

Profile milling cutter

ADD^{FORCE}BARREL

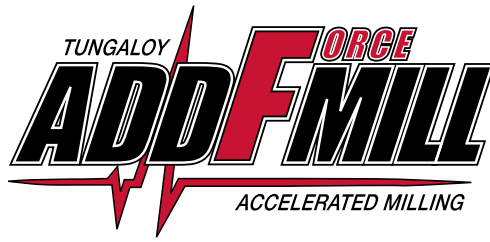
Tungaloy Report No. 552-G

Barrel-shaped inserts for profile milling with productivity boost





INDUSTRY 4.0
FEED the SPEED!



ADD F ORCE BARREL



High productivity profile milling cutter

Large R cutting edge and multi-flute design for unparalleled productivity



Large R
for small
cusp height



Close pitch design

ADD^{FORCE}BARREL

DCX = 20 mm, PRFRAD = 30 mm



Large
pitch

Cusp height

Ball endmill

DCX = 20 mm, R = 10 mm



Small
pitch

Cusp height

AddForceBarrel reduces the number of passes by 40% compared to ball endmill with 10 mm radius without compromising the surface quality (cusp height).

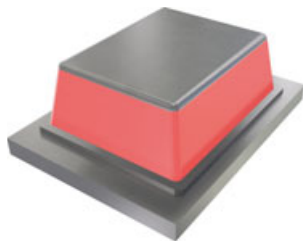
Practical example

Performance comparison of **AddForceBarrel** with indexable ball endmill



Carbon steel
S55C / C55 (204HB)

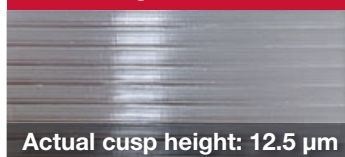
Dry condition
Width of cut: $a_e = 0.1$ mm



	ADD^{FORCE}BARREL DCX = 20 mm, CICT = 4	Ball endmill DCX = 20 mm, CICT = 2
Cutter	HFZN10M020M10R04	Indexable endmill
Insert	ZNHU1003R30-MM AH9130	R = 10 mm
Cutting speed: V_c	250 m/min	
Feed per tooth: f_z	0.2 mm/t	
Feed speed: V_f	3180 mm/min	1590 mm/min
Pitch (depth of cut): p	1.7 mm	1 mm
Theoretical cusp height	12 μ m	12 μ m

ADD^{FORCE}BARREL

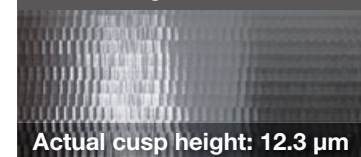
Machining time: 210 sec.



Actual cusp height: 12.5 μ m

Ball endmill

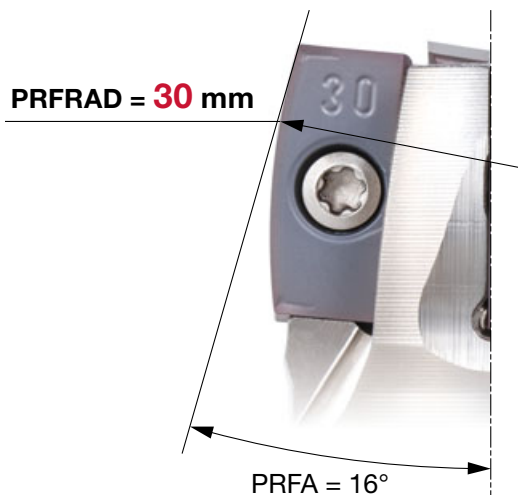
Machining time: 570 sec.



Actual cusp height: 12.3 μ m

AddForceBarrel saved 64% of machining time.

