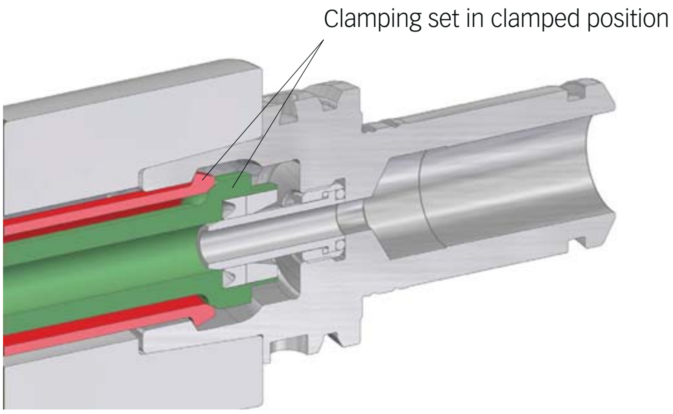
HSK interface

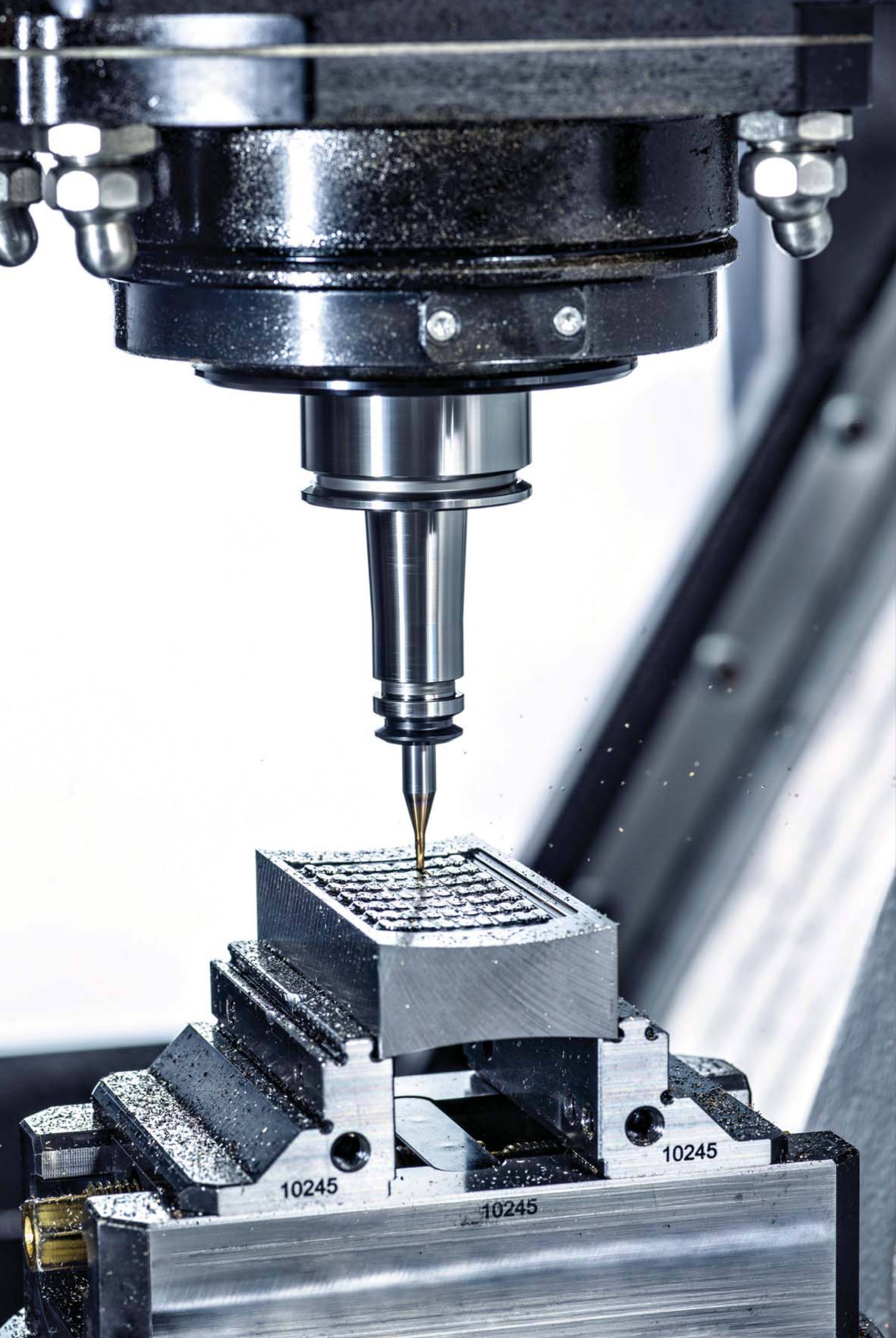


Position with unclamped HSK toolholder



Position with clamped HSK toolholder




10245
10245
10245

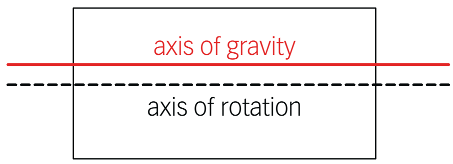
Balancing

The experience of REGO-FIX in the development and manufacturing of tool holding systems has provided us a large knowledge basis on the subject of balancing.

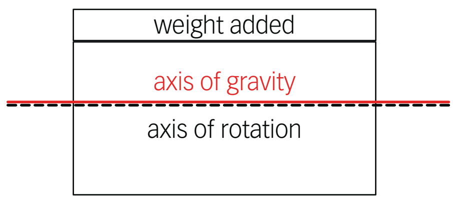
In our production we have the latest manufacturing equipment and testing methods available, but as with other manufacturers the physical limits of balancing have to be considered. Furthermore, it has to be considered whether a process is economically feasible and the imbalance measurable. The weights and interaction of the individual components of the tool holding system determines which options for balancing are practical. Therefore, we recommend that the entire assembly be considered as a whole, as it is stipulated in the DIN 69888.

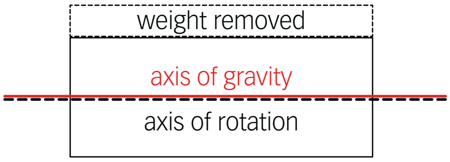
What is imbalance Imbalance occurs when the mass of a rotating body is not distributed rotationally symmetric. This leads to vibration and can cause increased wear or damage to cutting tools and or machine bearing components. The weight of each part of the tool holding system is critical to the question: At what speed is balancing economically producible? Speeds have a great influence on the centrifugal forces. Due to its nature the centrifugal force increase exponentially, which means when you double the speed you get four times the centrifugal force.

Static imbalance A static unbalance results when the axis of rotation does not pass through the center of gravity axis of the rotary body. The axis of rotation is parallel to the axis of gravity, but is displaced by some amount. This displacement (called eccentricity) produces a rotational circular vibration perpendicular to the rotational axis. This imbalance can be measured in a stationary position.

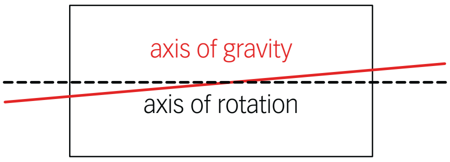


To reduce a static imbalance an appropriate weight is removed or adjusted perpendicular to the rotational axis.

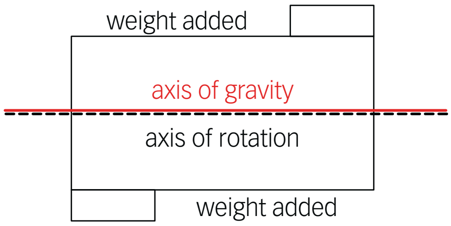


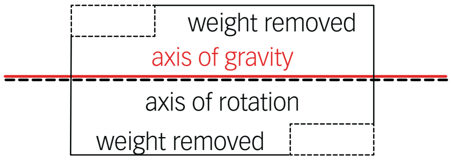


Dynamic imbalance Dynamic imbalance occurs only during operation. It manifests itself in an unbalanced moment on the axis of rot ation producing coupled forces and orbital oscillations. The center of gravity of the rotating body is in the rest position, while the axis for the coupled forces rotates in circular motions.



To balance a dynamic imbalance, weight added, removed or adjusted at two levels.

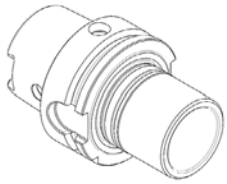




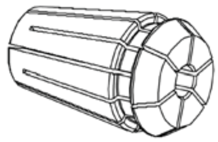
Influences on the imbalance

The whole toolholding system and spindle should be considered as well as any external influences such as dried-coolant film or dirt that has collected on the spindle. The weight of the individual components and the speeds are important factors to consider as well.

Machine spindle
The spindle rotors are supported in the spindle housing in several locations and have for the most part a weight of about 15 kg. Therefore, they can be balanced much more accurately than a small rotating body such as a toolholder of only 200 g.

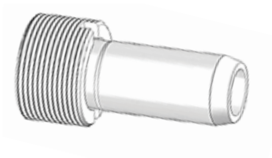


Toolholder
The toolholder is the largest component in the interface between the spindle and the tool. These are balanced according to the manufacturer at the factory.



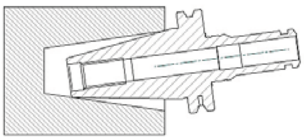
Collet
These are usually rotationally symmetrical parts and do not have to be balanced. Installation error (eg. not correct clamping) or pollution (chips, dried coolant etc.) can cause an imbalance.

Clamping nut
These are balanced according to manufacturer. Dirt, debris or damage can cause an imbalance.



Accessories for clamping system
Accessories, such as coolant tubes, stop screws, pull studs, sealing and cooling disks may cause an additional imbalance.

Tool
Cutting tool design may (eg, single-edged, Weldon clamping surface, etc.) already have an imbalance.



Postioning error / Taper fit
The tool change position accuracy of toolholders can play a large role in the balancing and repeatability of the measured imbalance. An HSK holder has a position repeatability of between 2-4 microns while most steep taper holders can be up to 5 microns. Impurities on the cone or on the mating surface between the toolholder and the spindle can also lead to an imbalance and larger position inaccuracies. So as can been it is very important to clean all surfaces thoroughly as to minimize the position error that can occur.

Balancing quality

In recent years the cutting speeds have increased because of better materials and processes. This has resulted in new requirements on the balance of the whole system (machine spindle, clamping tool and tool).

General informations can be read in the Norm DIN ISO 19499:2008-03 "Mechanical vibration – Balancing – Guidance on the use and application of balancing standards".

Norms

Selection of DIN ISO 1940
This standard specifies the requirements on balancing as regulated grades of rotors in a constant (rigid) state. This standard is not applicable for tooling systems for the following reasons entire.

Spindles, tool holder systems and cutting tools have, in contrast to other rigid rotors (such as electric motor armatures, etc.) essential differences:

a) Spindle, tool holder and cutting tool form a system with high temporal variation (for example, frequent tool change machining centers).
b) Due to the radial angle and tension-related inaccuracies a repeated change of tool in the spindle leads to a change in the balancing state of the entire system.
c) Fit tolerances of individual components (spindle, tool holder and cutting tool) set limits for balancing.

Selection of DIN 69888:2008-09
This standard specifies balancing requirements for tooling systems with HSK 25 to HSK 100 according DIN 69063-1, DIN 69063-2, DIN 69063-5, DIN 69063-6, DIN 69893-1, DIN 69893-2, DIN 69893-5 and DIN 69893-6 firmly based on their particular operating speed. In this standard the HSK 125 and HSK 160 are not given any consideration, so it is recommended to apply the limits for HSK 100. Correspondingly, the standard tool for systems with interfaces and tapers such as ABS, CAPTO, KM, SK and cylindrical shank are used. Here, the type-specific aspects of the interfaces and holders are taken into account.

The standard applies under the following conditions:

a) In the area of operating speeds the tool systems are considered to be rigid.
b) The limit of vibration mechanical stress is defined by the permissible bearing load of the machine spindle.
c) So as not to unbalance-related impairments in the production is given in compliance with the procedures specified in the standard requirements (load bearing and thus the vibration velocity).

Importance of balance of quality
By balancing quality value G, the weight of the rotor (M), the speed (n) and the conversion factor (9549), the permissible residual unbalance U_{zul} is calculated in gmm. It tells us how much mass asymmetrically distributed in the radial direction from the axis of rotation is still permissible. With the calculated value, the distance of this mass may be recalculated to gravitational axis.

Formulas

$$G = e \times w = \frac{U}{M} \times \frac{2 \times \pi \times n}{60} = \frac{U \times \pi \times n}{M \times 30}$$

result $$U = \frac{G \times M \times 30}{\pi \times n}$$

Conversion factor $= 9.549$

$$U_{zul} = \frac{G \times M \times 9.549}{n}$$

$$e_{zul} = \frac{U_{zul}}{M}$$

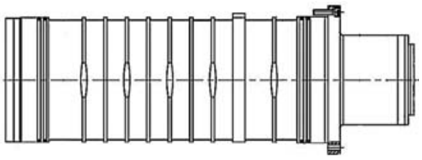
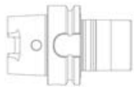
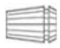
$$u = \frac{U_{zul}}{R}$$

U = Unbalance of the rotor	(gmm)
G = Balance quality	(mm/s)
M = Weight of the rotor	(g)
n = Speed of the rotors	(1/min)
e = Eccentricity of gravity	(µm)
w = Angular speed	(1/sec)
U_{zul} = Permitted residual unbalance of the rotor	(gmm)
e_{zul} = Permitted eccentricity	(µm)
u = Unbalance mass on the largest outer radius	(g)
R = Radius at which the balancing is done	(mm)

Comparison

The comparison between the overall system and a single toolholder demonstrates that the balance of the individual component has a very small effect on the overall system.

Overall system

					
Machine spindle for HSK-A 63	Toolholder HSK-A 63 ER32X080-H	Collet ER 32-UP 6.00 – 5.00	Seal disk DS / ER 32 6.00 – 5.50	Clamping nut Hi-Q ERC 32	Cutter with internal cooling ø 6 mm
15,000 g	1035 g	150 g	15 g	15 g	30 g

Weight	16398 g	
Radius (R)	31.5 mm	
Speed	10,000 min^{-1}	42,000 min^{-1}
Balance quality (G)	2.5	2.5
Permitted residual unbalance (U_{zul})	39.146 gmm	9.321 gmm
Permitted eccentricity (e_{zul})	2.387 µm	0.568 µm

$$U_{zul10\,000} = \frac{2.5 \times 16{,}398 \times 9.549}{10{,}000} = 39.146 \text{ gmm} \qquad U_{zul42\,000} = \frac{2.5 \times 16{,}398 \times 9.549}{42{,}000} = 9.321 \text{ gmm}$$

$$e_{zul10\,000} = \frac{39.146}{16{,}398} = 2.387\,\mu\text{m} \qquad e_{zul42\,000} = \frac{9.321}{16{,}398} = 0.568\,\mu\text{m}$$

$$u_{10\,000} = \frac{39.146}{31.5} = 1.2 \text{ g} \qquad u_{42\,000} = \frac{9.321}{31.5} = 0.3 \text{ g}$$

By calculation the entire system is allowed 1.2 g at 10,000 min^{-1} and 0.3 g at 42,000 min^{-1} and the permissible unbalanced mass is at its greatest diameter (in this case the spindle rotor). The following calculation is used to demonstrate how little unbalanced mass of a toolholder HSK-A 63 / ER32 x 080 is acceptable in comparison to the overall system:

Weight	1035 g	
Radius (R)	31.5 mm	
Speed	10,000 min^{-1}	42,000 min^{-1}
Balance quality (G)	2.5	2.5
Permitted residual unbalance (U_{zul})	2.471 gmm	0.588 gmm
Permitted eccentricity (e_{zul})	2.387 µm	0.568 µm

$$U_{zul10\,000} = \frac{2.5 \times 1035 \times 9.549}{10{,}000} = 2.471 \text{ gmm} \qquad U_{zul42\,000} = \frac{2.5 \times 1035 \times 9.549}{42{,}000} = 0.588 \text{ gmm}$$

$$e_{zul10\,000} = \frac{2.471}{1035} = 2.380\,\mu\text{m} \qquad e_{zul42\,000} = \frac{0.588}{1035} = 0.568\,\mu\text{m}$$

$$u_{10\,000} = \frac{2.471}{31.5} = 0.078 \text{ g} \qquad u_{42\,000} = \frac{0.588}{31.5} = 0.019 \text{ g}$$

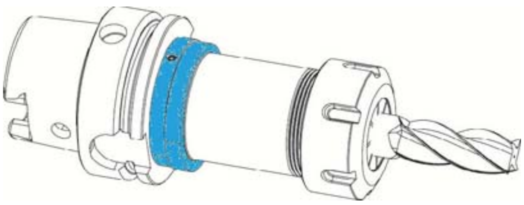
If now the allowable imbalance masses are compared, it is evident that in the overall system may be about 15 times larger than in the toolholder alone. The current state of balancing technology is not economically producible when just looking at the toolholder, but when the entire system is considered it may not necessary. An imbalance caused by positioning error can't be corrected or accounted for.

