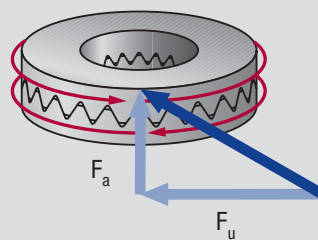


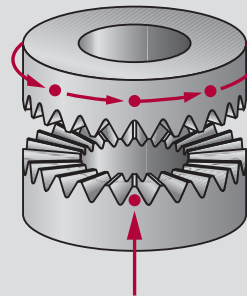
Voith Hirth couplings, standard and custom-made toothed rings



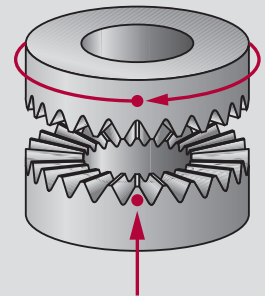
Positive locking



Accurate in indexing



Accurate in repetition



The original

Invented decades ago but still up to date, the original Hirth couplings from Voith Turbo meet the complex requirements of modern engineering:

- lightweight design
- high strength connections

We offer a complete range of services to meet almost any requirements:

- Standard rings
- Toothed rings to customer specifications
- Serrations on customer components

Voith standard rings act as a compact indexing element that achieve high indexing accuracy and as a positioning element with high repeat accuracy.

Benefits

Voith Turbo offers a broad range of standard rings:

- Diameter 50 – 900 mm, number of teeth 12 – 720
- Transmittable torque 340 – 98,600 Nm

For our customers, this means:

- Short delivery times and low logistics costs, almost all standard rings are available from stock
- Excellent purchase prices due to large scale manufacturing
- Guaranteed long-term replacement, as versions remain unchanged for decades

All the world's our home

Voith Hirth couplings have proven their worth more than 100,000 times over in all of the major international markets.

Applications for standard rings include:

- Machine tools (particularly rotary indexing tables, turret heads and pallet changers)
- Turbo compressors
- Metrology
- Robotics
- Nuclear technology
- Medical technology
- General engineering

Our experience – your advantage

Features of Voith Hirth serrations	Advantages
<ul style="list-style-type: none"> ■ Angular surfaces provide positive locking transmission of most of the peripheral force 	<ul style="list-style-type: none"> ■ High torque capacity ■ The bolts only have to absorb a small axial force
<ul style="list-style-type: none"> ■ High load-bearing percentage on tooth flanks 	<ul style="list-style-type: none"> ■ High wear resistance ■ Indexing accuracy $\pm 2''$
<ul style="list-style-type: none"> ■ Multiple wedge effect 	<ul style="list-style-type: none"> ■ Repeat accuracy ≤ 0.001 mm
<ul style="list-style-type: none"> ■ Optimized geometrical shape of teeth 	<ul style="list-style-type: none"> ■ Self-centering ■ Low axial and concentric run-out
<ul style="list-style-type: none"> ■ Hardened serration 	<ul style="list-style-type: none"> ■ Long service life

Standard rings - Technical data

Ring size	Outer diameter of dimension D	Inner diameter of dimension d	Maximum transmittable torque T_{\max}
	[mm]	[mm]	[Nm]
N 5	50	20	340
N 10	100	60	940
N 12	125	85	1,700
N 16	160	120	2,260
N 20	200	150	3,720
N 25	250	200	6,460
N 28	280	230	7,320
N 32	320	260	8,330
N 36	360	300	15,000
N 40	400	340	16,800
N 45	450	350	25,500
N 50	500	400	28,800
N 56	560	450	46,700
N 63	630	520	53,500
N 71	710	590	60,300
N 80	800	670	87,500
N 90	900	760	98,600

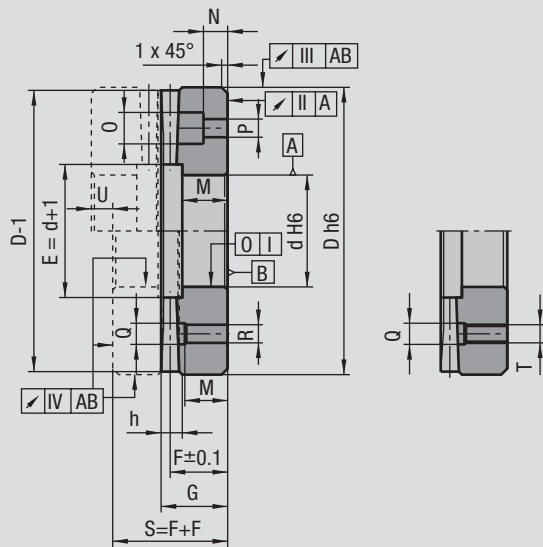
Requirements

- No safety allowance
- Fully tightened bolts, material class 10.9 in compliance with ISO 898-1
- Hardened locating pins with solid cross-section in compliance with ISO 8734

Note

Higher torques can be transmitted with custom-made rings.