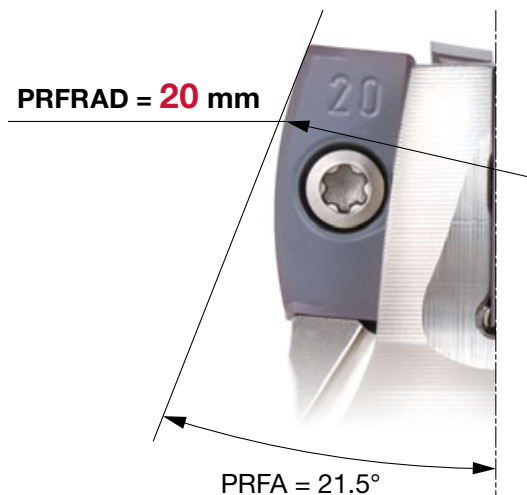
■ Two kinds of barrel-shaped cutting edge profiles (PRFRAD)



1st choice ZNHU1003R30...

2-corner double sided insert

High productive geometry that provides a large stepover distance for reduced cusp height

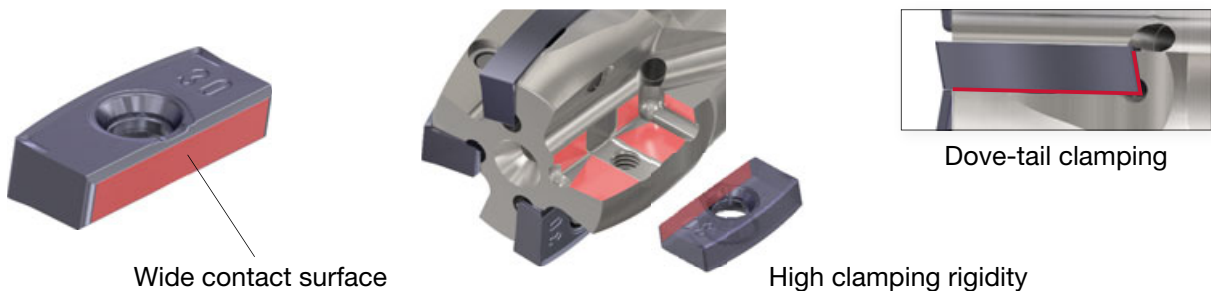


ZNHU1003R20...

2-corner double sided insert

Profiling geometry with an increased tilt angle for enhanced application versatility

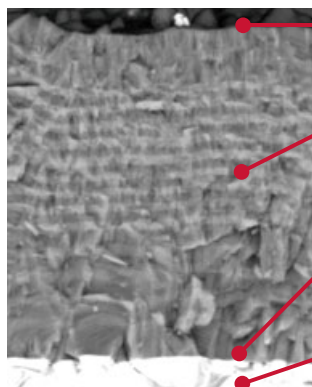
■ Excellent clamping reliability with dove-tail back support



■ Grade with high wear resistance

AH9130 **P M K S H**

- Nano multi-layer coating technology with three major properties for optimal cutting edge integrity
- Increased resistance to wear, fracture, oxidation, built-up edge, and delamination



Resistance to built-up edge

The coating surface prevents built-up edge

Resistance to wear, oxidation, and fracture

Multi-layered coating is designed to resist wear and oxidation, while preventing micro-cracks from propagating in the coating layer for improved resistance to edge chipping

Strong coating / substrate adhesion

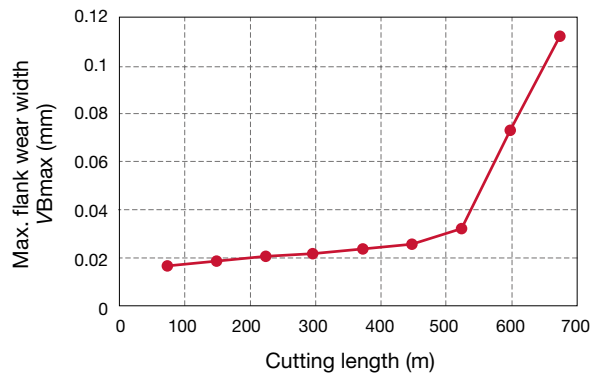
Coating is optimized for strong adhesion property with substrate to maintain strong cutting edge integrity