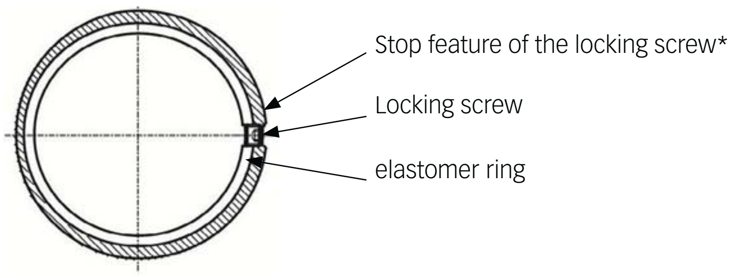
Balancing at REGO-FIX

All toolholders and clamping nuts from the production of REGO-FIX are balanced at the factory by design. In addition, the toolholders are fine balanced and 100% customized. The balancing data refer only to the toolholder. Most REGO-FIX toolholders are designed to accommodate the REGO-FIX Hi-Q® balancing rings for fine balancing when required.

Fine balance with Hi-Q® balancing rings

REGO-FIX Hi-Q® balancing rings (patented) are mounted on the grooves designed into the toolholder, making all the clamping system (holder, nut, tool, etc.) balanceable.





**The locking set screw has a feature that prevents it from baking out and being thrown into the machine, which can at high speeds and the resulting centrifugal forces cause serious injury and damage to machinery.*

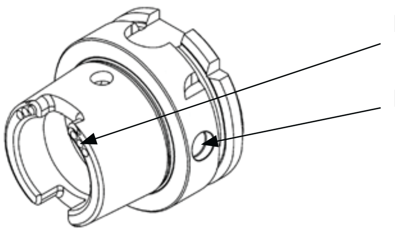
Details of the balance values of toolholders

The stated REGO-FIX balance values (noted in packaging, catalogs, brochures, etc.) are the actual measured values from the state-of-the-art-balancers.

Toolholder
These toolholders are under production on a Level (static) as standard balanced at:

G 2.5 @ 25,000 min^{-1}	SK 40 BT 40 CAT 40 SK 50 BT 50 CAT 50 CAT 50+ CAT 40+ BT 50+ BT 40+ HSK 100 HSK 125 HSK 80 HSK 63 Capto (C3, C4, C5, C6, C8)
balanced to 30,000 min^{-1}	BT 30 SK 30 CAT 30 BT 30+ BT-OM 30
balanced to 33,000 min^{-1}	HSK 80 F HSK 80 FP
balanced to 36,000 min^{-1}	HSK 50
balanced to 45,000 min^{-1}	HSK 40
balanced to 50,000 min^{-1}	ISO 20 (HAAS) HSK 32-25 / PG 6 x 046
balanced to 60,000 min^{-1}	HSK 32
balanced to 90,000 min^{-1}	HSK 20 / HSK 25
G 2.5 @ 5,000 min^{-1}	all XL toolholders

HSK – Toolholder
These toolholders are balanced by a special process (Pat. pend.), in which two axially spaced staggered levels material ablated.



*Other balance qualities are available on request at an additional cost. It can't be guaranteed that these values are reproducible due to positioning error and taper fit. See the section on Positioning Error and Taper Fit for more details, page 315.

Hi-Q® – Clamping nut
The REGO-FIX-Hi-Q® clamping nuts are balanced due to its design (patented) and are continuously tested during production.

Collets
Collets are rotationally symmetric and do not require balancing. To enable the best possible concentricity collets must be cleaned before each use.

Accessories (sealing disks, coolant disks, etc.)
These are rotationally symmetric and do not require balancing. To enable the best possible concentricity the accessories must be cleaned before each use. By improper handling or installation can lead to imbalance.

Interpreting the DIN 69888:2008-09

The accuracy of balancing machines is only partially dependent on the tool mass, i.e. for small tool masses (< 1,5kg), the inaccuracy of balancing machines is much more noticeable.

In addition to the error of the balancing machines, there is also the influence of the interface between the holder and the balancing machine. The following assumptions can be made:

Repeatable residual imbalances per balancing plane

max. mass of test piece (rotor) kg	repeatable residual unbalance[a] ^{U}wm gmm
< 7.0	0.75
> 7.0 to 16.0	1.5

[a] Depending on the clamping accuracy in the machine. The clamping accuracy of the balancing machine is greater than that of the machine.

In addition to the repeated residual imbalances on a balancing machine (Uwm), further error lies in the limited repeatability of interfaces. As reference values for the common HSK interfaces, the values specified in the table can be assumed.

Joining accuracy of the HSK interface

HSK	25	32	40	50	63	80	100
^{e}HSK	2	2	2	2	2	3	4

In micrometers

Thus, the repeated achievable residual unbalance of the overall system can be calculated:

^{U}min ≥ (^{m}wkz · ^{e}HSK) + ^{U}wm

Example 1

Toolholder type:	HSK-E 40 / PG 10 x 062
Mass of toolholder:	^{m}wkz = 0.250 kg
Joining accuracy HSK interface:	^{e}HSK = 2 µm for HSK 40
Reproducible residual unbalance:	^{U}wm = 0.75 gmm for mass < 7.0 kg

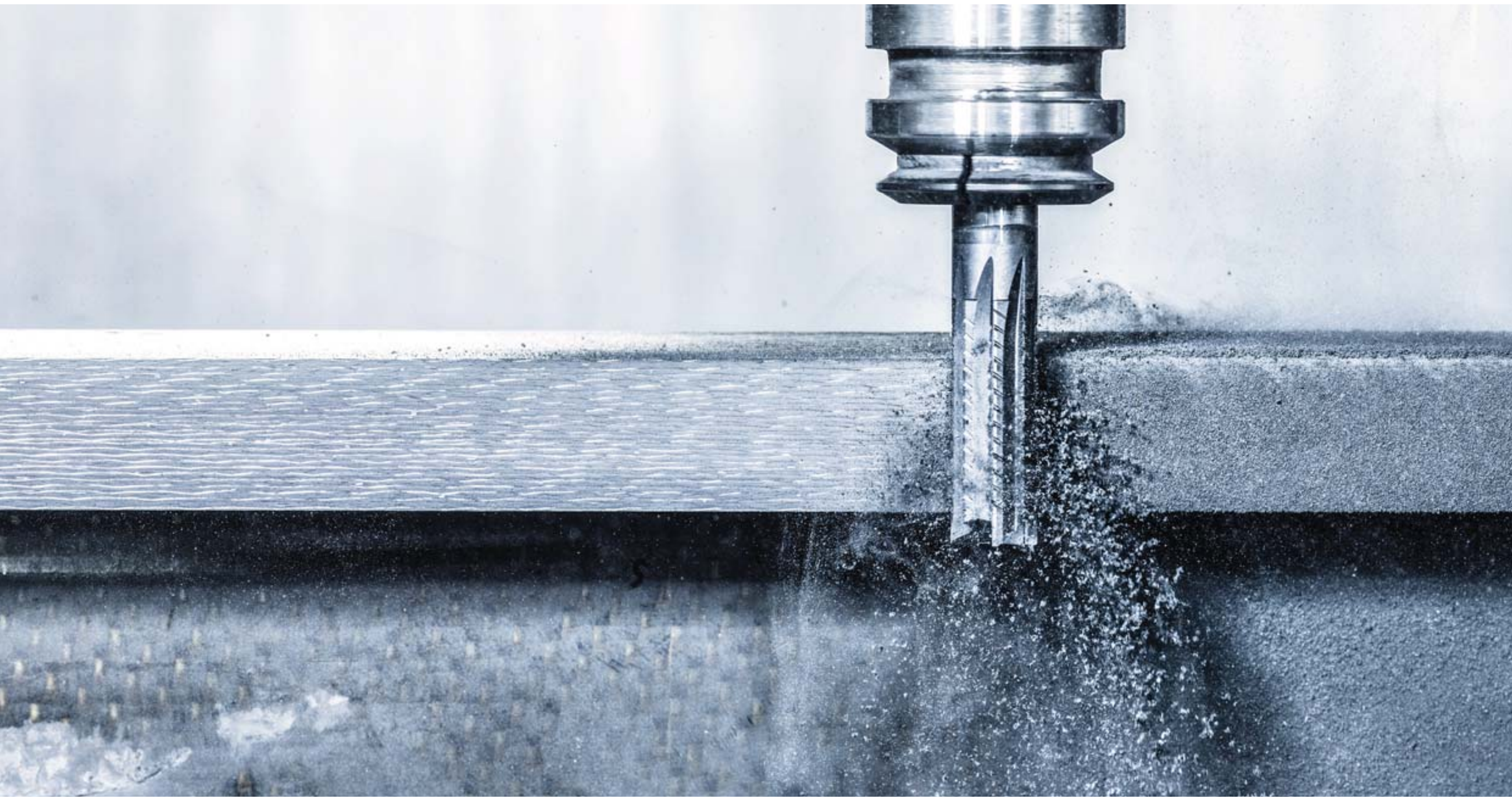
umin ≥ (0.25 kg * 2 µm) + 0.75 gmm = 1.250 gmm

Example 2

Toolholder type:	HSK-A 63 / PG 32 x 100
Mass of toolholder:	^{m}wkz = 1.228 kg
Joining accuracy HSK interface:	^{e}HSK = 2 µm for HSK 63
Reproducible residual unbalance:	^{U}wm = 0.75 gmm for mass < 7.0 kg

^{u}min ≥ (1.228 kg * 2 µm) + 0.75 gmm = 3.206 gmm

Compared to the permissible residual unbalance, which results at G 2.5 @ 25 000 min^{-1}, the values calculated above for the reproducible residual unbalance are partially higher. As a result, not all G values are reproducible.



Milling strategies

Which milling strategy is the most suitable for my application? HSC, HPC or trochoidal milling? Am I focusing on a high chip removal rate or a perfectly finished surface? Choosing the most efficient method and reaching the maximum performance is the key to successful machining.

Depending on the type of machine, lot size, clamping equipment and many other factors, the fastest strategy might not be the most efficient. Sometimes, a conventional approach is faster for smaller quantities than a perfectly optimized CAM-program following the latest development.

Machines – 3, 5 or 5-axis simultaneous 3-axis and 5-axis are essentially different types of milling machines. The definition stands for the number of axles the machine can move, on a 3-axis machine it is usually X, Y and Z. If you add a rotary head and table to the machine, often called A- and C-axis, it becomes a 5-axis machine. It allows you to machine up to 5 sides of a workpiece in a single clamping as well as applications at any angle necessary. A 5-axis simultaneous machine is able to move all of its axles at the same time and is used for workpieces with complex 3D contours.

Down-milling In almost any application, down milling is the preferred method and base of modern milling strategies. Following the "thick to thin" rule, the feed is in the same direction as the rotation of the cutting tool. The maximum chip thickness is reached at the start of the cut and slowly decreases until the end of the cut. Results are better surface quality, longer tool life and less burr formation.

Up-milling If the cutting tool is fed in the opposite direction of the cutting tool rotation, an up-milling strategy is applied. The slowly increasing chip thickness causes high temperatures and a burnishing or rubbing effect due to friction, resulting in a reduced tool life. Different than in down-milling, the tool gets pulled towards the workpiece which was a welcoming effect in earlier years of milling machines. As the precision of spindles and guides couldn't reach modern standards, it helped stabilizing the milling process. In today's machining, up milling is used in workpieces with hardened, abrasive or forged surfaces, allowing the tool to start the cut in softer material to increase tool life.

Roughing The roughing process is mostly used at the beginning of a workpiece. Aiming at removing a large amount of material in the fastest and most process-safe way and get as close as possible to the final shape. Surface quality and dimensional accuracy are secondary requirements.

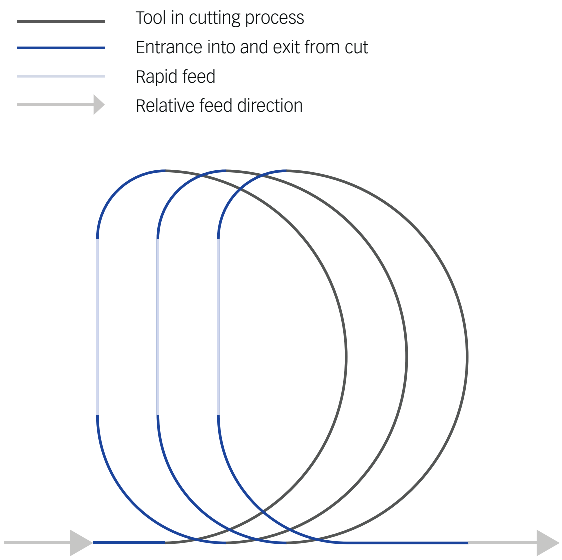
Finishing Following the roughing process, finishing operations are used to achieve the required specifications regarding dimensional and geometrical accuracy, surface quality, deburring and an optimal preparation for following processes such as grinding and surface treatments. Finishing tools are

designed specifically for this purpose, allowing higher cutting speeds and developed to reach a long tool life for a stable process.

HSC HSC, short for High Speed Cutting, essentially increases the metal removal rate Q by practicing exceedingly higher speeds and feeds up to 10 times and very low cutting depth and width. Compared to conventional milling methods, HSC results in an up to 30% higher material removal rate while at the same time achieving better surface quality, lower cutting forces and less heat development due to short contact times. Applications can be found in thin-walled structural parts for the aerospace industry, turbine blades, moulds or electrodes. While HSC is generating lower forces on the spindle, the tooling machine has the requirement to be able to withstand high rpm and fast movements on long term.

HPC High Performance Cutting also has its target in reaching the highest possible metal removal rate Q, although using a different strategy. While the cutting speed Vc will not reach the levels of HSC, the increased cutting depth and cutting width will make the difference. While the rotational speeds and the feeds are suitable for almost any type of machines, strong forces will appear to the spindle. As the surface quality mostly is lower than in High Speed Cutting, HPC is mainly used in the roughing process. Also, it has fewer requirements to CAM and programming-systems.

Trochoidal Milling Similar to HSC, trochoidal milling is based on high speeds and feeds, small Ae and maximal Ap. Mainly used in roughing and semi-roughing, its application is found in slots, corners and deep pockets. Due to a constant circular-like movement it creates a flowing process that positively affects the spindle and guides. The small chip thickness allows narrower flutes and a close pitch on the milling tool, resulting and a stronger core and increased stability to prevent vibrations.



Troubleshooting when milling with end mill

Possible corrective measures when milling with end mill

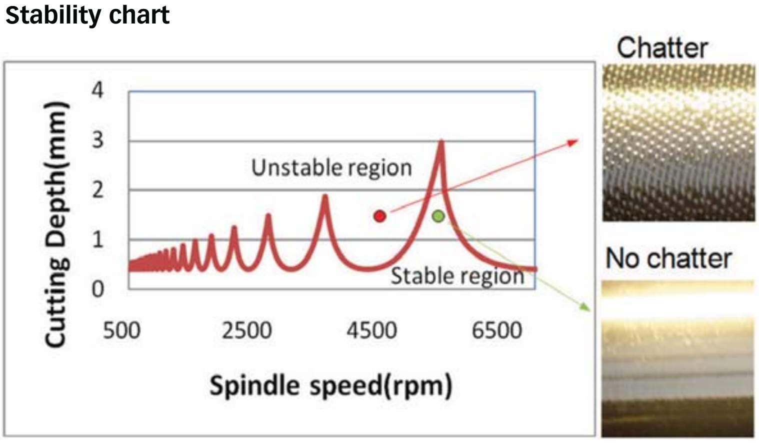
Problem	Adjust cutting speed (Vc)	Adjust feed per tooth (fz)	Reduce milling depth	Increase coolant supply	Reduce projecting length	Review tooling system	Re-check choice of drilling tool	Review work mounting	Reduce lateral infeed	Check tool wear	Review cooling strategy	Review milling strategy*	REGO-FIX Expert advice
Vibrations	↓	↑		•	•	•	•	•	•			•	Strive for stable region (see stability chart) Improve result with the powRgrip® System
Low stability					•	•		•	•				Improve result with the powRgrip® System
Hevy deflection		↓			•	•			•	•			Use more stable tooling system (powRgrip®)
Poor surface quality	↑	↓		•	•	•	•	•	•	•			Improve runout and tool rigidity with the powRgrip® System
High tool wear	↓	↓		•	•	•	•	•	•				Improve runout with precision tools from REGO-FIX (ER, MR, powRgrip®)
Built-up edge	↑	↑		•			•			•			
Cutting edge chipping	↑	↓		•		•	•	•			•		
Tool breakage	↓	↓		•	•	•	•	•	•			•	
Edge breakage on workpiece		↓				•	•		•	•			
Burrs	↓	↑								•			
Uneven surface					•	•		•		•		•	
Non-parallel surface					•	•		•		•		•	
Insufficient chip removal		↑		•			•		•		•	•	For peripheral cooling use CF collet (powRgrip® System) or Coolant flush disk KS (ER System)
Chip jam (only with slot milling)		↓	•	•								•	

• Corrective measures

↑ *Increase values* ↓ *Lower values*

**Milling strategies:*
Down-milling
Up-milling
High Performance Cutting (HPC)
High Speed Cutting (HSC)
Trochoidal Milling (TBC)