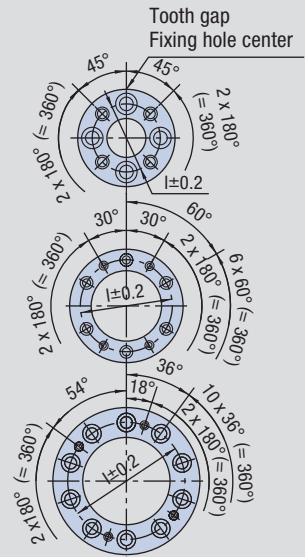
Standard rings - Dimensions and part numbers



Fixing hole pattern J

Fixing hole pattern K

Fixing hole pattern L



Note

On all standard rings, the center of the tooth gap is identical to the center of the fixing hole for the bolts. This means that the fixing holes are offset by half a spacing when paired.

Order example

Ring size	Number of teeth	Part no.
N 20	96	H15.093220

When ordering, always specify the ring size, number of teeth and part number.

Ring size	N5			N10			N12			N16			N20			N25			N28			N32			N36			N40					
ø D	50			100			125			160			200			250			280			320			360			400					
	G	h	U	G	h	U	G	h	U	G	h	U	G	h	U	G	h	U	G	h	U	G	h	U	G	h	U	G	h	U	G	h	U
Number of teeth	12.1	6.08	4.5																														
12	H15.093030																																
24	11.6	3.8	3.5	14.5	5.91	4.2																											
	H15.093010			H15.092040																													
36	11.2	2.72	2.5	14.5	4.81	4.0	17.3	5.8	4.6																								
	H15.093020			H15.092010			H15.093140																										
48	10.7	1.78	1.4	14.1	3.82	3.5	16.7	4.34	3.6	17.1	5.43	4.3	19.5	5.9	4.1																		
	H15.093040			H15.092020			H15.093110			H15.092140			H15.093240																				
60	10.4	1.2	0.9	13.6	2.69	2.3	16.	3.83	3.5	16.8	4.5	3.8	19.6	5.4	4.3	19.5	5.91	4.2	22.7	7.27	5.7												
	H15.093050			H15.092030			H15.093120			H15.092110			H15.093250			H15.092240			H15.093340														
72				13.7	2.74	2.4	16.6	3.69	3.5	16.8	4.21	3.8	19.5	4.83	4.2	19.8	5.82	4.7	22.8	6.95	5.8	22.4	6.66	4.9	26.2	8.18	6.4						
				H15.092050			15.093.130			15.092.120			H15.093210			H15.092250			H15.093350			H15.092340			H15.093440								
96							16.1	2.52	2.2	16.6	3.51	3.4	19.1	3.84	3.5	19.2	4.36	3.7	22.5	5.21	4.5	22.1	5.45	4.5	25.2	6.58	5.4	25.0	5.91	4.2			
							H15.093150			H15.092130			H15.093220			H15.092210			H15.093310			H15.092310			H15.093450			H15.092450					
120										16.1	2.61	2.3	19.1	3.51	3.3	19.1	3.85	3.5	21.4	3.63	3.0	22.4	5.43	5.0	24.7	5.4	4.6	24.6	5.45	4.3			
										H15.092160			H15.093230			H15.092220			H15.093320			H15.092320			H15.093470			H15.092470					
144													18.7	2.76	2.4	18.7	2.91	2.5	21.4	3.47	3.2	21.8	4.23	4.0	24.7	4.98	4.5	24.5	4.84	4.2			
													H15.093270			H15.092230			H15.093330			H15.092330			H15.093410			H15.092410					
180																18.7	2.76	2.4	21.4	3.22	2.9	21.7	3.82	3.4	24.0	3.63	3.5	24.3	4.23	4.0			
																H15.092270			H15.093370			H15.092360			H15.093420			H15.092420					
240																						21.1	2.62	2.3	23.8	3.07	3.0	23.6	2.72	2.4			
																						H15.092370			H15.093430			H15.092430					
288																									23.5	2.39	2.0	23.6	2.77	2.4			
																									H15.093480			H15.092480					
360																									23.15	1.71	1.4	23.4	2.02	1.7			
																									H15.093490			H15.092440					
d	20			60			85			120			150			200			230			260			300			340					
F	10			12.5			15			15			17.5			17.5			20			20			22.5			22.5					
I	35			80			105			140			175			225			255			290			330			370					
J	●																																
K				●			●			●			●																				
L																●			●			●			●			●					
M	7.5			8.6			11.6			10.6			13.1			13.7			15			15.3			17.8			17.6					
N	3			4.1			4.6			4.6			5.1			5.2			7.2			7.3			9			9					
O	11			11			11			11			15			15			15			15			18			18					
P	7			7			7			7			9.5			9.5			9.5			9.5			11.5			11.5					
Q	7			7			10			10			9.5			9.5			9.5			9.5			11.5			11.5					
R	5			5			7			7			6.8			6.8			6.8			6.8			9			9					
T	M6			M6			M6			M6			M8			M8			M8			M8			M8			M8					
I/II/III													0.005															0.01					
IV													0.01															0.02					