Carbide substrate

Provides a good combination of wear and fracture resistance

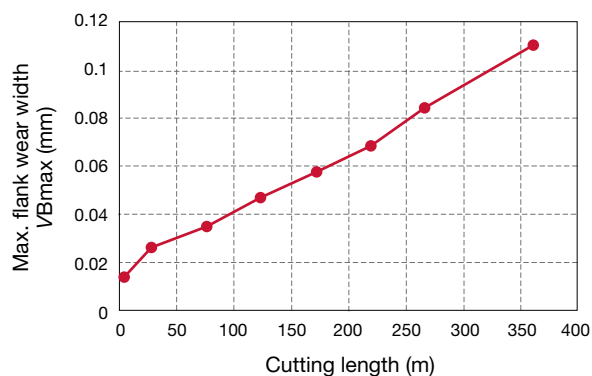
TOOL LIFE

P Carbon steel S55C / C55 (204HB)



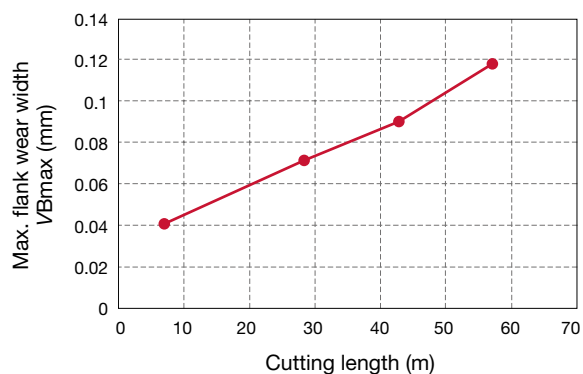
Cutter : HFZN10M020M10R04 (DCX = 20 mm, CICT = 4)
 Insert : ZNHU1003R30-MM AH9130
 Cutting speed : $V_c = 600$ m/min
 Feed per tooth : $f_z = 0.2$ mm/t
 Pitch (depth of cut) : $p = 2$ mm
 Width of cut : $a_e = 0.1$ mm
 Coolant : Dry
 Overhang length : 110 mm
 Machine : Vertical M/C, BT40
 Performed with only one insert on the cutter

M Martensitic stainless steel SUS420J1 / X20Cr13 (281HB)



Cutter : HFZN10M020M10R04 (DCX = 20 mm, CICT = 4)
 Insert : ZNHU1003R30-MM AH9130
 Cutting speed : $V_c = 500$ m/min
 Feed per tooth : $f_z = 0.15$ mm/t
 Pitch (depth of cut) : $p = 2$ mm
 Width of cut : $a_e = 0.1$ mm
 Coolant : Dry
 Overhang length : 110 mm
 Machine : Vertical M/C, BT40
 Performed with only one insert on the cutter

H Hardened steel DH31S (50HRC)



Cutter : HFZN10M020M10R04 (DCX = 20 mm, CICT = 4)
 Insert : ZNHU1003R30-MM AH9130
 Cutting speed : $V_c = 200$ m/min
 Feed per tooth : $f_z = 0.1$ mm/t
 Pitch (depth of cut) : $p = 2$ mm
 Width of cut : $a_e = 0.1$ mm
 Coolant : Dry
 Overhang length : 110 mm
 Machine : Vertical M/C, BT40
 Performed with only one insert on the cutter

MODULAR TYPE

TUNGFLEX

HFZN10-M

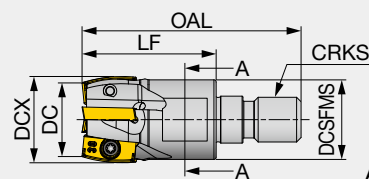
Profiling endmill, modular type (TungFlex), for 2-corner double sided inserts

GAMP = +7.1° ~ +9.2°, GAMF = -20.8° ~ -17.9°

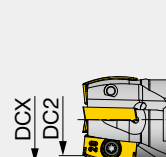
New



with ZNHU1003R30-MM



with ZNHU1003R20-MM



Designation	DCX	CICT	DC	DC2	OAL	LF	DCSFMS	CRKS	H	WT(kg)	Air hole	Insert
HFZN10M016M08R03	16	3	13	12.5	42	25	14.5	M8	10	0.02	With	ZNHU1003...
HFZN10M020M10R04	20	4	17	16.5	49	30	17.8	M10	15	0.05	With	ZNHU1003...
HFZN10M025M12R05	25	5	22	21.5	57	35	23	M12	17	0.1	With	ZNHU1003...
HFZN10M035M16R07	35	7	31.9	31.4	63	40	28.8	M16	22	0.22	With	ZNHU1003...
HFZN10M040M16R08	40	8	36.9	36.4	63	40	28.8	M16	22	0.25	With	ZNHU1003...