Stability chart



Troubleshooting when drilling

Possible corrective measures when drilling

Problem	Adjust cutting speed (Vc)	Adjust feed per rotation (f)	Increase coolant supply	Reduce projecting length	Review tooling system	Re-check choice of drilling tool	Review spot-drilling	Review cutting data	Review work mounting	Check tool wear	REGO-FIX Expert advice
Vibrations	↓	↑		•	•			•	•		Improve result with the vibration-damping and high-precision powRgrip® System
Deflection		↓		•	•	•	•			•	
Poor surface quality	↑	↓	•	•	•			•	•	•	Improve runout and tool rigidity with the powRgrip® System
High tool wear	↓	↓	•	•	•	•		•	•		Improve runout with precision tools from REGO-FIX (ER, MR, powRgrip®)
Tool breakage	↓	↓	•		•	•		•	•		
Bore out-of-center		↓		•	•	•	•		•	•	
Bore diameter too big	↓	↓	•	•	•			•	•	•	
Cutting edge chipping	↓	↓	•			•		•			
Built-up edge	↑	↑	•			•		•			
Burrs		↓								•	
Long chips	↓	↑				•					
Chip jam	↑	↓	•			•					Use tools with internal cooling, together with REGO-FIX sealing disks DS

• Corrective measures　　*↑ Increase values*　　*↓ Lower values*

Troubleshooting when reaming

Possible corrective measures when reaming

Problem	Adjust cutting speed (Vc)	Adjust feed per rotation (f)	Adjust pilot bore diameter	Reduce projecting length	Increase coolant supply	Review cutting data	Check tool wear	Extend pilot bore depth	Check axial offset	REGO-FIX Expert advice
Vibrations	↓	↑		•	•	•				
Poor surface quality			↓		•	•	•	•	•	Improve result with the self-centering REGO-FIX floating chuck
Built-up edge	↑	↑				•				
Cutting edge chipping	↓	↓	↑	•	•	•		•		
Tool breakage			↑		•	•		•	•	Improve result with the self-centering REGO-FIX floating chuck
High tool wear	↓	↓		•	•				•	
Bore not cylindrical							•		•	Improve result with the self-centering REGO-FIX floating chuck
Bore too small	↑	↓	↑			•	•		•	Eliminate radial forces with the self-centering REGO-FIX floating chuck
Bore too big	↓	↑	↓	•			•		•	Eliminate radial forces with the self-centering REGO-FIX floating chuck
Chip jam	↓	↓			•	•		•		

• Corrective measures ↑ *Increase values* ↓ *Lower values*

Troubleshooting when tapping

Possible corrective measures when tapping

Problem	Adjust cutting speed (Vc)	Adjust core hole diameter	Increase coolant supply	Check tool wear	Review tap tolerance	Review chamfering	Extend clearance at end of the thread	Check runout (TIR)	Review feedrate or spindle synchronization	REGO-FIX Expert advice
Toolshank is spinning		↑		•						Use REGO-FIX ER-GB / PCM ET1 / PG-TAP tapping collets
Thread too big	↓		•	•	•			•		Improve dimensional accuracy with REGO-FIX tapping tools
Thread too small		↑		•	•	•				Improve dimensional accuracy with REGO-FIX tapping tools
Axial miscut thread						•			•	Use REGO-FIX tapping tools with axial compensation
Rough thread sides		↑	•	•		•		•		Use REGO-FIX tapping tools with axial compensation
High tool wear	↓		•					•		Use REGO-FIX tapping tools with axial compensation
Cutting edge chipping			•				•	•		Use REGO-FIX tapping tools with axial compensation
Tool breakage	↓	↑	•	•			•		•	Use REGO-FIX tapping tools with axial compensation

• Corrective measures

↑ Increase values ↓ Lower values

Formulas for cutting data

End mills

d_1 Diameter of the cutting edge [mm]
z Number of cutting edges
a_p Axial infeed depth [mm]
a_e Radial infeed depth [mm]
v_c Cutting speed [m / min]
f_z Feed per tooth and revolution [mm]
n Spindle speed [min^{-1}]
v_f Feed rate [mm / min]
f Feed per rotation [mm]
Q Material removal rate [cm^3/min]
d_{eff} Effective engagement diameter [mm]
ß Setting angle «Beta» [° – DEG]

Spindle speed	$n = \frac{V_C \times 1000}{d \times \Pi}$	$\left[\frac{1}{min}\right]$
Cutting speed	$V_c = \frac{d_1 \times n \times \Pi}{1000}$	$\left[\frac{m}{min}\right]$
Feed rate	$V_f = f_z \times z \times n$	$\left[\frac{mm}{min}\right]$
Feed per tooth	$f_z = \frac{V_f}{z \times n}$	$[mm]$
Feed per revolution	$f = f_z \times z$	$[mm]$
Material removal rate	$Q = \frac{ap \times ae \times V_f}{1000}$	$\left[\frac{cm^3}{min}\right]$

Drills

d_1 Diameter of the cutting edge [mm]
v_c Cutting speed [m / min]
f Feed per rotation [mm]
n Spindle speed [min^{-1}]
v_f Feed rate [m / min]
Q Material removal rate [cm^3/min]
T Primary processing time for the maximum drill depth of the tool [sec]
L Effective drill depth [mm]

Spindle speed	$n = \frac{V_C \times 1000}{d_1 \times \Pi}$	$\left[\frac{1}{min}\right]$
Cutting speed	$V_c = \frac{d_1 \times n \times \Pi}{1000}$	$\left[\frac{m}{min}\right]$
Feed rate	$V_f = f \times n$	$\left[\frac{mm}{min}\right]$
Material removal rate	$Q = \frac{d_1^2 \times \Pi \times V_f}{4 \times 1000}$	$\left[\frac{cm^3}{min}\right]$
Primary processing time	$T = \frac{L}{V_f} \times 60$	$[sec]$

Taps

a Dimension of square end
d Nominal diameter of the thread
n Spindle speed
P Thread pitch
v_c Cutting speed
v_f Feed rate

Spindle speed	$n = \frac{V_C \times 1000}{d \times \Pi}$	$\left[\frac{1}{min}\right]$
Cutting speed	$V_c = \frac{d \times \Pi \times n}{1000}$	$\left[\frac{m}{min}\right]$
Feed rate	$V_f = P \times n$	$\left[\frac{mm}{min}\right]$

Cutting speed conversion table for threading

Ø d_1	Vc m/min 1 min⁻¹	2	3	4	5	6	8	10	12	15	20	25	30	40	50	60
1	318	637	955	1273	1592	1910	2546	3183	3820	4775	6366	7958	9549	12732	15915	19099
2	159	318	477	637	796	955	1273	1592	1910	2387	3183	3979	4775	6366	7958	9549
3	106	212	318	424	531	637	849	1051	1273	1592	2122	2653	3183	2144	5305	6366
4	80	159	239	318	398	477	637	796	955	1194	1592	1989	2387	3163	3979	4775
5	64	127	191	255	318	382	509	637	764	955	1273	1592	1910	2546	3183	3820
6	53	106	159	212	265	318	424	531	637	796	1061	1326	1592	2122	26553	3183
8	40	80	119	159	199	239	318	398	477	597	796	995	1194	1592	1989	2387
10	32	64	95	127	159	191	255	318	382	477	637	796	955	1273	1592	1910
12	27	53	80	106	133	159	212	265	318	398	531	663	796	1061	1326	1592
14	23	45	68	91	114	136	183	227	273	341	455	568	682	909	1137	1364
16	20	40	60	80	99	119	159	199	239	298	398	497	597	796	995	1194
18	18	35	53	71	86	106	141	177	212	265	354	442	531	707	884	1061
20	16	32	48	64	80	95	127	159	191	239	318	398	477	637	796	955
25	13	25	38	51	64	76	102	127	153	191	255	318	382	509	637	764
30	11	21	32	42	53	64	85	106	127	159	212	265	318	424	531	637
35	9	18	27	36	45	55	73	91	109	136	182	227	273	364	455	546
40	8	16	24	32	40	48	64	80	95	119	159	199	239	318	398	477
45	7	14	21	28	35	42	57	71	85	106	141	177	212	283	354	424
50	6	13	19	25	32	38	51	64	76	95	127	159	191	255	318	382

Hardness comparison chart

HRC Hardness Rockwell	**HB** Hardness Brinell	**HV** Hardness Vickers	**N / mm² Mpa** Tensile strenght
25	253	266	854
26	254	273	873
27	265	279	897
28	272	286	914
29	274	294	944
30	287	302	970
31	295	310	995
32	302	318	1024
33	311	327	1052
34	320	336	1082
35	329	345	1111
36	337	355	1139
37	346	364	1168
38	354	373	1198
39	363	382	1227
40	373	392	1262
41	382	402	1296
42	392	412	1327
43	402	423	1362
44	413	434	1401
45	424	446	1442
46	436	459	1481
47	448	471	1524
48	460	484	1572
49	474	499	1625
50	488	513	1668
51	502	528	1733
52	518	545	1793
53	532	560	1845
54	548	578	1912
55	566	596	1979
56	585	615	2050
57	603	634	2121
58		654	
59		675	
60		698	

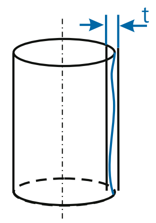
Conversion chart for hardness values, according to DIN 50150

Conversion table / inch-metric

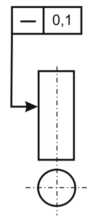
0″ d_1	Ø mm	0″ d_1	Ø mm	0″ d_1	Ø mm	0″ d_1	Ø mm	0″ d_1	Ø mm	0″ d_1	Ø mm
0	0	2-1/16	52.3876	4-1/16	103.188	6-1/16	153.988	8-1/16	204.788	10-1/16	255.588
1/16	1.5875	2-1/8	53.9751	4-1/8	104.775	6-1/8	155.575	8-1/8	206.375	10-1/8	257.176
3/32	2.3812	2-3/16	55.5626	4-3/16	106.363	6-3/16	157.163	8-3/16	207.963	10-3/16	258.763
1/8	3.1750	2-1/4	57.1501	4-1/4	107.950	6-1/4	158.750	8-1/4	209.550	10-1/4	260.351
5/32	3.9687	2-5/16	58.7376	4-5/16	109.538	6-5/16	160.338	8-5/16	211.138	10-5/16	261.938
3/16	4.7625	2-3/8	60.3251	4-3/8	111.125	6-3/8	161.925	8-3/8	212.725	10-3/8	263.526
7/32	5.5562	2-7/16	61.9126	4-7/16	112.713	6-7/16	163.513	8-7/16	214.313	10-7/16	265.113
1/4	6.3500	2-1/2	63.5001	4-1/2	114.300	6-1/2	165.100	8-1/2	215.900	10-1/2	266.701
5/16	7.9375	–	–	–	–	–	–	–	–	–	–
3/8	9.5250	–	–	–	–	–	–	–	–	–	–
7/16	11.1125	–	–	–	–	–	–	–	–	–	–
1/2	12.7000	–	–	–	–	–	–	–	–	–	–
9/16	14.2875	2-9/16	65.0876	4-9/16	115.888	6-9/16	166.688	8-9/16	217.488	10-9/16	268.288
5/8	15.8750	2-5/8	66.6751	4-5/8	117.475	6-5/8	168.275	8-5/8	219.075	10-5/8	269.876
11/16	17.4625	2-11/16	68.2626	4-11/16	119.063	6-11/16	169.863	8-11/16	220.663	10-11/16	271.463
3/4	19.0500	2-3/4	69.8501	4-3/4	120.650	6-3/4	171.450	8-3/4	222.250	10-3/4	273.051
13/16	20.6375	2-13/16	71.4376	4-13/16	122.238	6-13/16	173.038	8-13/16	223.838	10-13/16	274.638
7/8	22.2250	2-7/8	73.0251	4-7/8	123.825	6-7/8	174.625	8-7/8	225.425	10-7/8	276.226
15/16	23.8125	2-15/16	74.6126	4-15/16	125.413	6-15/16	176.213	8-15/16	227.013	10-15/16	277.813
1	25.4001	3	76.2002	5	127.00	7	177.800	9	228.600	11	279.401
1-1/16	26.9876	3-1/16	77.7877	5-1/16	128.588	7-1/16	179.388	9-1/16	230.188	11-1/16	280.988
1-1/8	28.5751	3-1/8	79.3752	5-1/8	130.175	7-1/8	180.975	9-1/8	231.775	11-1/8	282.576
1-3/16	30.1626	3-3/16	80.9627	5-3/16	131.763	7-3/16	182.563	9-3/16	233.363	11-3/16	284.163
1-1/4	31.7501	3-1/4	82.5502	5-1/4	133.350	7-1/4	184.150	9-1/4	234.950	11-1/4	285.751
1-5/16	33.3376	3-5/16	84.1377	5-5/16	134.938	7-5/16	184.738	9-5/16	236.538	11-5/16	287.338
1-3/8	34.9251	3-3/8	85.7252	5-3/8	136.525	7-3/8	187.325	9-3/8	238.125	11-3/8	288.926
1-7/16	36.5126	3-7/16	87.3127	5-7/16	138.113	7-7/16	188.913	9-7/16	239.713	11-7/16	290.513
1-1/2	38.1001	3-1/2	88.9002	5-1/2	139.700	7-1/2	190.500	9-1/2	241.300	11-1/2	292.101
1-9/16	39.6876	3-9/16	90.4877	5-9/16	141.288	7-9/16	192.088	9-9/16	242.888	11-9/16	293.688
1-5/8	41.2751	3-5/8	92.0752	5-5/8	142.875	7-5/8	193.675	9-5/8	244.475	11-5/8	295.276
1-11/16	42.8626	3-11/16	93.6627	5-11/16	144.463	7-11/16	195.263	9-11/16	246.063	11-11/16	296.863
1-3/4	44.4501	3-3/4	95.2502	5-3/4	146.051	7-3/4	196.850	9-3/4	247.650	11-3/4	298.451
1-13/16	46.0376	3-13/16	96.8377	5-13/16	147.638	7-13/16	198.438	9-13/16	249.238	11-13/16	300.038
1-7/8	47.6251	3-7/8	98.4252	5-7/8	149.225	7-7/8	200.025	9-7/8	250.825	11-7/8	301.626
1-15/16	49.2126	3-15/16	100.013	5-15/16	150.813	7-15/16	201 .613	9-15/16	252.413	11-15/16	303.213
2	50.8001	4	101 .600	6	152.400	8	203.200	10	254.001	12	304.801

Form and position tolerances in practice

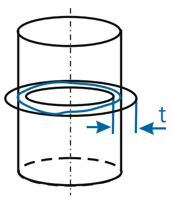
Form tolerances according to DIN EN ISO 1101



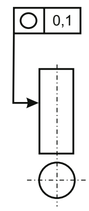
Straightness The tolerance zone is limited by two parallel lines at a distance t apart. Every envelope line of the toleranced cylinder must be between these two parallel lines.



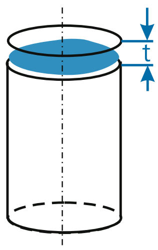
Example Every envelope line of the toleranced cylinder surface must be between two parallel lines at a distance apart of 0.1.



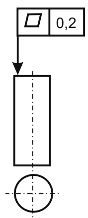
Roundness The tolerance zone is limited by two concentric circles at a distance t apart. The circumference line of the toleranced cylinder must be within a circle ring of the zone width t, in every radial section plane.



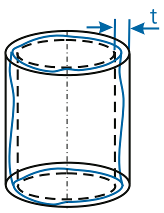
Example The circumference line of the toleranced cylinder must be within a circle ring of the zone width 0.1 in every radial section plane.



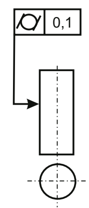
Flatness The tolerance zone is limited by two parallel planes at a distance t apart, the dimensions of which correspond to those of the toleranced area. The real workpiece area must be between the two parallel planes at distance t apart.



Example The real workpiece area must be between two parallel planes at a distance apart of 0.2.

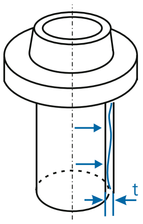


Cylindricity The tolerance zone for the cylinder envelope area limits the deviation of the roundness, the straightness of the envelope line and the parallelism of the envelope line to the cylinder axis. It is formed by two coaxial cylinders with the radial distance t.

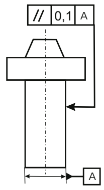


Example The toleranced cylindrical area must be between two coaxial cylinders with a radial distance of 0.1.

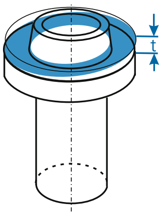
Position tolerances according to DIN EN ISO 1101



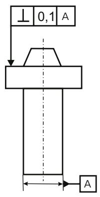
Parallelism The tolerance zone within which the envelope lines of the toleranced cylinder must lie is limited by two parallel lines at a distance t apart which run parallel to the datum plane.



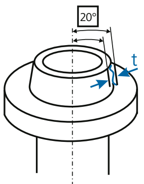
Example Every single envelope line of the toleranced area must be between two parallel lines that are at a distance of 0.1 apart, and are parallel to the center axis.



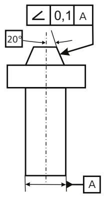
Perpendicularity The tolerance zone is limited by two parallel planes at a distance t apart, which are perpendicular to the datum axis. The toleranced plane face must be between these two planes.