Dimensions in mm

- Available from stock
- Fixing hole pattern

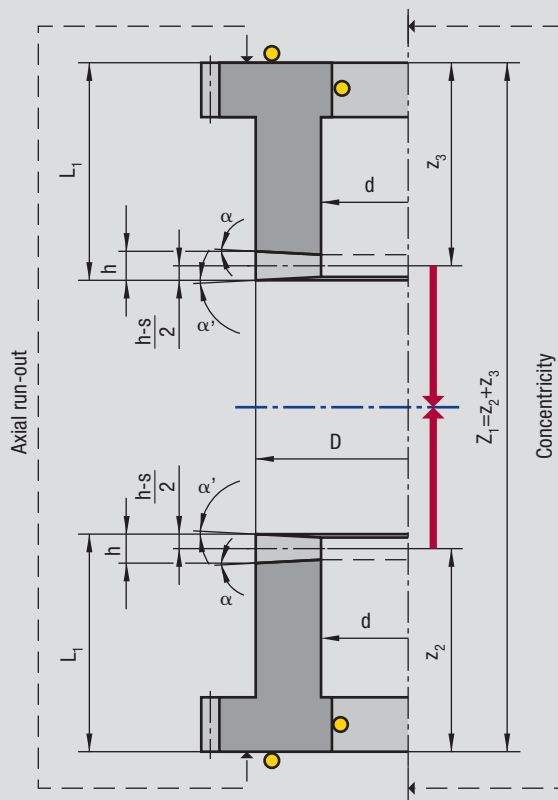
Ring size	N45			N50			N56			N63			N71			N80			N90				
ø D	450			500			560			630			710			800			900				
	G	h	U	G	h	U	G	h	U	G	h	U	G	h	U	G	h	U	G	h	U		
Number of teeth	26.5	5.53	3.2																				
96	H15.093540																						
120	27.7	6.58	5.4	27	5.92	4.2																	
	H15.093560			H15.092540																			
144	26.8	4.89	4.0	27.3	5.83	4.7	29.1	5.16	3.5	29.8	6.48	4.7	31.9	6.2	4								
	H15.093510			H15.092550			H15.092940			H15.092640			H15.092740										
180	26.6	4.09	3.5	27.6	5.74	5.4	29.3	4.85	3.7	29.8	5.91	4.8	31.75	5.32	3.5	37.4	6.68	4.9					
	H15.093520			H15.092510			H15.092950			H15.092650			H15.092750			H15.092840							
240	26.6	3.29	3.0	26.7	3.86	3.5	29.5	4.54	4.2	29.9	5.33	5.0	32.2	5.34	4.7	37.1	5.47	4.5	42.3	6.59	5.4		
	H15.093530			H15.092520			H15.092910			H15.092610			H15.092710			H15.092810			H15.097630				
288	26.4	3.24	2.9	26.15	2.91	2.4	29	3.48	3.2	29.3	4.14	3.8	32.2	4.90	4.5	37	4.85	4.3	41.8	4.85	3.8		
	H15.093570			H15.092560			H15.092920			H15.092620			H15.092720			H15.092820			H15.097640				
360	26	2.39	2.1	26.2	2.78	2.6	29	3.22	3.2	29.2	3.75	3.6	31.5	3.56	3.2	36.8	4.24	4.0	42.2	4.99	4.7		
	H15.093580			H15.092530			H15.092930			H15.092630			H15.092730			H15.092830			H15.097610				
720							27.85	1.11	0.8	28	1.38	1.0	30.6	1.68	1.4	35.8	2.02	1.7	41	2.4	2.5		
							H15.092960			H15.092660			H15.092760			H15.092850			H15.097620				
d	350			400			450			520			590			670			760				
E	400			450			502			580			650			740			840				
F	25			25			27.5			27.5			30			35			40				
I	380 ± 0.2			430 ± 0.2			480 ± 0.5			550 ± 0.5			620 ± 0.5			710 ± 0.5			800 ± 0.5				
J	●			●			●			●			●										
K																●			●				
M	20.8			20.2			24			23			25.5			31			35				
N	9.8			9.2			11			10			12.5			18			22				
O	18			18			20			20			20			20			20				
P	11.5			11.5			14			14			14			14			14				
R	9			9			11			11			11			11			11				
T	M8			M8			M10			M10			M10			M10			M10				
I/II/III							0.01												0.015				
IV							0.02												0.03				