SPARE PARTS



Designation	Clamping screw	Wrench
HFZN10...	SR-M2.5X0.45-L6IP7	IP-7D

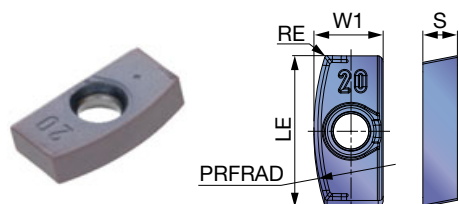
*Recommended clamping torque (N·m): SR-M2.5x0.45-L6IP7 = 1

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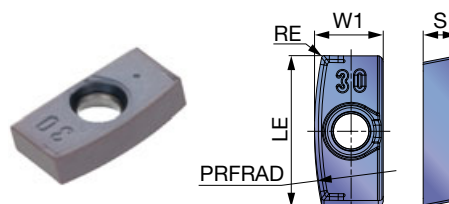


INSERTS

ZNHU1003R20-MM



ZNHU1003R30-MM



P	Steel	★										
M	Stainless	★										
K	Cast iron	★										
N	Non-ferrous											
S	Superalloy	★										
H	Hard materials	☆										

★ : First choice
☆ : Second choice

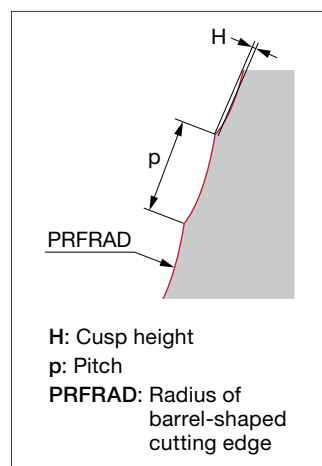
Designation	PRFRAD	RE	Coated								LE	W1	S
			AH9130										
ZNHU1003R20-MM	20	0.2	●								11.5	5.61	2.8
ZNHU1003R30-MM	30	0.2	●								11.5	5.56	2.8

● : Line up

STANDARD CUTTING CONDITIONS

ISO	Workpiece materials	Hardness	Cutting speed V _c (m/min)	Feed per tooth f _z (mm/t)	Width of cut a _e (mm)
P	Low carbon steel S15C, SS400, etc. C15E4, E275A, etc.	- 200HB	100 - 600	0.05 - 0.3	< 0.4
	Carbon steel S45C, S55C, etc. C45, C55, etc.	- 300HB	100 - 600	0.05 - 0.3	< 0.3
	Prehardened steel NAK80, PX5, etc.	30 - 40HRC	100 - 600	0.05 - 0.3	< 0.3
M	Austenitic stainless steel SUS304, SUS316, etc. X5CrNi18-9, X5CrNiMo17-12-2, etc.	- 200HB	100 - 500	0.05 - 0.3	< 0.3
	Precipitation hardening stainless steel SUS630, etc. X5CrNiCuNb16-4, etc.	- 45HRC	100 - 300	0.05 - 0.25	< 0.2
K	Grey cast iron FC250, FC300, etc. 250, 300, etc.	150 - 250HB	100 - 600	0.05 - 0.3	< 0.3
	Ductile cast iron FCD400, etc. 400-15, 600-3, etc.	150 - 250HB	100 - 600	0.05 - 0.3	< 0.3
S	Titanium alloys Ti-6Al-4V, etc.	- 45HRC	40 - 120	0.05 - 0.2	< 0.2
	Superalloys Inconel718, etc.	- 45HRC	20 - 80	0.05 - 0.2	< 0.2
H	Hardened steel SKD61, etc. X40CrMoV5-1, etc.	40 - 55HRC	50 - 300	0.05 - 0.2	< 0.2