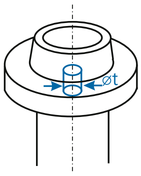
Example All points / circle lines of the toleranced area must be between two parallel planes that are at a distance of 0.1 apart, and are perpendicular to the datum plane.



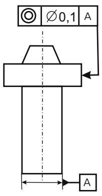
Angularity The tolerance zone is limited by two parallel planes at a distance t apart at the nominal angle to the datum axis.



Example All points of the toleranced area must be between two parallel planes that are at a distance apart of 0.1, and are angled at 20° to the datum axis.

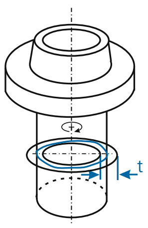


Coaxiality The tolerance zone is limited by a cylinder of diameter t, the axis of which matches the datum axis. The actual axis of the toleranced element must be within the tolerance zone.

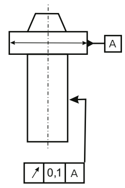


Example The axis of the toleranced cylinder must be within a cylinder that has a diameter of 0.1 and is coaxial to the datum axis A.

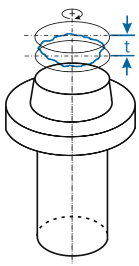
Run-out tolerances according to DIN EN ISO 1101



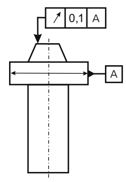
Radial run-out In every radial section plane perpendicular to the surface, the tolerance zone is limited by two concentric circles at a distance t apart, the common center point of which is on the datum axis. The radial run-out tolerance applies generally for a full revolution of the toleranced element around the datum axis.



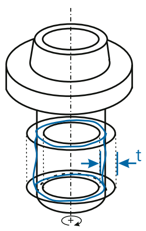
Example The circumference line of every radial section plane of the toleranced cylindrical area must be between two concentric circles at a distance apart of 0.1 with their common center point on the datum axis A.



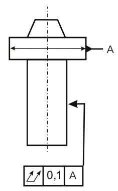
Axial run-out The tolerance zone is limited in every radial distance of two circles at a distance t apart. The circles are in a cylinder, the axis of which matches the datum axis. The diameter of the cylinder can adopt any value of the diameter of the plane face.



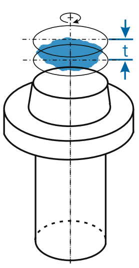
Example Every circle line of the toleranced area must be between two parallel circle planes at a distance apart of 0.1 with their common center point on the datum axis A.



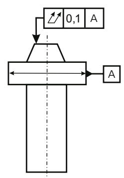
Total radial run-out The tolerance zone is limited by two coaxial cylinders at a distance t apart, the axes of which match the datum axis. After several rotations around the datum axis and axial shift of the transducer all points of the toleranced element must be within the tolerance zone.



Example The toleranced cylindrical area must be between two coaxial cylinders with a radial distance apart of 0.1 with their common axis on the datum axis.



Total axial run-out The tolerance zone is limited by two parallel planes at a distance t apart, which are perpendicular to the datum (rotational) axis. After several rotations round the datum axis and radial shift of the transducer, all points of the surface of the tolerance plane face must be within the tolerance zone.



Example The toleranced area must be between two parallel circle planes at a distance apart of 0.1 with their common center point on the datum axis A.

Tolerance charts

Outside dimensions (Shafts)

Tolerances on dimensions in µm

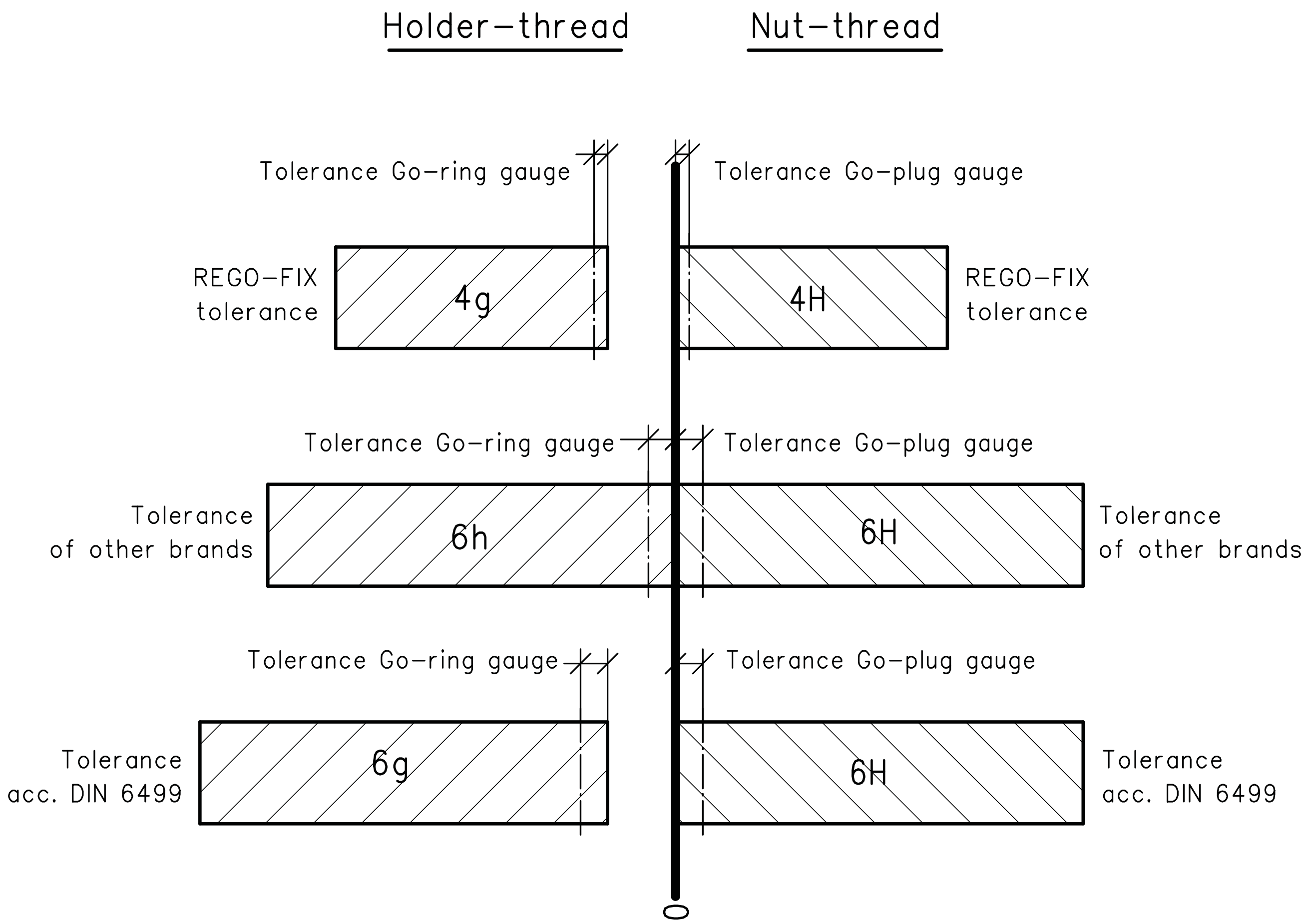
Nominal size range in mm		g4	g5	g6	g7	h4	h5	h6	h7	h8	h9	h10	h11	h13
from	1	-2	-2	-2	-2	0	0	0	0	0	0	0	0	0
to	3	-5	-6	-8	-12	-3	-4	-6	-10	-14	-25	-40	-60	-140
over	3	-4	-4	-4	-4	0	0	0	0	0	0	0	0	0
to	6	-8	-9	-12	-16	-4	-5	-8	-12	-18	-30	-48	-75	-180
over	6	-5	-5	-5	-5	0	0	0	0	0	0	0	0	0
to	10	-9	-11	-14	-20	-4	-6	-9	-15	-22	-36	-58	-90	-220
over	10	-6	-6	-6	-6	0	0	0	0	0	0	0	0	0
to	18	-11	-14	-17	-24	-5	-8	-11	-18	-27	-43	-70	-110	-270
over	18	-7	-7	-7	-7	0	0	0	0	0	0	0	0	0
to	30	-13	-16	-20	-28	-6	-9	-13	-21	-33	-52	-84	-130	-330
over	30	-9	-9	-9	-9	0	0	0	0	0	0	0	0	0
to	50	-16	-25	-20	-34	-7	-11	-16	-25	-39	-62	-100	-160	-390

Inside dimensions (Bores)

Tolerances on dimensions in µm

Nominal size range in mm		G4	G5	G6	G7	H4	H5	H6	H7	H8	H9	H10	H11	H13
from	1	+5	+6	+8	+12	+3	+4	+6	+10	+14	+25	+40	+60	+140
to	3	+2	+2	+2	+2	0	0	0	0	0	0	0	0	0
over	3	+8	+9	+12	+16	+4	+5	+8	+12	+18	+30	+48	+75	+180
to	6	+4	+4	+4	+4	0	0	0	0	0	0	0	0	0
over	6	+9	+11	+14	+20	+4	+6	+9	+15	+22	+36	+58	+90	+220
to	10	+5	+5	+5	+5	0	0	0	0	0	0	0	0	0
over	10	+11	+14	+17	+24	+5	+8	+11	+18	+27	+43	+70	+110	+270
to	18	+6	+6	+6	+6	0	0	0	0	0	0	0	0	0
over	18	+13	+16	+20	+28	+6	+9	+13	+21	+33	+52	+84	+130	+330
to	30	+7	+7	+7	+7	0	0	0	0	0	0	0	0	0
over	30	+16	+25	+20	+34	+7	+11	+16	+25	+39	+62	+100	+160	+390
to	50	+9	+9	+9	+9	0	0	0	0	0	0	0	0	0

Thread tolerances



Core hole diameters for thread cutting

M DIN 13, ISO 261, *5H/6H

d1	mm	Ø mini	Ø maxi	Ø guide line
*1	0.25	0.729	0.785	0.75
*1.1	0.25	0.829	0.885	0.85
*1.2	0.25	0.929	0.985	0.95
*1.4	0.30	1.075	1.142	1.10
1.6	0.35	1.221	1.321	1.25
1.7	0.35	1.321	1.421	1.35
1.8	0.35	1.421	1.521	1.45
2	0.40	1.567	1.679	1.60
2.2	0.45	1.713	1.838	1.75
2.3	0.40	1.867	1.979	1.90
2.5	0.45	2.013	2.138	2.05
2.6	0.45	2.113	2.238	2.15
3	0.50	2.459	2.599	2.50
3.5	0.60	2.850	3.010	2.90
4	0.70	3.242	3.422	3.30
4.5	0.75	3.688	3.878	3.75
5	0.80	4.134	4.334	4.20
6	1.00	4.917	5.153	5.00
7	1.00	5.917	6.153	6.00
8	1.25	6.647	6.912	6.80
9	1.25	7.647	7.912	7.80
10	1.50	8.376	8.676	8.50
11	1.50	9.376	9.676	9.50
12	1.75	10.106	10.441	10.20
14	2.00	11.835	12.210	12.00
16	2.00	13.835	14.210	14.00
18	2.50	15.294	15.744	15.50
20	2.50	17.294	17.744	17.50
22	2.50	19.294	19.744	19.50
24	3.00	20.752	21.252	21.00
27	3.00	23.752	24.252	24.00
30	3.50	26.211	26.771	26.50
33	3.50	29.211	29.771	29.50
36	4.00	31.670	32.270	32.00
39	4.00	34.670	35.270	35.00
42	4.50	37.129	37.799	37.50
45	4.50	40.129	40.799	40.50
48	5.00	42.587	43.297	43.00
52	5.00	46.587	47.297	47.00
56	5.50	50.046	50.796	50.50

MF DIN 13, ISO 261, 6H

d1	mm	Ø mini	Ø maxi	Øguide line
2.5	0.35	2.121	2.221	2.15
3	0.35	2.621	2.721	2.65
3.5	0.35	3.121	3.221	3.15
4	0.50	3.459	3.599	3.50

MF DIN 13, ISO 261, 6H

d1	mm	Ø mini	Ø maxi	Ø guide line
4.5	0.50	3.959	4.099	4.00
5	0.50	4.459	4.599	4.50
5.5	0.50	4.959	5.099	5.00
6	0.75	5.188	5.378	5.25
7	0.75	6.188	6.378	6.25
8	0.75	7.188	7.378	7.25
8	1.00	6.917	7.153	7.00
9	0.75	8.188	8.378	8.25
9	1.00	7.917	8.153	8.00
10	0.75	9.188	9.378	9.25
10	1.00	8.917	9.153	9.00
10	1.25	8.647	8.912	8.80
11	0.75	10.188	10.378	10.25
11	1.00	9.917	10.153	10.00
12	1.00	10.917	11.153	11.00
12	1.25	10.647	10.912	10.80
12	1.50	10.376	10.676	10.50
14	1.00	12.917	13.153	13.00
14	1.25	12.647	12.912	12.80
14	1.50	12.376	12.676	12.50
15	1.00	13.917	14.153	14.00
15	1.50	13.376	13.676	13.50
16	1.00	14.917	15.153	15.00
16	1.50	14.376	14.676	14.50
17	1.00	15.917	16.153	16.00
17	1.50	15.376	15.676	15.50
18	1.00	16.917	17.153	17.00
18	1.50	16.376	16.676	16.50
18	2.00	15.835	16.210	16.00
20	1.00	18.917	19.153	19.00
20	1.50	18.376	18.676	18.50
20	2.00	17.835	18.210	18.00
22	1.00	20.917	21.153	21.00
22	1.50	20.376	20.676	20.50
22	2.00	19.835	20.210	20.00
24	1.00	22.917	23.153	23.00
24	1.50	22.376	22.676	22.50
24	2.00	21.835	22.210	22.00
25	1.00	23.917	24.153	24.00
25	1.50	23.376	23.676	23.50
25	2.00	22.835	23.210	23.00
27	1.50	25.376	25.676	25.50
27	2.00	24.835	25.210	25.00
28	1.00	26.917	27.153	27.00
28	1.50	26.376	26.676	26.50
28	2.00	25.835	26.210	26.00
30	1.00	28.917	29.153	29.00

MF DIN 13, ISO 261, 6H

d1	mm	Ø mini	Ø maxi	Ø guide line
30	1.50	28.376	28.676	28.50
30	2.00	27.835	28.210	28.00
32	1.50	30.376	30.676	30.50
32	2.00	29.835	30.210	30.00
33	1.50	31.376	31.676	31.50
33	2.00	30.835	31.210	31.00
35	1.50	33.376	33.676	33.50
36	1.50	34.376	34.676	34.50
36	2.00	33.835	34.210	34.00
36	3.00	32.752	33.252	33.00
39	1.50	37.376	37.676	37.50
39	2.00	36.835	37.210	37.00
39	3.00	35.752	36.252	36.00
40	1.50	38.376	38.676	38.50
40	2.00	37.835	38.210	38.00
40	3.00	36.752	37.252	37.00
42	1.50	40.376	40.676	40.50
42	2.00	39.835	40.210	40.00
42	3.00	38.752	39.252	39.00
45	1.50	43.376	43.676	43.50
45	2.00	42.835	43.210	43.00
45	3.00	41.752	42.252	42.00
48	1.50	46.376	46.676	46.50
48	2.00	45.835	46.210	46.00
48	3.00	44.752	45.252	45.00
50	1.50	48.376	48.676	48.50
50	2.00	47.835	48.210	48.00
50	3.00	46.752	47.252	47.00
52	1.50	50.376	50.676	50.50
52	2.00	49.835	50.210	50.00
52	3.00	48.752	49.252	49.00
55	2.00	52.835	53.210	53.00
60	2.00	57.835	58.210	58.00

MF EN 60423:1994, 7H

d1	mm	Ø mini	Ø maxi	Ø guide line
8	1.00	6.917	7.217	7.00
10	1.00	8.917	9.217	9.00
12	1.50	10.376	10.751	10.50
16	1.50	14.376	14.751	14.50
20	1.50	18.376	18.751	18.50
25	1.50	23.376	23.751	23.50
32	1.50	30.376	30.751	30.50
40	1.50	38.376	38.751	38.50
63	1.50	61.376	61.751	61.50

UNC ANSI B1.1, 2B

d1	TPI	mm	Ø mini	Ø maxi	Ø guide line
1	64	0.397	1.425	1.582	1.45
2	56	0.454	1.695	1.871	1.75
3	48	0.529	1.941	2.146	2.00
4	40	0.635	2.157	2.385	2.25
5	40	0.635	2.487	2.697	2.55
6	32	0.794	2.642	2.895	2.75
8	32	0.794	3.302	3.530	3.40
10	24	1.058	3.683	3.962	3.80
12	24	1.058	4.344	4.597	4.40
1/4"	20	1.270	4.979	5.257	5.10
5/16"	18	1.411	6.401	6.731	6.50
3/8"	16	1.588	7.798	8.153	8.00
7/16"	14	1.814	9.144	9.550	9.30
1/2"	13	1.954	10.592	11.023	10.80
9/16"	12	2.117	11.989	12.446	12.20
5/8"	11	2.309	13.386	13.868	13.60
3/4"	10	2.540	16.307	16.840	16.60
7/8"	9	2.822	19.177	19.761	19.50
1"	8	3.175	21.971	22.606	22.30
1 1/8"	7	3.629	24.638	25.349	25.00
1 1/4"	7	3.629	27.813	28.524	28.20
1 3/8"	6	4.233	30.353	31.115	30.80
1 1/2"	6	4.233	33.528	34.290	34.00
1 3/4"	5	5.080	38.964	39.827	39.50
2"	4.5	5.644	44.679	45.593	45.30