Dimensions in mm

- Available from stock
- Fixing hole pattern

Toothed rings to customer specifications

What if our standard rings are not right for your application? No problem! We can produce custom-made Hirth toothed rings for you. Needless to say, we will also support you in the design process and with the calculations for the Hirth serration. We have access to effective simulation tools for performing the calculations. Take advantage of this opportunity and benefit from our years of experience.

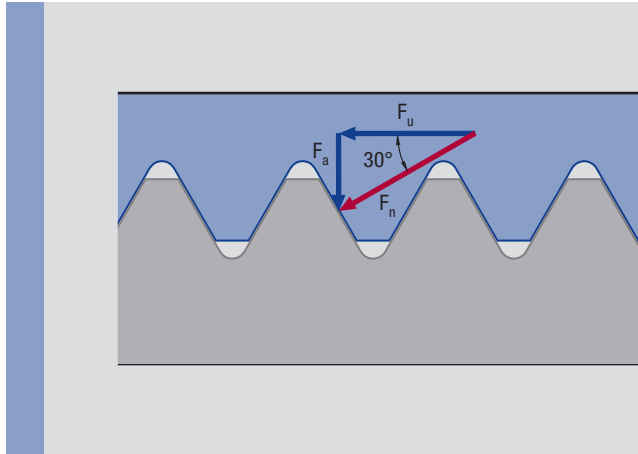


● Contact or alignment surfaces

To produce custom-made rings, we require the following information:

- Number of teeth z
- Outer diameter of teeth D
- Inner diameter of teeth d
- Position of teeth in respect of any fixing holes, keyways etc. (e.g. tooth gap center to center of fixing hole)
- Assembly dimension Z_1 of toothed parts
- Indication of prepared concentricity checking surface (diameter) and contact surface(s) [●]
- Details of material and type of any treatment
- Machining and positional tolerance
- Surface quality of teeth

Design and calculation information



Force diagram:

- F_u Circumferential force
- F_a Axial force
- F_n Normal force

Calculation

- Hirth serrations are not calculated in the same way as involute toothing.
- The transmitted torque T is proportional to the circumferential force F_u
- The inclination of the tooth flanks results in an axial force F_a
- When compressed together, the teeth support each other if the pre-load F_{va} is sufficient. This means that the teeth do not bend.
- The varying loads on the tooth flanks result merely in a slightly irregular distribution of the pressure pre-load in the tooth root cross-section

Here:

$$F_u = \frac{4 T}{D + d}$$

and

$$F_a = F_u \cdot \tan 30^\circ$$

- The axial force must be absorbed by pre-loading tensioning devices of adequate dimensions. These tensioning devices could be disk springs, hydraulic cylinders and, in special cases, bolts.