■ Cusp height and pitch



To obtain the pitch (p) from the given cusp height (H)

H (mm)	0.001	0.002	0.003	0.004	0.005	0.01	0.015	0.02
PRFRAD (mm)								
20 (ZNHU1003R20...)	0.4	0.57	0.69	0.8	0.89	1.26	1.55	1.79
30 (ZNHU1003R30...)	0.49	0.69	0.85	0.98	1.1	1.55	1.9	2.19

$$p = \sqrt{8 \times H \times \text{PRFRAD}}$$

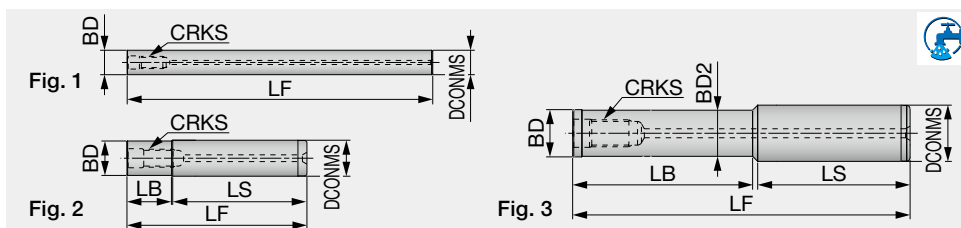
(mm)

To obtain the cusp height (H) from the given pitch (p)

p (mm)	0.5	0.75	1	1.25	1.5	1.75	2
PRFRAD (mm)							
20 (ZNHU1003R20...)	0.002	0.004	0.006	0.01	0.014	0.019	0.025
30 (ZNHU1003R30...)	0.001	0.002	0.004	0.007	0.009	0.013	0.017

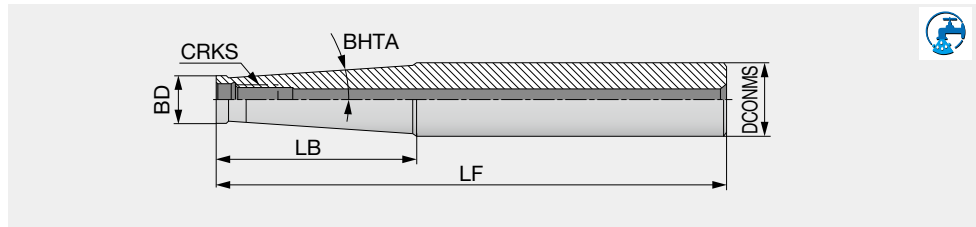
$$H = \frac{p^2}{8 \times \text{PRFRAD}}$$

(mm)