UNJC ISO 3161:1999, 3B

d1	TPI	mm	Ø mini	Ø maxi	Ø guide line
4	40	0.635	2.228	2.393	2.30
5	40	0.635	2.558	2.723	2.60
6	32	0.794	2.733	2.939	2.80
8	32	0.794	3.393	3.599	3.45
10	24	1.058	3.795	4.064	3.90
12	24	1.058	4.455	4.704	4.55
1/4"	20	1.270	5.113	5.387	5.20
5/16"	18	1.411	6.563	6.833	6.70
3/8"	16	1.588	7.978	8.255	8.10
7/16"	14	1.814	9.347	9.639	9.40
1/2"	13	1.954	10.798	11.095	10.90
9/16"	12	2.117	12.228	12.482	12.40
5/8"	11	2.309	13.627	13.904	13.80
3/4"	10	2.540	16.576	16.881	16.70

Core hole diameters for thread cutting

UNF ANSI B1.1, 2B

d1	TPI	mm	Ø mini	Ø maxi	Ø guide line
0	80	0.318	1.182	1.305	1.20
1	72	0.353	1.474	1.612	1.50
2	64	0.397	1.756	1.912	1.80
3	56	0.454	2.025	2.197	2.10
4	48	0.529	2.271	2.458	2.35
5	44	0.577	2.551	2.740	2.60
6	40	0.635	2.820	3.022	2.90
8	36	0.706	3.404	3.606	3.50
10	32	0.794	3.963	4.165	4.05
12	28	0.907	4.496	4.724	4.60
1/4"	28	0.907	5.360	5.588	5.50
5/16"	24	1.058	6.782	7.035	6.90
3/8"	24	1.058	8.382	8.636	8.50
7/16"	20	1.270	9.729	10.033	9.80
1/2"	20	1.270	11.329	11.607	11.40
9/16"	18	1.411	12.751	13.081	12.90
5/8"	18	1.411	14.351	14.681	14.50
3/4"	16	1.588	17.323	17.678	17.50
7/8"	14	1.814	20.270	20.675	20.40
1"	12	2.117	23.114	23.571	23.30
1 1/8"	12	2.117	26.289	26.746	26.50
1 1/4"	12	2.117	29.464	29.921	29.70
1 3/8"	12	2.117	32.639	33.096	32.80
1 1/2"	12	2.117	35.814	36.271	36.00

UNJF ISO 3161:1999, 3B

d1	TPI	mm	Ø mini	Ø maxi	Ø guide line
0	80	0.318	1.217	1.298	1.25
1	72	0.353	1.511	1.603	1.55
2	64	0.397	1.798	1.902	1.85
3	56	0.454	2.073	2.189	2.15
4	48	0.529	2.329	2.466	2.35
5	44	0.577	2.614	2.764	2.70
6	40	0.635	2.888	3.053	2.95
8	36	0.706	3.480	3.663	3.60
10	32	0.794	4.054	4.255	4.10
12	28	0.907	4.602	4.816	4.70
1/4"	28	0.907	5.466	5.662	5.55
5/16"	24	1.058	6.906	7.109	7.00
3/8"	24	1.058	8.494	8.679	8.60
7/16"	20	1.270	9.876	10.084	10.00
1/2"	20	1.270	11.463	11.661	11.55
9/16"	18	1.411	12.913	13.122	13.05
5/8"	18	1.411	14.501	14.702	14.60
3/4"	16	1.588	17.506	17.722	17.60
7/8"	14	1.814	20.460	20.706	20.50
1"	12	2.117	23.340	23.594	23.40

UNEF ANSI B1.1, 2B

d1	TPI	mm	Ø mini	Ø maxi	Ø guide line
12	32	0.794	4.623	4.826	4.70
1/4"	32	0.794	5.487	5.689	5.60
5/16"	32	0.794	7.087	7.264	7.20
3/8"	32	0.794	8.662	8.864	8.75
7/16"	28	0.907	10.135	10.337	10.25
1/2"	28	0.907	11.710	11.938	11.85
9/16"	24	1.058	13.132	13.385	13.20
5/8"	24	1.058	14.732	14.986	14.80
11/16"	24	1.058	16.307	16.560	16.40
3/4"	20	1.270	17.679	17.957	17.80
13/16"	20	1.270	19.254	19.558	19.40
7/8"	20	1.270	20.854	21.132	21.00
1"	20	1.270	24.029	24.307	24.10

UN ANSI B1.1, 2B

d1	TPI	mm	Ø mini	Ø maxi	Ø guide line
5/16"	20	1.270	6.554	6.858	6.70
3/8"	20	1.270	8.154	8.432	8.30
9/16"	20	1.270	12.904	13.208	13.00
5/8"	20	1.270	14.504	14.782	14.60
1 1/8"	8	3.175	25.146	25.781	25.50
1 1/4"	8	3.175	28.321	28.956	28.70
1 3/8"	8	3.175	31.496	32.131	31.80
1 1/2"	8	3.175	34.671	35.306	35.00
1 5/8"	8	3.175	37.846	38.481	38.20
1 3/4"	8	3.175	41.021	41.656	41.40
1 7/8"	8	3.175	44.196	44.831	44.50
2"	8	3.175	47.371	48.006	47.70
2 1/4"	8	3.175	53.721	54.356	54.10
2 1/2"	8	3.175	60.071	60.706	60.40

UNS ANSI B1.1, 2B

d1	TPI	mm	Ø mini	Ø maxi	Ø guide line
10	36	0.706	4.064	4.216	4.10
10	40	0.635	4.141	4.292	4.20
10	56	0.454	4.344	4.445	4.40
1/4"	36	0.706	5.588	5.740	5.65
1/4"	40	0.635	5.665	5.816	5.70
1/4"	48	0.529	5.766	5.892	5.80
1/4"	56	0.454	5.868	5.969	5.90
5/16"	36	0.706	7.163	7.340	7.25
3/8"	36	0.706	8.763	8.940	8.80
7/16"	24	1.058	9.957	10.210	10.00
1/2"	24	1.058	11.557	11.811	11.60
1"	14	1.814	23.445	23.825	23.60

G (BSP) DIN ISO 228

d1	TPI	mm	Ø mini	Ø maxi	Ø guide line
1/16"	28	0.907	6.561	6.843	6.75
1/8"	28	0.907	8.566	8.848	8.75
1/4"	19	1.337	11.445	11.890	11.60
3/8"	19	1.337	14.950	15.395	15.20
1/2"	14	1.814	18.631	19.172	18.90
5/8"	14	1.814	20.587	21.128	20.90
3/4"	14	1.814	24.117	24.658	24.40
7/8"	14	1.814	27.877	28.418	28.20
1"	11	2.309	30.291	30.931	30.70
1 1/8"	11	2.309	34.939	35.579	35.30
1 1/4"	11	2.309	38.952	39.592	39.30
1 3/8"	11	2.309	41.365	42.005	41.80
1 1/2"	11	2.309	44.845	45.485	45.20
1 3/4"	11	2.309	50.788	51.428	51.20
2"	11	2.309	56.656	57.296	57.00
2 1/4"	11	2.309	62.752	63.392	63.10
2 1/2"	11	2.309	72.226	72.866	72.60
3"	11	2.309	84.926	85.566	85.30

W (BSW) BS 84, (DIN11-1970)

d1	TPI	mm	Ø mini	Ø maxi	guide line
3/32"	48				1.80
1/8"	40	0.635	2.362	2.591	2.50
5/32"	32				3.10
3/16"	24	1.058	3.406	3.744	3.60
7/32"	24				4.40
1/4"	20	1.270	4.724	5.156	4.90
5/16"	18	1.411	6.129	6.588	6.40
3/8"	16	1.588	7.493	7.988	7.70
7/16"	14	1.814	8.791	9.332	9.10
1/2"	12	2.117	9.987	10.589	10.30
5/8"	11	2.309	12.918	13.558	13.30
3/4"	10	2.540	15.799	16.484	16.20
7/8"	9	2.822	18.613	19.355	19.25
1"	8	3.175	21.336	22.149	21.90

PG DIN 40430

d1	TPI	mm	Ø mini	Ø maxi	Ø guide line
7	20	1.270	11.28	11.43	11.35
9	18	1.411	13.86	14.01	13.90
11	18	1.411	17.26	17.41	17.30
13.5	18	1.411	19.06	19.21	19.10
16	18	1.411	21.16	21.31	21.20
21	16	1.588	26.78	27.03	26.80
29	16	1.588	35.48	35.73	35.50
36	16	1.588	45.48	45.73	45.50
42	16	1.588	52.48	52.73	52.50
48	16	1.588	57.78	58.03	57.80

TR ISO 2901-2904, DIN 103, 7H

d1	mm	Ø mini	Ø maxi	Ø guide line
10	2	8	8.236	8.20
12	3	9	9.315	9.25
14	3	11	11.315	11.25
16	4	12	12.375	12.25
18	4	14	14.375	14.25
20	4	16	16.375	16.25
22	5	17	17.450	17.25
24	5	19	19.450	19.25
26	5	21	21.450	21.25
28	5	23	23.450	23.25
30	6	24	24.500	24.25
32	6	26	26.500	26.25

Shank diameter of taps

	Thread	ISO 529*		ISO 2283		DIN 371		DIN 357/376		DIN 352		JIS B 4430 1998		ASME B 94.9 1999	
[mm]	[Zoll]	[Ø]	[□]	[Ø]	[□]	[Ø]	[□]	[Ø]	[□]	[Ø]	[□]	[Ø]	[□]	[Ø]	[□]
M 1	–	2.5	2	–	–	2.5	2.1	–	–	2.5	2.1	3	2.5	–	–
M 1.1	–	2.5	2	–	–	2.5	2.1	–	–	2.5	2.1	3	2.5	–	–
M 1.2	–	2.5	2	–	–	2.5	2.1	–	–	2.5	2.1	3	2.5	–	–
M 1.4	–	2.5	2	–	–	2.5	2.1	–	–	2.5	2.1	3	2.5	–	–
M 1.6	1/16	2.5	2	–	–	2.5	2.1	–	–	2.5	2.1	3	2.5	0.141	0.11
M 1.7	–	–	2	–	–	2.5	2.1	–	–	2.5	2.1	3	2.5	–	–
M 1.8	–	2.5	2	–	–	2.5	2.1	–	–	2.5	2.1	3	2.5	0.141	0.11
M 2	–	2.5	2	–	–	2.8	2.1	–	–	2.8	2.1	3	2.5	0.141	0.11
M 2.2	–	2.8	2.24	–	–	2.8	2.1	–	–	2.8	2.1	3	2.5	0.141	0.11
M 2.3	–	–	–	–	–	2.8	2.1	–	–	2.8	2.1	3	2.5	–	–
M 2.5	3/32	2.8	2.25	–	–	2.8	2.1	–	–	2.8	2.1	3	2.5	0.141	0.11
M 2.6	–	–	–	–	–	2.8	2.1	–	–	2.8	2.1	3	2.5	–	–
M 3	1/8	3.15	2.5	2.24	1.8	3.5	2.7	2.2	–	3.5	2.1	4	3.2	0.141	0.11
M 3.5	–	3.55	2.8	2.5	2	4	3	2.5	2.1	4	3	4	3.2	0.141	0.11
M 4	5/32	4	3.15	3.15	2.5	4.5	3.4	2.8	2.1	4.5	3.4	5	4	0.168	0.131
M 4.5	3/16	4.5	3.55	3.55	2.8	6	4.9	3.5	2.7	6	4.9	5	4	0.194	0.152
M 5	–	5	4	4	3.15	6	4.9	3.5	2.7	6	4.9	5.5	4.5	0.194	0.152
M 6	1/4	6.3	5	4.5	3.55	6	4.9	4.5	3.4	6	4.9	6	4.5	0.255	0.191
M 7	5/16	7.1	5.6	5.6	4.5	7	5.5	5.5	4.3	6	4.9	6.2	5	0.318	0.238
M 8	–	8	6.3	6.3	5	8	6.2	6	4.9	6	4.9	6.2	5	0.318	0.238
M 9	–	9	7.1	7.1	5.6	9	7	7	5.5	7	5.5	7	5.5	–	–
M 10	3/8	10	8	8	6.3	10	8	7	5.5	7	5.5	7	5.5	0.318	0.286
M 11	–	8	6.3	8	6.3	–	–	8	6.2	8	6.2	8	6	–	–
M 12	1/2	9	7.1	9	7.1	–	–	9	7	9	7	8.5	6.5	0.367	0.275
M 14	9/16	11.2	9	11.2	9	–	–	11	9	11	9	10.5	8	0.429	0.322
M 16	5/8	12.5	10	12.5	10	–	–	12	9	12	9	12.5	10	0.48	0.36
M 18	11/16	14	11.2	14	11.2	–	–	14	11	14	11	14	11	0.542	0.406
M 20	13/16	14	11.2	14	11.2	–	–	16	12	16	12	15	12	0.652	0.489
M 22	7/8	16	12.5	16	12.5	–	–	18	14.5	18	14.5	17	13	0.697	0.523
M 24	15/16	18	14	18	14	–	–	18	14.5	18	14.5	19	15	0.76	0.571
M 27	1/16	20	16	–	–	–	–	20	16	20	16	20	15	0.896	0.672
M 30	3/16	20	16	–	–	–	–	22	18	22	18	23	17	1.021	0.766

All dimensions in mm (except US standard ASME B 94.9 in inch)

**M3–M10 with reinforced shank*

Material comparison chart

Material No.	DIN	AFNOR	BS	GOST	USA
1.2002	125Cr1	C120E3UCr4	–	–	–
1.2008	140 Cr 3	130 C 3	–	–	–
1.2067	102Cr6	100Cr6	BL 3	X (LUX15)	L 3 (AISI)
1.2080	X210Cr12	X200Cr12	BD 3	X12	D 3 (AISI)
1.2083	X40Cr14	X40Cr144	–	40X13	–
1.2201	G-X 165 Cr V 12	–	–	–	–
1.2208	31 Cr V 3	–	–	3Xф	–
1.2210	115CrV3	–	–	Xф	L 2 (AISI)
1.2235	80CrV2	–	–	8Xф	–
1.2241	51CrMnV4	–	–	5Xф	–
1.2249	45SiCrV6	45SiCrV6	–	–	–
1.2303	100CrMo5	–	–	–	L 7 (AISI)
1.2316	X36CrMo17	–	–	40X16M	–
1.2323	48CrMoV6-7	45 CDV 6	–	5XMф	–
1.2330	35CrMo4		BP 20		P 20 (AISI)
1.2341	6CrMo15-5				P 4 (AISI)
1.2343	X37CrMoV5-1	X38CrMoV5	BH 11	4Ch5MFS	H 11 (AISI)
1.2344	X40CrMoV5-1	X40CrMoV5	BH 13	4Ch5MF1S	H 13 (AISI)
1.2357	50CrMoV13-14	50 CDV 13			
1.2363	X100CrMoV5	X100CrMoV5	BA 2	X5ΓM	A 2 (AISI)
1.2365	32CrMoV12-28	32 CDV 12-28	BH 10	3Ch3M3F	H 10 (AISI)
1.2367	X38CrMoV5-3	X38CrMoV5-3		4X5M3ф	
1.2369	81MoCrV42-16				613 (AISI)
1.2379	X153CrMoV12	X160CrMoV12	BD 2	X12Mф	D 2 (AISI)
1.2419	105WCr6	105 WC 13		XBΓ	
1.2436	X210CrW12	X210CrW12-1		X12B	
1.2510	100MnCrW4	90 MWCV 5	BO 1	XΓBф	O 1 (AISI)
1.2542	45WCrV7	45 WCV 20	BS 1	5XB2Cф	S 1 (AISI)
1.2550	60WCrV7			6XB2Cф	
1.2567	30WCrV17-2	X32WCrV5		3X2B4ф	
1.2581	X30WCrV9-3	X30WCrV9	BH 21	3X2B8ф	H 21 (AISI)
1.2606	X37CrMoW5-1	X35CrWMoV5	BH 12	H 12 (AISI)	
1.2662	X30WCrCoV9-3			4Ch3M2WFGS	
1.2706	X 3 NiCoMo 18 8 5			03N18K8M5T-WD	
1.2709	X3NiCoMoTi18-9-5			03N18K9M5T-WD	