The required pre-load F_{va} is:

$$F_{va} = \nu \cdot F_a$$

with the safety factor

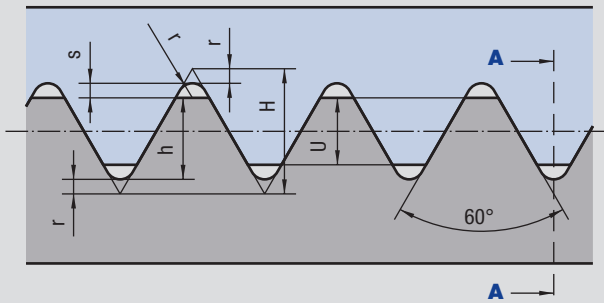
$$\nu = 1.8 \dots 3.0$$

The maximum surface pressure p_{\max} is calculated as follows:

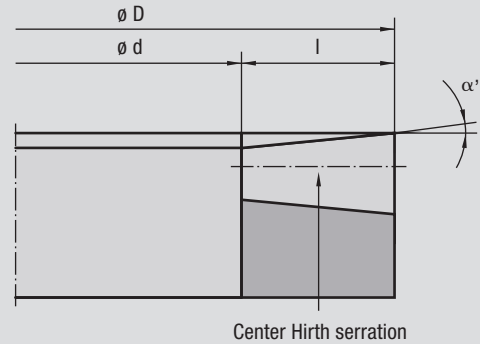
$$p_{\max} = \frac{F_{va} + F_a}{A_z}$$

with the effective tooth flank area

$$A_z = \left(D - d - \frac{n \cdot d_L^2}{D + d} \right) \cdot \left[\frac{\pi}{4} (D + d) - 1.155 \cdot z \cdot (r + s) \right] \cdot \eta_z$$



Section A-A



Center Hirth serration

Geometry

The number of teeth z and the theoretical tooth height H depend on the outer tooth diameter D .

A reference value for the tooth length l is:

$$l = \frac{D - d}{2} = b \cdot D \text{ where } b = 0.05 \dots 0.3$$

The formula for the actual tooth height h is:

$$h = c \cdot D - (2r + s)$$

with the following assignment:

Number of teeth z	Factor c
12	0.234
24	0.114
36	0.075
48	0.056
60	0.045
72	0.037
96	0.028
120	0.022
144	0.018
180	0.015
240	0.011
288	0.009
360	0.007
720	0.003

and

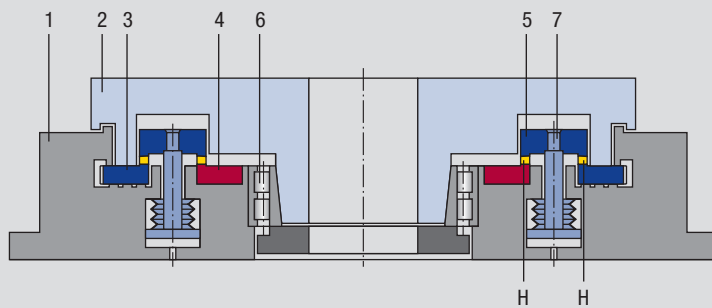
Tooth root radius r	Crown clearance s
[mm]	[mm]
0.3	0.4
0.6	0.6
1.0	1.0
1.6	1.6
2.5	2.5

Symbols

A_z	Effective tooth flank area
b	Factor
c	Factor
D	Outer diameter of teeth
d	Inner diameter of teeth
d_L	Fixing hole diameter
F_a	Axial force
F_u	Circumferential force
F_{va}	Pre-load
h	Actual tooth height
l	Tooth width
T	Transmitted torque
n	Number of bolts in serration surface
p_{max}	Maximum surface pressure
r	Tooth root radius
s	Crown clearance
z	Number of teeth
ν	Safety factor
η_z	Load bearing percentage (0.65 if milled, 0.75 if ground)

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 UJShafts@voith.com
 www.voithturbo.com/hirth-coupling

**Three-part coupling design –
 invented by Voith Turbo**



Schematic diagram of non-lifting rotary indexing table with Voith Hirth serration in 3 toothed ring design

- 1 Housing
- 2 Upper section of indexing table
- 3 Rotating toothed ring
- 4 Fixed toothed ring
- 5 Closing toothed ring
- 6 Radial bearing
- 7 Lifting cylinder

- H Hirth serration

The idea of using 3 toothed rings enables hugely advantageous designs to be realized, particularly in machine tool engineering. Frequent applications include non-lifting rotary index tables and tool holders.

Advantages of 3-part Voith Hirth toothed rings in ...

non-lifting rotary indexing table

- Minimal force required to rotate the workpiece
- Incursion of coolant can easily be prevented
- Cost-optimized design
- High positioning accuracy (indexing accuracy $\pm 2''$)

tool holders

- Short travel distances when changing tools
- Quick tool changes

VOITH
Engineered reliability.