Designation	CRKS	DCONMS	LF	LB	LS	BD	BD2	Fig.
SM06-L100-C10-C-H	M6	10	100	-	-	10	-	1
SM06-L150-C10-C-H	M6	10	150	-	-	10	-	1
SM06-L100-C12-C-H	M6	12	100	-	-	12	-	1
SM06-L150-C12-C-H	M6	12	150	-	-	12	-	1
SM08-L80-20-C16-C-H	M8	16	80	20	59.6	15.3	-	2
SM08-L100-40-C16-C-H	M8	16	100	40	59.6	15.3	-	2
SM08-L150-80-C16-C-H	M8	16	150	80	69.6	15.3	-	2
SM08-L200-100-C16-C-H	M8	16	200	100	98.2	13	12.5	3
SM08-L200-140-C16-C-H	M8	16	200	140	59.6	15.3	-	2
SM08-L250-180-C16-C-H	M8	16	250	180	69.6	15.3	-	2
SM10-L80-20-C20-C-H	M10	20	80	20	59.2	18.5	-	2
SM10-L100-40-C20-C-H	M10	20	100	40	59.2	18.5	-	2
SM10-L150-80-C20-C-H	M10	20	150	80	69.2	18.5	-	2
SM10-L200-100-C20-C-H	M10	20	200	100	99.2	18.5	-	2
SM10-L200-140-C20-C-H	M10	20	200	140	58.7	18	17.5	3
SM10-L200-140-C20-C-H-N	M10	20	200	140	59.2	18.5	-	2
SM10-L250-130-C20-C-H	M10	20	250	130	118.7	18	17.5	3
SM10-L250-180-C20-C-H	M10	20	250	180	68.7	18	17.5	3
SM10-L250-180-C20-C-H-N	M10	20	250	180	69.2	18.5	-	2
SM10-L300-180-C20-C-H	M10	20	300	180	118.7	18	17.5	3
SM10-L300-230-C20-C-H	M10	20	300	230	68.7	18	17.5	3
SM12-L100-40-C25-C-H	M12	25	100	40	59.5	24	-	2
SM12-L150-80-C25-C-H	M12	25	150	80	67.7	21	20.5	3
SM12-L150-80-C25-C-H-N	M12	25	150	80	69.5	24	-	2
SM12-L200-100-C25-C-H	M12	25	200	100	97.7	21	20.5	3
SM12-L200-100-C25-C-H-N	M12	25	200	100	99.5	24	-	2
SM12-L200-140-C25-C-H	M12	25	200	140	57.7	21	20.5	3
SM12-L250-130-C25-C-H	M12	25	250	130	117.7	21	20.5	3
SM12-L250-180-C25-C-H	M12	25	250	180	69.5	24	-	2
SM12-L300-180-C25-C-H	M12	25	300	180	117.7	21	20.5	3
SM12-L300-180-C25-C-H-N	M12	25	300	180	119.5	24	-	2
SM12-L300-230-C25-C-H	M12	25	300	230	67.7	21	20.5	3
SM16-L100-40-C32-C-H	M16	32	100	40	58.5	29	-	2
SM16-L150-80-C32-C-H	M16	32	150	80	68.5	29	-	2
SM16-L200-100-C32-C-H	M16	32	200	100	98.5	29	-	2
SM16-L200-140-C32-C-H	M16	32	200	140	58.5	29	-	2
SM16-L250-130-C32-C-H	M16	32	250	130	118.5	29	-	2
SM16-L250-180-C32-C-H	M16	32	250	180	68.5	29	-	2
SM16-L300-180-C32-C-H	M16	32	300	180	118.5	29	-	2
SM16-L300-230-C32-C-H	M16	32	300	230	68.5	29	-	2
SM16-L350-230-C32-C-H	M16	32	350	230	118.5	29	-	2
SM16-L350-280-C32-C-H	M16	32	350	280	68.5	29	-	2



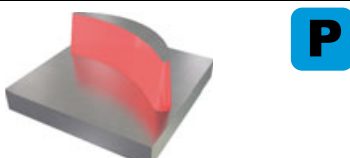
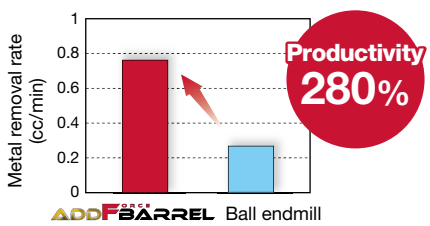
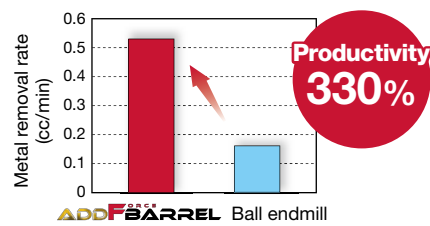