Material No.	DIN	AFNOR	BS	GOST	USA
1.2713	55NiCrMoV6	55 NCDV 7	BH 224/5	5XH2Mф-Y	L 6 (AISI)
1.2714	55NiCrMoV7	–	–	5XH2Mф	L 6 (AISI)
1.2735	15NiCr14	–	–	–	P 6 (AISI)
1.2742	55CrNiMoV4-2-4	55 CNDV 4	–	–	–
1.2764	X19NiCrMo4	–	–	20XH4M	–
1.2766	35NiCrMo16	–	BP 30	35XH4M	–
1.2767	45NiCrMo16	–	–	45X2H4M	–
1.2769	G45CrNiMo4-2	–	–	–	–
1.2779	X6NiCrTi26-15	–	–	–	660 (AISI)
1.2782	X16CrNiSi25-20	X15CrNiSi25-20	–	–	–
1.2786	X13NiCrSi36-16	X15NiCrSi37-18	–	–	–
1.2787	X23CrNi17	X21CrNi17	–	–	–
1.2833	100V1	100V2	BW 2	–	W 210 (AISI)
1.2842	90MnCrV8	90 MV 8	BO 2	9Г2ф	O 2 (AISI)
1.2880	G-X 165 Cr Co Mo 12	–	–		
1.3202	HS12-1-4-5	–	BT 15	P12Mф4K5	T 15 (AISI)
1.3207	HS10-4-3-10	10-4-3-10	BT 42	P10M4ф3K10	
1.3243	HS6-5-2-5	6-5-2-5	BM 35	R6M5K5	
1.3245	HS6-5-2-5S	–	–	–	
1.3246	HS7-4-2-5	7-4-2-5	–	–	41 (AISI)
1.3247	HS2-9-1-8	2-9-1-8	BM 42	P2M10K8ф	M 42 (AISI)
1.3249	HS2-9-2-8	–	BM 34	–	M 33 (AISI)
1.3255	HS18-1-2-5	18-1-1-5	BT 4	P18Mф2K5	T 4 (AISI)
1.3257	HS18-1-2-15	–	–	–	–
1.3265	HS18-1-2-10	–	BT 5	–	T 5 (AISI)
1.3302	HS12-1-4	–	–	P12Mф4	–
1.3318	HS12-1-2	–	–	P12Mф2	–
1.3333	HS3-3-2	–	–	P12Mф2	–
1.3339	HS6-5-2	–	–	–	–
1.3340	HS6-5-2CS	–	–	–	–
1.3341	HS6-5-2S	-	–	–	–
1.3342	HS6-5-2C	6-5-2 HC	–	P6M5ф3	3 Class 1
1.3343	HS6-5-2	6-5-2	BM 2	R6M5	611 (AISI)
1.3344	HS6-5-3	6-5-3	–	P6M5ф3	M 3 Class 1
1.3345	HS6-5-3C	–	–	–	–
1.3346	HS2-9-1	2-8-1	BM 1	P2M9ф	H 41 (AISI)
1.3348	HS2-9-2	2-9-2	–	P2M9ф2	M 7 (AISI)
1.3355	HS18-0-1	18-0-1	BT 1	R18	T 1 (AISI)

Material No.	DIN	AFNOR	BS	GOST	USA
1.3401	X120Mn12	–	BW 10	110G13L	–
1.3402	X110Mn14	–	–	Np-G13A	–
1.3501	100Cr2	100Cr2	–	WX4	E 50100 (SAE)
1.3503	105 Cr 4	–	–	–	E 51100 (AISI)
1.3505	100Cr6	100 C 6	2 S.135	WX15	E 52100 (SAE)
1.3520	100CrMn6	100 CM 6	–	WX15CГ	–
1.4000	X6Cr13	X6Cr13	403 S 17	08X13	403 (AISI)
1.4001	G-X 7 Cr 13	–	–	–	410 S (AISI)
1.4002	X6CrAl13	X6CrAl13	405 S 17	–	405 (AISI)
1.4003	X 2 Cr 11	X2CrNi12	X2CrNi12	–	–
1.4005	X12CrS13	X12CrS13	416 S 21	12X13-Y	416 (AISI)
1.4006	X12Cr13	X12Cr13	1630 grade A	12X13	410 (AISI)
1.4007	X35Cr14	–	–	Np-40Ch13	–
1.4008	GX7CrNiMo12-1	GX7CrNiMo12-1	GX7CrNiMo12-1	–	–
1.4010	X2Cr17	X2Cr17	–	–	–
1.4011	GX12Cr12	GX12Cr12	GX12Cr12	–	–
1.4016	X6Cr17	X6Cr17	430 S 15	08X17	430 (AISI)
1.4017	X6CrNi17-1	X6CrNi17-1	X6CrNi17-1	–	–
1.4021	X20Cr13	X20Cr13	420 S 37	20X13	420 (AISI)
1.4024	X15Cr13	Z 12 C 13 M	420 S 29	20X13	420 (SAE)
1.4027	GX20Cr14	X30Cr13	1630 grade B	28ГМ	–
1.4028	X30Cr13	X29CrS13	420 S 45	30X13	–
1.4029	X29CrS13	X39Cr13	X29CrS13	–	–
1.4031	X39Cr13	X46Cr13	X39Cr13	40X13	–
1.4034	X46Cr13	X45CrS13	X46Cr13	46X13	–
1.4035	X45CrS13	–	–	–	–
1.4037	X65Cr13	X17CrNi16-2	–	65Ch13	–
1.4057	X17CrNi16-2	Z 20 CN 17.2 M	431 S 29	17X16H2	431 (AISI)
1.4059	GX22CrNi17	–	ANC 2	–	–
1.4086	GX120Cr29	X6CrNiMo12	1648 grade B 1	–	–
1.4102	X6CrNiMo12	X14CrMoS17	–	–	–
1.4104	X14CrMoS17	X14CrMoS17	X14CrMoS17	–	430 F (AISI)
1.4105	X6CrMoS17	X6CrMoS17	X6CrMoS17	–	–
1.4106	X2CrMoSiS18-2-1	X2CrMoSiS18-2-1	–	–	–
1.4107	GX8CrNi12	–	GX8CrNi12	–	–
1.4109	X70CrMo15	X70CrMo15	X70CrMo15	–	–
1.4110	X55CrMo14	Z 50 CD 15 Cl	–	–	–
1.4112	X90CrMoV18	X 89 CrMoV 18-1	X90CrMoV18	90X18Mф	440 B (AISI)

Material No.	DIN	AFNOR	BS	GOST	USA
1.4114	X6CrMoS19-2	X6CrMoS19-2	–	–	–
1.4116	X50CrMoV15	X50CrMoV15	X50CrMoV15	–	–
1.4118	X40CrMo15	X40CrMo15	–	20ХГМ	–
1.4120	GX20CrMo13	–	–	–	–
1.4121	X22CrMoNiS13-1	X22CrMoNiS13-1	–	–	–
1.4122	GX35CrMo17	X38CrMo16-1	X39CrMo17-1	39X17M	–
1.4125	X105CrMo17	X105CrMo17	X105CrMo17	110Ch18M-SChD	440 C (AISI)
1.4136	GX70CrMo29-2	Z 60 CD 29.2 M	–	–	–
1.4300	X 12 CrNi 18 8	–	302 S 25	–	–
1.4301	X5CrNi18-10	X5CrNi18-10	302 S 17	08Ch18N10	304 (AISI)
1.4302	X5CrNi19-9	–	308 S 96	Sw-04Ch19N9	–
1.4303	X4CrNi18-12	X4CrNi18-12	305 S 17	06Ch18N11	305 (L) (AISI)
1.4305	X8CrNiS18-9	X8CrNiS18-9	303 S 22	10X18H9-Y	303 (AISI)
1.4306	X2CrNi19-11	X2CrNi19-11	1631 grade C	03Ch18N11	304 L (AISI)
1.4307	X2CrNi18-9	X2CrNi18-9	X2CrNi18-9	03X18H9	
1.4308	GX5CrNi19-10	GX5CrNi19-10	1631 grade A	07Ch18N9L	304 H (SAE)
1.4309	GX2CrNi19-11	GX2CrNi19-11	1631 grade C	–	–
1.4310	X 12 CrNi 17 7	X10CrNi18-8	301 S 21	–	301 (AISI)
1.4311	X2CrNiN18-10	X2CrNiN18-10	304 S 61	–	304 LN (AISI)
1.4312	GX10CrNi18-8	Z 10 CN 18.9 M	1631 grade D	10Ch18N9L	–
1.4313	X3CrNiMo13-4	X3CrNiMo13-4	425 C 11	03X13H4M	S 41500 (AISI)
1.4316	X1CrNi19-9	Z 1 CN 20-10	308 S 92	Sw-01Ch19N9	–
1.4317	GXZ5CrNi13-4	X4CrNi13-4	425 C 11	–	–
1.4318	X2CrNiN18-7	X2CrNiN18-7	X2CrNiN18-7	–	–
1.4319	X3CrNiN17-8	X3CrNiN17-8	301 S 26	–	–
1.4324	–	–	302 S 26	–	302 (SAE)
1.4332	X2CrNi24-12	Z 2 CNS 25-13	309 S 92	–	–
1.4333	X 5 NiCr 32 21	–	–	–	330 (AISI)
1.4335	X1CrNi25-21	X1CrNi25-21	X1CrNi25-21	–	–
1.4337	X10CrNi30-9	Z 10 CN 30-09	312 S 94	–	–
1.4347	GX6CrNiN26-7	GX6CrNiN26-7	GX6CrNiN26-7	–	–
1.4361	X1CrNiSi18-15-4	X1CrNiSi18-15-4	X1CrNiSi18-15-4	–	–
1.4362	X2CrNiN23-4	X2CrNiN23-4	X2CrNiN23-4	–	–
1.4370	X15CrNiMn18-8	Z 8 CNM 19-09-07	307 S 98	–	–
1.4371	X2CrMnNiN17-7-5	X2CrMnNiN17-7-5	202 S 16	–	202 (AISI)
1.4372	X12CrMnNiN17-7-5	X12CrMnNiN17-7-5	X12CrMnNiN17-7-5	–	–
1.4373	X12CrMnNiN18-9-5	X12CrMnNiN18-9-5	284 S 16	–	–
1.4375	X2CrMnNiN20-9-7	X2CrMnNiN20-9-7	–	–	S 21904 (AISI)

Material No.	DIN	AFNOR	BS	GOST	USA
1.4401	X5CrNiMo17-12-2	X5CrNiMo17-12-2	316 S 17	08X17H13M2	316 (AISI)
1.4403	X5CrNiMo19-11	–	316 S 96	–	–
1.4404	X2CrNiMo17-12-2	X2CrNiMo17-12-2	1632 grade F	03X17H13M2	–
1.4405	GX4CrNiMo16-5-1	GX4CrNiMo16-5-1	1632 grade F	–	–
1.4406	X2CrNiMoN17-11-2	X2CrNiMoN17-11-2	316 S 61	–	316 LN (AISI)
1.4408	GX5CrNiMo19-11-2	GX5CrNiMo19-11-2	1632 grade B	07Ch18N10G2S2M2L	–
1.4409	GX2CrNiMo19-11-2	GX2CrNiMo19-11-2	GX2CrNiMo19-11-2	–	–
1.4410	X2CrNiMoN25-7-4	X2CrNiMoN25-7-4	X2CrNiMoN25-7-4	–	S 32750 (AISI)
1.4411	GX4CrNiMo16-5-2	GX4CrNiMo16-5-2	GX4CrNiMo16-5-2	–	–
1.4412	GX5CrNiMo19-11-3	GX5CrNiMo19-11-3	GX5CrNiMo19-11-3	–	–
1.4413	X 3 CrNiMo 13 4	X3CrNiMo13-4	–	–	S 41500 (AISI)
1.4416	GX2NiCr-MoN25-20-5	GX2NiCr-MoN25-20-5	GX2NiCr-MoN25-20-5	–	–
1.4417	GX2CrNiMoN25-7-3	GX2CrNiMoN25-7-3	GX2CrNiMoN25-7-3	–	S 31500 (AISI)
1.4418	X4CrNiMo16-5-1	X4CrNiMo16-5-1	X4CrNiMo16-5-1	–	–
1.4420	X 5 CrNiMo 18 11	–	315 S 16	–	–
1.4429	X2CrNiMoN17-13-3	X2CrNiMoN17-13-3	316 S 63	–	316 LN (AISI)
1.4430	X2CrNiMo19-12	Z 2 CND 19-12-03	316 S 92	–	–
1.4431	X12CrNiMo19-10	Z 8 CND 18.10.3 M	–	–	–
1.4432	X2CrNiMo17-12-3	X2CrNiMo17-12-3	316 S 12	06Ch17N13M3-WD	–
1.4434	X2CrNiMoN18-12-4	X2CrNiMoN18-12-4	X2CrNiMoN18-12-4	–	–
1.4435	X2CrNiMo18-14-3	X2CrNiMo18-14-3	1632 grade F	03Ch17N14M3	316 L (AISI)
1.4436	X3CrNiMo17-13-3	X3CrNiMo17-13-3	316 S 19	05X17H13M3	316 (AISI)
1.4437	GX6CrNiMo18-12	Z 4 CND 19.13 M	–	08X17H13M2	316 (SAE)
1.4438	X2CrNiMo18-15-4	X2CrNiMo18-15-4	317 S 12	–	317 L (AISI)
1.4439	GX3CrNi-MoN17-13-5	X2CrNiMoN17-13-5	X2CrNiMoN17-13-5	–	–
1.4441	X2CrNiMo18-15-3	X2CrNiMo18-15-3	–	–	–
1.4442	X2CrNiMoN18-15-4	Z 3 CND 19-14 Az	–	–	–
1.4446	GX2CrNi-MoN17-13-4	GX2CrNi-MoN17-13-4	GX2CrNi-MoN17-13-4	–	–
1.4448	GX6CrNiMo17-13	–	1632 grade A	–	–
1.4449	X3CrNiMo18-12-3	–	317 S 16	–	317 (AISI)
1.4454	–	–	–	–	S 21900 (AISI)
1.4458	GX2NiCrMo28-20-2	GX2NiCrMo28-20-2	GX2NiCrMo28-20-2	–	–
1.4459	X8CrNiMo23-13	Z 3 CND 22-15-03	–	–	–
1.4460	X3CrNiMoN27-5-2	X3CrNiMoN27-5-2	X3CrNiMoN27-5-2	10Ch26N5M	329 (AISI)
1.4462	X2CrNiMoN22-5-3	X2CrNiMoN22-5-3	318 S 13	03X22H5AM3	S 31803 (AISI)
1.4465	X1CrNiMoN25-25-2	–	–	02Ch25N22AM2-PT	310 MoLN (AISI)
1.4466	X1CrNiMoN25-22-2	X1CrNiMoN25-22-2	X1CrNiMoN25-22-2	–	–
1.4468	GX2CrNiMoN25-6-3	GX2CrNiMoN25-6-3	GX2CrNiMoN25-6-3	03Ch24N6AM3	–

Material No.	DIN	AFNOR	BS	GOST	USA
1.4469	GX2CrNiMoN26-7-4	GX2CrNiMoN26-7-4	GX2CrNiMoN26-7-4	–	S 32615 (AISI)
1.4470	GX2CrNiMoN22-5-3	GX2CrNiMoN22-5-3	GX2CrNiMoN22-5-3	–	–
1.4500	GX7NiCrMoCuNb25-20	Z 3 NCDU 25.20 M	332 C 11	–	–
1.4501	X2CrNiMoCuWN25-7-4	X2CrNiMoCuWN25-7-4	X2CrNiMoCuWN25-7-4	–	–
1.4502	X8CrTi18	X8CrTi18	–	–	–
1.4504	–	–	–	–	631 (AISI)
1.4507	X2CrNiMoCuN25-6-3	X2CrNiMoCuN25-6-3	X2CrNiMoCuN25-6-3	–	–
1.4508	GX2CrNiMoCuWN25-8-4	Z 4 CNUD 17-11-03 FF	–	–	–
1.4509	X2CrTiNb18	X2CrTiNb18	X2CrTiNb18	–	–
1.4510	X3CrTi17	X3CrTi17	X3CrTi17	05X17T	430 Ti (AISI)
1.4511	X3CrNb17	X3CrNb17	X3CrNb17	–	–
1.4512	X2CrTi12	X2CrTi12	409 S 19	–	409 (AISI)
1.4513	X2CrMoTi17-1	X2CrMoTi17-1	X2CrMoTi17-1	–	
1.4516	X6CrNiTi12	X6CrNiTi12	X6CrNiTi12	–	–
1.4517	GX2CrNiMoCuN25-6-3-3	GX2CrNiMoCuN25-6-3-3	GX2CrNiMoCuN25-6-3-3	–	–
1.4519	X2CrNiMoCu20-25	–	904 S 92	–	–
1.4520	X2CrTi17	X2CrTi17	X2CrTi17	–	–
1.4521	X2CrMoTi18-2	X2CrMoTi18-2	X2CrMoTi18-2	20XH2M	443 (AISI)
1.4522	X2CrMoNb18-2	–	–	–	443 (AISI)
1.4523	X2CrMoTiS18-2	X2CrMoTiS18-2	X2CrMoTiS18-2	–	–
1.4525	GX5CrNiCu16-4	GX5CrNiCu16-4	GX5CrNiCu16-4	–	–
1.4526	X6CrMoNb17-1	X6CrMoNb17-1	X6CrMoNb17-1	–	–
1.4527	GX4NiCrCuMo30-20-4	GX4NiCrCuMo30-20-4	GX4NiCrCuMo30-20-4	–	–
1.4529	X1NiCrMoCuN25-20-7	X1CrNiMoCuN25-20-7	X1NiCrMoCuN25-20-7	–	N 08926 (AISI)
1.4532	X8CrNiMoAl15-7-2	X8CrNiMoAl15-7-2	X8CrNiMoAl15-7-2	–	631 (AISI)
1.4533	X6CrNiTi18-10S	–	–	05Ch18N10T	–
1.4534	X3CrNiMoAl13-8-2	–	–	–	–
1.4537	X1CrNiMoCuN25-25-5	X1CrNiMoCuN25-25-5	X1CrNiMoCuN25-25-5	–	–
1.4539	X1NiCrMoCu25-20-5	X1NiCrMoCu25-20-5	904 S 13	–	904 L (AISI)
1.4540	GX4CrNiCuNb16-4	Z 4 CNUNb 16.4 M	–	–	–
1.4541	X6CrNiTi18-10	X6CrNiTi18-10	321 S 12	08X18H10T	321 (AISI)
1.4542	X5CrNiCuNb16-4	X5CrNiCuNb16-4	X5CrNiCuNb16-4	–	630 (AISI)
1.4543	X3CrNiCuTi12-9	–	2 T.66	–	–
1.4544	–	–	2 S.129	08X18H1OT	321 (SAE)
1.4545	–	–	–	–	S 15500 (AISI)
1.4546	X5CrNiNb18-10	–	2 S.130	–	347 (SAE)
1.4547	X1CrNiMoCuN20-18-7	X1CrNiMoCuN20-18-7	X1CrNiMoCuN20-18-7	–	S 31254 (AISI)
1.4548	X5CrNiCuNb17-4-4	–	–	–	630 (AISI)

Material No.	DIN	AFNOR	BS	GOST	USA
1.4550	X6CrNiNb18-10	X6CrNiNb18-10	347 S 20	08Ch18N12B	347 (AISI)
1.4551	X5CrNiNb19-9	Z 6 CNNb 20-10	–	–	–
1.4552	GX5CrNiNb19-11	GX5CrNiNb19-11	1631 grade B	–	–
1.4555	X2CrNiNb21-10	–	347 S 96	–	–
1.4557	GX2CrNiMoCuN20-18-6	GX2CrNiMoCuN20-18-6	GX2CrNiMoCuN20-18-6	–	–
1.4559	G-X 7 NiCrMoCuNb 42 20	–	–	–	–
1.4560	X3CrNiCu19-9-2	X3CrNiCu19-9-2	X3CrNiCu19-9-2	–	–
1.4563	X1NiCrMoCu31-27-4	X1NiCrMoCu31-27-4	X1NiCrMoCu31-27-4	–	–
1.4564	–	–	–	–	631 (AISI)
1.4565	X2CrNiMnMoN-bN25-18-5-4	–	–	–	S 34565 (AISI)
1.4567	X 3 CrNiCu 18 9	X3CrNiCu18-9-4	394 S 17	–	–
1.4568	X7CrNiAl17-7	X7CrNiAl17-7	301 S 81	09Ch17N7Ju1	631 (AISI)
1.4570	X6CrNiCuS18-9-2	X6CrNiCuS18-9-2	X6CrNiCuS18-9-2	–	–
1.4571	X6CrNiMoTi17-12-2	X6CrNiMoTi17-12-2	320 S 18	08Ch16N11M3T	316 Ti (AISI)
1.4573	GX3CrNiMoCuN24-6-5	–	320 S 33	08Ch17N13M2T	316 Ti (AISI)
1.4574	–	Z 9 CNDA 15-07	–	–	631 (AISI)
1.4575	X1CrNiMoNb28-4-2	–	–	–	S 32803 (AISI)
1.4576	X5CrNiMoNb19-12	Z 4 CNDSNb 19-12-03	18 S 96	–	–
1.4578	X3CrNiCuMo17-11-3-2	X3CrNiCuMo17-11-3-2	X3CrNiCuMo17-11-3-2	–	–
1.4580	G-X 10 CrNiMoNb 18 10	X6CrNiMoNb17-12-2	318 S 17	08X17H13M2T	316 Cb (AISI)
1.4581	X5CrNiMoNb19-11-2	GX5CrNiMoNb19-11-2	1632 grade C	–	–
1.4583	GX10CrNiMoNb18-12	–	–	–	–
1.4584	GX2NiCrMoCu25-20-5	GX2NiCrMoCu25-20-5	GX2NiCrMoCu25-20-5	–	–
1.4587	GX2NiCrMoCuN29-25-5	GX2NiCrMoCuN29-25-5	GX2NiCrMoCuN29-25-5	–	–
1.4588	GX2NiCrMoCuN25-20-6	GX2NiCrMoCuN25-20-6	GX2NiCrMoCuN25-20-6	–	–
1.4590	X2CrNbZr17	X2CrNbZr17	X2CrNbZr17	–	–
1.4592	X2CrMoTi29-4	X2CrMoTi29-4	X2CrMoTi29-4	–	–
1.4594	X5CrNiMoCuNb14-5	X5CrNiMoCuNb14-5	X5CrNiMoCuNb14-5	–	–
1.4601	X6CrNb12	–	–	–	–
1.4602	X4CrCu17-1	–	–	–	–
1.4603	X1CrTi17	–	–	–	–
1.4604	X2CrTi20	–	–	–	–
1.4605	X2CrAlTi18-2	–	X2CrAlTi18-2	–	–
1.4650	X2CrNiCu19-10	–	–	–	–
1.4651	6CrNiCuS18-9-4	–	–	–	HNV 2 (SAE)
1.4704	45SiCr16-11	–	–	–	–
1.4710	GX30CrSi6	–	–	–	–
1.4713	X10CrAl7	–	X10CrAlSi7	12X7ClO	–

Material No.	DIN	AFNOR	BS	GOST	USA
1.4718	G-X 45 CrSi 9 3	X45CrSi9-3	401 S 45	45X9C3	HNV 3 (SAE)
1.4720	X7CrTi12	–	–	–	409 (AISI)
1.4724	X10CrAl13	Z 13 C 13	X10CrAlSi13	10Ch13SJu	–
1.4725	CrAl 14 4	–	–	–	–
1.4731	X40CrSiMo10-2	X40CrSiMo10-2	X40CrSiMo10-2	40Ch10S2M	–
1.4736	X3CrAlTi18-2	–	X3CrAlTi18-2	–	–
1.4742	X10CrAl18	Z 12 CAS 18	X10CrAlSi18	15Ch18SJu	–
1.4745	GX40CrSi23	–	–	–	–
1.4747	X 80 CrNiSi 20	–	–	–	HNV 6 (SAE)
1.4748	X85CrMoV18-2	X85CrMoV18-2	X85CrMoV18-2	–	
1.4749	X18CrN28	–	X18CrN28	–	–
1.4762	X10CrAl24	Z 12 CAS 25	X10CrAlSi25	–	446 (AISI)
1.4763	X8Cr24	X8Cr24	–	–	–
1.4765	CrAl 25 5	–	—	Ch23Ju5T	–
1.4767	CrAl 20 5	–	–	–	–
1.4768	CrAl 21 6	–	–	–	–
1.4776	GX40CrSi28	–	–	–	–
1.4818	X6CrNiSiNCe19-10	–	X6CrNiSiNCe19-10	–	S 30415 (AISI)
1.4820	G-X 12 CrNi 26 5	–		–	–
1.4821	X15CrNiSi25-4	–	X15CrNiSi25-4	–	–
1.4825	GX25CrNiSi18-9	–	–	–	302 mod. (SAE)
1.4826	GX40CrNiSi22-10	–	–	–	–
1.4828	X15CrNiSi20-12	Z 17 CNS 20-12	309 S 24	20Ch20N14S2	309 (AISI)
1.4829	X12CrNi22-12	–	309 S 94	–	–
1.4832	GX25CrNiSi20-14	–	–	20Ch20N14S2L	–
1.4833	X 7 CrNi 23 14	Z 15 CN 23-13	309 S 24	–	309 S (AISI)
1.4835	X9CrNiSiNCe21-11-2	–	X9CrNiSiNCe21-11-2	–	S 30815 (AISI)
1.4837	GX40CrNiSi25-12	–	1648 grade E	40Ch24N12SL	–
1.4840	GX15CrNi25-20	–	–	15Ch23N18L	–
1.4841	X15CrNiSi25-20	Z 15 CNS 25-20	314 S 25	20Ch25N20S2	310 (AISI)
1.4842	X12CrNi25-20	Z 12 CN 26-21	310 S 94	–	–
1.4843	CrNi 25 20	–	–	ChN20JuS	–
1.4845	X12CrNi25-21	Z 12 CN 26-21	310 S 16	08X25H10	310 S (AISI)
1.4846	X40CrNi25-21	–	310 S 98	–	–
1.4847	X8CrNiAlTi20-20	–	–	–	334 (AISI)
1.4848	GX40CrNiSi25-20	–	1648 grade F	–	–
1.4849	GX40NiCrSiNb38-18	–	–	–	–
1.4852	G40NiCrSiNb35-26	–	–	–	–

Material No.	DIN	AFNOR	BS	GOST	USA
1.4854	X6NiCrSiNCe35-25	–	X6NiCrSiNCe35-25	–	–
1.4855	GX30CrNiSiNb24-24	–	–	–	–
1.4857	GX40NiCrSi35-25	–	–	–	–
1.4859	GX10NiCrNb32-20	–	–	–	–
1.4860	NiCr 30 20	–	–	–	–
1.4864	X12NiCrSi35-16	Z 20 NCS 33-16	NA 17	–	330 (AISI)
1.4865	GX40NiCrSi38-18	–	330 C 11	–	
1.4866	X33CrNiMnN23-8	X33CrNiMnN23-8	X33CrNiMnN23-8	–	EV 16 (SAE)
1.4870	X53CrMnNiNbN21-9	X53CrMnNiNbN21-9	352 S 52	–	–
1.4871	X53CrMnNiN21-9	X53CrMnNiN21-9	349 S 52	55Ch20G9AN4	EV 8 (SAE)
1.4872	X25CrMnNiN25-9-7	–	X25CrMnNiN25-9-7	–	–
1.4873	X45CrNiW18-9	–	–	–	–
1.4875	X55CrMnNiN20-8	X55CrMnNiN20-8	X55CrMnNiN20-8	–	EV 12 (SAE)
1.4876	X10NiCrAlTi32-20	Z 10 NC 32-21	NA 15	–	N 08800 (AISI)
1.4877	X6NiCrNbCe32-27	–	X6NiCrNbCe32-27	–	–
1.4878	X12CrNiTi18-9	Z 6 CNT 18-10	321 S 31	–	–
1.4882	X50CrMnNiNbN21-9	–	X50CrMnNiNbN21-9	–	XEV-F (SAE)
1.4886	X10NiCrSi35-19	–	X10NiCrSi35-19	–	–
1.4887	X10NiCrSiNb35-22	–	X10NiCrSiNb35-22	–	–
1.4891	X 4 CrNiSiN 18 10	–	–	–	S 30415 (AISI)
1.4893	X 8 CrNiSiN 21 11	–	–	–	S 30815 (AISI)
1.4903	X10CrMoVNb9-1	X10CrMoV9-1	–	–	–
1.4909	X2CrNiMoN17-12-2	–	S.161	–	–
1.4910	X3CrNi- MoBN17-13-3	–	X3CrNi- MoBN17-13-3	–	–
1.4911	X8CrCoNiMo10-6	Z 9 CKD 11	S.152	–	–
1.4912	X7CrNiNb18-10	X7CrNiNb18-10	–	–	–
1.4913	X19CrMoNbVN11-1	Z 21 CDNbV 11	X19CrMoNbVN11-1	–	–
1.4919	X6CrNiMo17-13	X6CrNiMoB17-12-2	316 S 50	10X18H13M2	316 H (AISI)
1.4922	X20CrMoV11-1	X20CrMoV11-1	762	–	–
1.4923	X22CrMoV12-1	X19CrMoNbVN11-1	X22CrMoV12-1	–	–
1.4928	G-X 12 CrNiMoCoVN 12	–	–	–	–
1.4931	GX23CrMoV12-1	GX23CrMoV12-1	–	–	–
1.4935	X20CrMoWV12-1	–	–	–	422 (AISI)
1.4938	X11CrNiMoN12	X12CrNiMoV12-3	X12CrNiMoV12-3	–	–
1.4939	X12CrNiMo12	Z 12 CNDV 12-03	S.151	–	S 64152 (AISI)
1.4941	X6CrNiTiB18-10	X6CrNiTiB18-10	321 S 51	–	–
1.4943	X4NiCrTi25-15	Z 5 NCTDV 25-15 B	HR 251	–	660 (AISI)
1.4944	–	–	HR 51	–	660 (AISI)

Material No.	DIN	AFNOR	BS	GOST	USA
1.4948	X6CrNi18-10	X6CrNi18-10	304 S 50	10X20H10	304 H (AISI)
1.4949	X3CrNiN18-11	–	304 S 51	–	–
1.4958	X5NiCrAlTi31-20	Z 8 NC 33-21	NA 15	–	N 08810 (AISI)
1.4959	X8NiCrAlTi32-21	Z 8 NC 33-21	NA 15	–	–
1.4961	X8CrNiNb16-13	–	347 S 51	–	–
1.4971	X12CrCoNi21-20	–	–	–	661 (AISI)
1.4980	X5NiCrTi26-15	–	–	–	–
1.4982	X10CrNi-MoMnNbVB15-10-1	X10CrNi-MoMnNbVB15-10-1	X10CrNi-MoMnNbVB15-10-1	–	–
1.4986	X7CrNiMoBNb16-16	X7CrNiMoBNb16-16	X7CrNiMoBNb16-16	–	–
1.4988	G-X 8 CrNiMoVNb 16 13	–	–	–	–
1.5023	38Si7	40Si7	–	–	–
1.5024	46Si7	46 S 7	–	–	–
1.5025	51Si7	50 S 7	–	–	–
1.5026	55Si7	55 S 7	251 A 58	55S2	9255 (SAE)
1.5027	60Si7	60 S 7	251 A 60	60S2	9260 (SAE)
1.5029	71Si7	–	–	70S2ChA	
1.5069	36Mn7	–	–	–	1340 H (SAE)
1.5121	46MnSi4	–	–	–	–
1.5122	37MnSi5	38 MS 5	–	–	–
1.5128	10 MnSi 4 4	–	–	–	–
1.5403	17MnMoV6-4	–	271	–	–
1.5406	17MoV8-4	–	–	–	–
1.5415	15 Mo 3	15 D 3	16Mo3	15M	–
1.5419	G20Mo5	–	243-430	–	4422 (SAE)
1.5422	G18Mo5	–	G18Mo5	–	–
1.5423	16Mo5	–	–	–	4419 (SAE)
1.5430	G8MnMo7-4	–	–	–	–
1.5506	17MnB3	–	9/0	–	–
1.5509	23B2	25 B 3	–	–	–
1.5510	28B2	25 B 3	–	–	–
1.5511	35B2	35 B 3	35B2	–	–
1.5523	19MnB4	19MnB4	19MnB4	–	15B21 H (SAE)
1.5527	40MnB4	–	10/1	–	–
1.5530	20MnB5	20 MB 5	20MnB5	–	–
1.5531	30MnB5	30 MB 5	30MnB5	–	–
1.5532	38MnB5	38 MB 5	38MnB5	40GR	–
1.5621	G10Ni6	–	–	–	–
1.5622	14Ni6	16 N 6	–	–	–

Material No.	DIN	AFNOR	BS	GOST	USA
1.5633	24Ni8	20 N 8	–	–	–
1.5636	G9Ni10	–	G9Ni10	–	–
1.5637	10 Ni 14	12 N 14	12Ni14	–	–
1.5638	G9Ni14	–	503 LT 60	–	–
1.5639	16 Ni 14	–	–	–	2317 (SAE)
1.5662	G-X 8 Ni 9	9 Ni	502-650	–	–
1.5663	X7Ni9	X7Ni9	510	–	–
1.5680	12Ni19	12Ni19	12Ni19	–	2515 (SAE)
1.5681	GS-10 Ni 19	–	–	–	2512 (SAE)
1.5710	36 NiCr 6	30 NC 6	–	–	3135 (SAE)
1.5711	40NiCr6	–	–	40ChN	3140 (SAE)
1.5713	13NiCr6	–	–	–	3115 (SAE)
1.5714	16NiCr4	16NiCr4	16NiCr4	16XΓH	–
1.5715	16NiCrS4	16NiCrS4	16XΓH-Y	–	–
1.5732	14NiCr10	16 NC 11	–	–	3415 (SAE)
1.5736	36NiCr10	30 NC 11	–	–	3435 (SAE)
1.5737	30NiCr11	30 NC 12	–	–	–
1.5752	14NiCr14	10 NC 12	15NiCr13	17XH3	3310 (SAE)
1.5755	31 NiCr 14	18 NC 13	–	–	–
1.5805	10NiCr5-4	10NiCr5-4	10NiCr5-4	10XΓH1	–
1.6523	20NiCrMo2-2	20 NCD 2	20NiCrMo2-2	20XΓHM	8615 (SAE)
1.6526	20NiCrMoS2-2	20NiCrMoS2-2	20NiCrMoS2-2	20XΓHM-Y	–
1.6528	GS-60 NiCrMo 2	–	–	–	8660 (SAE)
1.6541	23MnNiCrMo5-2	23 MNCD 5	–	–	–
1.6543	21 NiCrMo 2 2		805 A 20	–	8622 (SAE)
1.6545	30NiCrMo2-2	30 NCD 2	–	–	8630 (SAE)
1.6546	40NiCrMo2-2	40 NCD 2	7	38ChGNM	8640 (SAE)
1.6552	G24CrNiMo3-2-5	–	–	–	–
1.6562	40 NiCrMo 8 4	–	817 M 40	–	4337 (SAE)
1.6563	41NiCrMo7-3-2	41NiCrMo7-3-2	41NiCrMo7-3-2	–	–
1.6565	40NiCrMo6	–	818 M 40	40XΓH2M	4340 (SAE)
1.6566	17NiCrMo6-4	17NiCrMo6-4	17NiCrMo6-4	17XΓH1M	–
1.6569	17NiCrMoS6-4	17NiCrMoS6-4	17NiCrMoS6-4	17XΓH1M-Y	–
1.6570	G30NiCrMo8-5	–	–	–	–
1.6571	20NiCrMoS6-4	20NiCrMoS6-4	20NiCrMoS6-4	20XΓH2M-Y	–
1.6580	30CrNiMo8	30 CND 8	30CrNiMo8	30X2H2M	–
1.6582	34CrNiMo6	34CrNiMo6	34CrNiMo6	34X2H2M	–
1.6587	17CrNiMo6	18 CND 6	18CrNiMo7-6	18X2ΓH2M	–