Designation	CRKS	DCONMS	LF	LB	BD	BHTA
SM06-L60C10	M6	10	60	20	9.7	0°
SM06-L105-C12	M6	12	105	60	9.7	1.2°
SM06-L125-C16	M6	16	125	60	9.7	3.3°
SM08-L73C16	M8	16	73	25	13	0°
SM08-L128-C16	M8	16	128	80	13	0.9°
SM08-L170-C20	M8	20	170	66.8	13	3.3°
SM10-L80C20	M10	20	80	30	18	0°
SM10-L130-C20	M10	20	130	80	18	0.6°
SM10-L200-C25	M10	25	200	57.2	19	3.3°
SM12-L86-C25	M12	25	86	30	21	5.1°
SM12-L200-C32	M12	32	200	78	21	4.4°
SM16-L95-C32	M16	32	95	35	29	1.7°
SM16-L230-C32	M16	32	230	50	29	1.8°

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PRACTICAL EXAMPLES

Workpiece type		Test piece	
Cutter		HFZN10M020M10R04 (DCX = 20 mm, CICT = 4)	
Insert		ZNHU1003R20-MM	
Grade		AH9130	
Workpiece material		S55C / C55	
		SUS304 / X5CrNi18-9	
Cutting conditions			
			
Cutting conditions	Cutting speed: Vc (m/min)	500	350
	Feed per tooth: fz (mm/t)	0.1	0.12
	Pitch : p (mm)	0.8	1
	Width of cut : ae (mm)	0.3	0.2
	Machining	Profiling	Profiling
	Coolant	Dry	Wet
Machine		Vertical M/C, BT40	
Results		 Productivity 280%	
		 Productivity 330%	
		A large PRFRAD and close pitch cutter body provided increased pitch and feed per tooth, boosting productivity by 2.8 times.	
		Thanks to large R cutting edge and close pitch design, increased pitch and feed speed could be used, boosting productivity by 3.3 times over ball endmill.	

FIXED TORQUE WRENCH

Achieves high cutting edge precision thanks to uniform clamping force

Easy setting

Handle

Multi-component handle optimally designed for the hand enables ideal power transmission.



Mechanism

Driver clicks to alert the operator when the preset torque is attained. IDs printed on the handle end allow easy identification of the driver specs. Driver has unlimited loosening torque. Driver mechanism is industrial-lubricant-resistant.

High repeatability & robustness

Robustness / Fitting

Wiha ChromTop® finish on tip for a perfect fit every time. Durability thanks to high quality chrome-vanadium-molybdenum steel, through hardened, chrome-plated.

Versatility

Extra slim blade geometry is particularly suitable for applications with confined narrow access.



Handle

Ex) **TW - D - 0.6NM**

1 Torque Wrench 2 Driver type 3 Torque



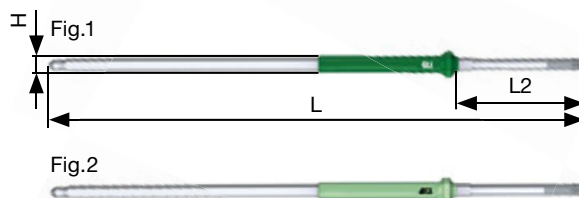
Designation	Stock	Torque (N-m)	Accuracy (%)	øD	L
TW-D-0.6NM	●	0.6	10	34	130
TW-D-0.9NM	●	0.9	10	34	130
TW-D-1.1NM	●	1.1	10	34	130
TW-D-1.4NM	●	1.4	10	34	130
TW-D-2.5NM	●	2.5	10	34	130
TW-D-3.0NM	●	3.0	10	34	130
TW-D-3.5NM	●	3.5	10	34	130

1 piece per package

Blade

Ex) **TW - B - T6**

1 Torque Wrench 2 Blade 3 TORX geom.



Designation	Stock	TORX geom.	H	L	L2	Fig.
TW-B-T6	●	T6	4	175	42	1
TW-B-T7	●	T7	4	175	42	1
TW-B-T8	●	T8	4	175	42	1
TW-B-T9	●	T9	4	175	42	1
TW-B-T10	●	T10	4	175	42	1
TW-B-T15	●	T15	4	175	42	1
TW-B-6IP	●	6IP	4	175	42	2
TW-B-7IP	●	7IP	4	175	42	2
TW-B-8IP	●	8IP	4	175	42	2
TW-B-10IP	●	10IP	4	175	42	2
TW-B-15IP	●	15IP	4	175	42	2

1 piece per package

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