Material No.	DIN	AFNOR	BS	GOST	USA
1.6655	32NiCrMo12-5	30 NCD 12	–	–	–
1.6657	14NiCrMo13-4	14NiCrMo13-4	14NiCrMo13-4	14XH3M	9310 (SAE)
1.7015	15Cr3	12 C 3	523 M 15	–	5015 (SAE)
1.7016	17Cr3	17Cr3	17Cr3	17XΓ	5117 (SAE)
1.7023	38CrS2	38 C 2 u	38 C 2 u	38X-Y	–
1.7025	46CrS2	46CrS2	46CrS2	46X-Y	–
1.7030	28Cr4	28Cr4	28Cr4	28XΓ	5130 (SAE)
1.7033	34Cr4	32 C 4	32 C 4	35X	5132 (SAE)
1.7034	37Cr4	37Cr4	37Cr4	37X	5135 (SAE)
1.7035	41Cr4	41Cr4	41Cr4	40X	5140 (SAE)
1.7036	28CrS4	28CrS4	28CrS4	28XΓ-Y	–
1.7037	34CrS4	32 C 4 u	34CrS4	34X-Y	–
1.7038	37CrS4	37CrS4	37CrS4	37X-Y	–
1.7039	41CrS4	41CrS4	41CrS4	40X-Y	–
1.7102	54SiCr6	54SiCr6	–	–	9254 (SAE)
1.7106	55SiCr7	–	251 A 60	–	–
1.7108	60SiCr7	56SiCr7	–	–	9261 (SAE)
1.7117	52SiCrNi5	52SiCrNi5	–	–	–
1.7131	16MnCr5	16 MC 5	16MnCr5	16XΓ	5115 (SAE)
1.7137	60MnCrB3	–	–	–	–
1.7138	52MnCrB3	–	–	–	–
1.7139	16MnCrS5	16MnCrS5	16MnCrS5	16XΓ-Y	–
1.7147	20MnCr5	20 MC 5	20MnCr5	20XΓ	5120 (SAE)
1.7149	20MnCrS5	20MnCrS5	20MnCrS5	20XΓ-Y	–
1.7150	G20MnCr5	–	–	16XΓP	–
1.7160	16MnCrB5	16MnCrB5	16MnCrB5	–	–
1.7176	55Cr3	55 C 3	525 A 58	50ChGA	5155 (SAE)
1.7182	27MnCrB5-2	27MnCrB5-2	27MnCrB5-2	–	–
1.7185	33MnCrB5-2	33MnCrB5-2	33MnCrB5-2	–	–
1.7189	39MnCrB6-2	39MnCrB6-2	39MnCrB6-2	–	–
1.7190	58 CrMnB 4	–	–	–	51B60 (SAE)
1.7213	25CrMoS4	25 CD 4 u	25CrMoS4	25XM-Y	–
1.7214	–	–	2 S.142	–	–
1.7218	25CrMo4	25 CD 4	25CrMo4	25XM	4130 (SAE)
1.7220	34CrMo4	34 CD 4	34CrMo4	34XM	4130 (SAE)
1.7221	G26CrMo4	–	–	–	–
1.7222	42CrMoPb4	–	–	35ChML	–
1.7223	41CrMo4	–	5/1	40ChFA	4142 (SAE)

Material No.	DIN	AFNOR	BS	GOST	USA
1.7225	42CrMo4	40 CD 4	42CrMo4	42XM	4140 (SAE)
1.7226	34CrMoS4	34 CD 3 u	34CrMoS4	34XM-Y 35XM	–
1.7227	42CrMoS4	42 CD 4 u	42CrMoS4	42XM-Y	–
1.7228	50CrMo4	50CrMo4	50CrMo4	50XM	4147 (SAE)
1.7233	42CrMo5-6	42CrMo5-6	42CrMo5-6	–	–
1.7242	16CrMo4	15 CD 3.5	–	–	–
1.7243	18CrMo4	18 CD 4	18CrMo4	18XM	–
1.7244	18CrMoS4	18CrMoS4	18CrMoS4	18XM-Y	–
1.7262	15CrMo5	12 CD 4 FF	–	–	–
1.7276	10CrMo11	CD 10	–	–	–
1.7281	16CrMo9-3	20 CD 8	–	–	–
1.7311	20 CrMo 2	–	–	–	–
1.7315	37 CrMo 3	–	–	–	–
1.7319	20MoCrS3	20MoCrS3	20MoCrS3	20XM-Y	–
1.7320	20MoCr3	20MoCr3	20MoCr3	20XM	–
1.7321	20MoCr4	20MoCr4	20MoCr4	20XГM	4118 (SAE)
1.7323	20MoCrS4	20MoCrS4	20MoCrS4	20XГM-Y	–
1.7333	22CrMoS3-5	22CrMoS3-5	22CrMoS3-5	22XГM-Y	–
1.7335	13 CrMo 4 4	13CrMo4-5	13CrMo4-5	13X;	–
1.7341	G34CrMo4-4	–	–	–	–
1.7353	1.7353	–	B 5	–	–
1.7354	G22CrMo5-4	–	–	–	–
1.7355	G17CrMnMo5-5	–	–	–	–
1.7357	G17CrMo5-5	–	621	–	–
1.7361	32CrMo12	–	722 M 24	–	–
1.7362	12 CrMo 19 5	X16CrMo5-1	625	12X5M	501 (AISI)
1.7363	GS-12 CrMo 19 5	–	–	–	–
1.7365	GX15CrMo5		625	–	–
1.7375	12CrMo9-10	12CrMo9-10	–	–	–
1.7377	G15CrMo9-10	–	–	–	–
1.7379	G17CrMo9-10	–	622	–	–
1.7380	10CrMo9-10	10CrMo9-10	10CrMo9-10	10X2M	–
1.7381	12CrMo12-10	12 CD 12.10	–	–	–
1.7383	11CrMo9-10	10 CD 9-10	11CrMo9-10	–	–
1.7386	X12CrMo9-1	–	629-470	–	504 (AISI)
1.7389	G-X 12 CrMo 10 1	–	B 6	–	–
1.7390	X15CrMo5-1	X15CrMo5-1	X15CrMo5-1	–	–
1.7503	67 CrV 2 2	–	–	70ChGFA	–

Material No.	DIN	AFNOR	BS	GOST	USA
1.7511	22CrV3	–	–	–	6118 (SAE)
1.7701	51CrMoV4	51 CDV 4	–	–	–
1.7706	G17CrMoV5-10	–	G17CrMoV5-10	–	–
1.7707	30CrMoV9	–	–	30Ch3MF	–
1.7709	21CrMoV5-7	21CrMoV5-7	21CrMoV5-7	–	–
1.7711	40CrMoV4-6	40CrMoV4-6	40CrMoV4-6	–	–
1.7715	14MoV6-3	14Mo6	660	–	–
1.8159	50 CrV 4	50 CV 4	51CrV4	50ХГф	6150 (SAE)
1.8507	34CrAlMo5	CAD 6.12	–	–	–
1.8509	41CrAlMo7	–	905 M 39	38Ch2MJuA	E 71400 (SAE)
2.4631	NiCr20TiAl	–	2 HR 201	–	HEV 5 (SAE)
2.4632	NiCr20Co18Ti	–	2 HR 2	–	HEV 6 (SAE)
2.4636	NiCo15Cr15MoAlTi	–	HR 4	–	–
2.4639	SG-NiCr20	–	NA 34	–	–
2.4650	NiCo20Cr20MoTi	–	2 HR 1	–	–
2.4652	EL-NiCr26Mo	–	–	–	S 32654 (AISI)
2.4654	NiCr19Co14Mo4Ti	–	–	–	XEV-H (SAE)
2.4660	NiCr20CuMo	–	–	–	N 08020 (AISI)
2.4665	NiCr22Fe18Mo	–	HR 204	–	–
2.4667	SG-NiCr19NbMoTi	–	NA 51	–	–
2.4668	NiCr19Fe19Nb5Mo3	–	–	–	XEV-I (SAE)
2.4669	NiCr15Fe7Ti2Al	NiCr15Fe7TiAl	NiCr15Fe7TiAl	–	688 (AISI)
2.4806	SG-NiCr20Nb	–	NA 35	–	–
2.4810	NiMo 30	Ni-Mo 28	ANC 15	–	–
2.4816	NiCr15Fe	–	HR 208	–	–
2.4819	NiMo16Cr15W	Ni-Mo 16 Cr 15	–	–	–
2.4831	SG-NiCr21Mo9Nb	–	–	–	–
2.4851	NiCr23Fe	–	NiCr23Fe	–	–
2.4854	NiFe33Cr25Co	–		–	S 35315 (AISI)
2.4856	NiCr22Mo9Nb	–	NA 21	–	–
2.4858	NiCr21Mo	–	NA 16	–	–
2.4867	NiCr60-15	–	–	Ch15N60	–
2.4869	NiCr 80 20	–	–	Ch20N80	–
2.4886	SG-NiMo16Cr16W	–	NA 48	–	–
1.4889	NiCr28FeSiCe	–	NiCr28FeSiCe	–	–
2.4951	NiCr20Ti	–	2 HR 504	–	–

Terminology A–L

A

A-E	Wrench head for standard locknut
A-E AX	Wrench head for slip-off proof locknut
A-E M	Wrench head for Mini locknut
A-E MS	Wrench head for Mini Speed locknut
A-E MX	Wrench head for intRlox® locknut
A-E P	Wrench head with profile for hexagon locknut
A-FLS	Roller-wrench-head
ANSI	American national standards institute
APC	Clamping insert for manual powRgrip® clamping unit PGC
APG	Clamping insert for automatic powRgrip® clamping unit PGU
AT1	Taper angle tolerance – gauge quality
AT3	taper angle tolerance
ATL	Tangs for Morsetaper shanks DIN 228-C

B

BT	Steep taper Norm BT MAS 403
BT+	Steep taper Norm BT+ licensed by BIG Daishowa Seiki

C

C3 – C8	REGO-FIX CAPTO sizes
CAPTO	Interface standard Capto licensed by Sandvik Coromant
CAT	Steep taper norm CAT (ASME 5.50)
CC	Chip cover for reduction sleeves
CGA	Coolant thread adapter for cylindrical toolholders
CPS	Cleaning paper set for powRgrip® taper cleaner
CRYO	Cryogen coolant
CTPG	Collet tray for powRgrip® collets
CYD	Cylindrical shank double toolholder
CYDF	Cylindrical shank double toolholder with clamping flat
CYL	Cylindrical shank toolholder
CYLF	Cylindrical shank toolholder with clamping flat

D

DS	Sealing disk
DSR	Tray for Sealing disks

E

E	Wrench for standard locknut
E A	Wrench for locknut with external thread
E AX	Wrench for slip-off proof locknut
E M	Wrench for Mini locknut
E MS	Wrench for Mini Speed locknut
E MX	Wrench for intRlox® locknut
E P	Wrench with profile for hexagon locknut
EHS	Extraction tool for reduction sleeves
ER	ER standard collet runout ≤ 10 µm
ER	ER collet DIN 6499 (**E** collet **R**EGO-FIX)
ER MS	ER locknut Mini Speed
ER NC	Cylindrical toolholder with shank NC lathe
ERA / Zero-Z	Toolholder with minimal gauge length and internal locknut
ERAX	Slip-off proof locknut with external thread
ERAXC	Slip-off proof locknut with external thread for sealing disks
ERB	Locknut with friction bearing
ERBC	Locknut with friction bearing for sealing disks
ERC	Locknut for sealing disks
ER-DM	ER collet metalically sealed
ER-GB	Tapping Collets with square without axial compensation
ERM	Locknut with Mini thread
ERMC	Locknut with Mini thread for sealing disks
ERMX	Slip-off proof Mini locknut intRlox®
ERMXC	Slip-off proof Mini locknut intRlox® for sealing disks
ER-UP	ER ultra precision collet runout ≤ 5 µm

F

FDS	Wrench for Universal Shellmill / Facemill Holders
FWR	Balancing ring

G

G-A	Grip bar
G-AS	Grip bar short
GSF	Tapping holder

H

H	Designed for FWR
HD	Heavy duty
Hi-Q	Clamping nut balanced and surface treated (impregnated)
HPC	High-performance-cutting
HS	Reduction sleeve
HSC	High-speed-cutting
HSK	Hollow taper shank
HSK-FP	Hollow taper shank form F with pin

I

IKZ	Coolant trough
INOX	Stainless steel
intRlox®	Slip-off proof nut and wrench
ISO 20 HAAS	Toolholders for HAAS Office Mill

K

KBF	Drill chuck
KFD	Universal Shellmill / Facemill Holders
KS	Coolant disk
KSR	Coolant tube

L

L	Clamping nut with left handed thread

Terminology M – Z

M	
MA	Shell Mill Arbor
MB	Microbore collet
MBX	Microbore collet with clamping range – stainless
MFD	Micro friction dampening
MK	Morse Taper DIN 228
ML	Multi Line
MPH	Mini floating chuck
MPHC	Mini floating chuck for internal coolant supply
MQL	Minimum quantity lubrication
MR	micRun® collet runout $\leq 2\,\mu m$
MRC	micRun® locknut for sealing disks
MRM	micRun® Mini locknut
MRMC	micRun® Mini locknut for sealing disks
MWZ	Assembly tool for sealing disks DS / ER 11
N	
NC	Cylindrical toolholder with shank NC lathe
NCT	No thread for coolant tube
NL	powRgrip® collets PG-L cannot be used
Nm	Newton meter
O	
OM	Steep taper toolholders without drive key slots
P	
PCM ET1	Tapping collet with axial compensation
PG	powRgrip®
PGC	Manual powRgrip® clamping unit
PG-CF	powgrip® coolant flush collet for peripheral cooling
PG-L	powRgrip® collet for long tool shanks
PG-MB	powRgrip® microbore collet
PG-S	powRgrip® collet for short tool shanks
PG-SG	powRgrip® secuRgrip® collet for pull-out protection
PGST	powgrip® short tail collet for PGST system
PG-T	powRgrip® collet for boring bars
PG-TAP	powRgrip® tapping collet
PG-TW	powRgrip® collet thin walled with limited life-time
PGU	Automatic powRgrip® clamping unit
PGU 9500 A	powRgrip® clamping unit USA (115 V)
PGU 9500 E	powRgrip® clamping unit Europe (230 V)
PGU 9500 J	powRgrip® clamping unit Japan (100 V)
PH	Floating chuck
PHC	Floating chuck for internal coolant supply
PHC-C	REGO-FIX CAPTO floating chuck for internal coolant supply
R	
Ra	Unit for surface finishing
RBA	reCool® ball adapter
RCR	reCool® rotary
RCS	reCool® static
REGO-FIX	Swiss company for tool holding solutions
RHS	reCool® hose with protector spring
RRA	reCool® aluminium ring adapter
RVA	reCool® 90° elbow push-in fitting
RVG	reCool® straight push-in fitting

S	
SG	secuRgrip® available for PG and ER
SGI	secuRgrip® threaded insert
SGN-PG	secuRgrip® safety nut
SH	Automotive Shank toolholders DIN 6327-C
SK	Steep taper
SKR	Key for coolant tube
SSM	Quick-change setting ring
SSY	Soft-Synchro tapping holder
T	
TCD	Brush head for taper cleaning device
TCD-BU	Base unit taper cleaning device
TKCP	powRgrip® taper cleaner with cleaning paper
TSD	TORX Torque screwdriver
V	
V-E AX	Slip-off proof extension
V-E MX	Slip-off proof extension intRlox®
VEW	Presetting tool for powRgrip® toolholders
W	
WA	Tool adapter
WD	Endmill toolholder (Weldon)
WMH	Tool assembly indexing
X	
X	Slip-off proof
XL	Extra long toolholder
Z	
ZWT	Tray for ER collets (metric)
ZZT	Tray for ER collets (inch)

www.rego-fix.com
0362.00251 / ENG