

High Feed Mill Double

HFMD

KORLOY
TECH-NEWS



- Available for economical and highly efficient machining with implementation of double sided 4 corner inserts and increase in the number of teeth per cutter diameter
- Available for high speed/high feed machining with high helix edge design and excellent clamping stability

High Feed Milling Tool with 4 Corners for Small Diameter

HFMD

With the development of the end-user market, the current cutting tool industry has challenges including:

First, discovering highly effective machining technologies that can improve productivity and reduce production costs within limited time and budget. Second, to find a tool/solution that can easily machine hard-to-cut materials which are becoming more widely used in numerous industries (mold, aerospace, and etc) in pursuit of durability and lighter weight.

KORLOY recommends a new high feed tool, **HFMD**, which can easily resolve above two challenges.

HFMD insert is a double sided 4 corner insert which is economical and enhances machining productivity by implementing more flutes per diameter. In addition, HFMD

has achieved high speed/high feed machining by applying high rake angle and helix design on its edge. These two features have significantly reduced cutting resistance compared to competitors' tools or even against positive-type inserts.

Furthermore, **HFMD** provides excellent clamping stability by applying concave clamping system on the side, wider bottom face at the clamping area, and bigger sized screws. These will help minimize noise and vibration, prevent damage of insert with stable machining in high feed machining, and improve the surface finish of the workpiece.

As we can see in these advantages, KORLOY's **HFMD** is the next-generation high speed/high feed machining solution, one step ahead in the high efficiency machining trend.



Highly efficient and economical insert

- Double-sided 4 corners

Superior clamping stability

- Prevents insert chipping and damage by minimizing vibrations
- Improved surface finish of workpieces

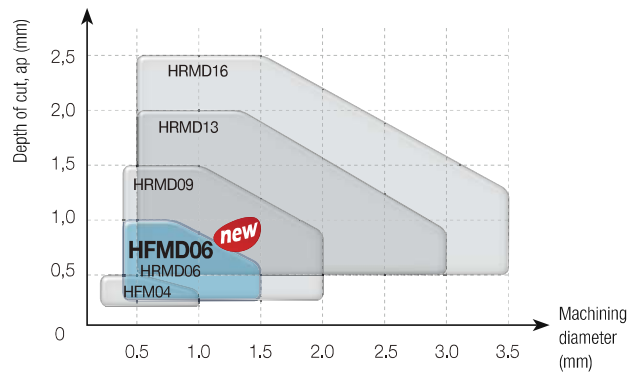
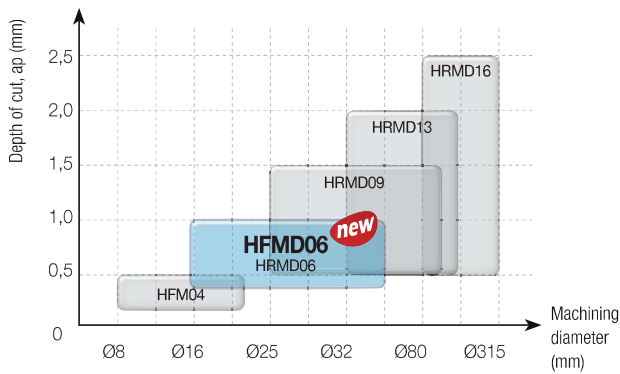
Realization of high speed/high feed

- High speed machining by applying high rake angle, and helix cutting edge
- Available for high feed machining with the increase in the number of teeth per cutter diameter

Optimized holder design

- Excellent chip evacuation in slotting or deep shouldering with minimized interference with side walls

Application Range



Code System

【Shank type】

HFMD	S	025	R	-	4	C	25	-	180	-	LN06
HFMD	Type	Machining diameter	Oil hole & Hand		No. of tooth	Shank type	Shank diameter		Overall length		Available inserts
	S : Shank	025: Ø25 mm	R: With oil hole, Right-handed NR: Without oil hole, Right-handed		4: 4 teeth	W : Weldon C : Cylinder	25: Ø25 mm		180: 180 mm		LN06: LNMX06

【Cutter type】

HFMD	C	M	040	R	-	22	-	7	-	LN06
HFMD	Type	Arbor type	Machining diameter	Oil hole & Hand		Internal diameter		No. of tooth		Available inserts
	C: Cutter	M: Metric A: Inch None: Asia	040: Ø40 mm	R: With oil hole, Right-handed NR: Without oil hole, Right-handed		22: Ø22 mm		7: 7 teeth		LN06: LNMX06

【Type Modular】

HFMD	M	025	R	-	4	-	M12	-	LN06
HFMD	Type	Machining diameter	Oil hole & Hand		No. of tooth		M Dimensions		Available inserts
	M: Modular	025: Ø25 mm	R: With oil hole, Right-handed NR: Without oil hole,		4: 4 teeth				LN06: LNMX06

Features

- Economical 4-corner double sided insert
- Increased productivity due to thinner and elongated shape of the insert which makes fine pitch available
- Insert designed for low cutting resistance with high rake angle and helix angle which reduces cutting load
- Inhibiting chipping and breakage due to concave clamping system and stronger screw

Economical 4-corner insert

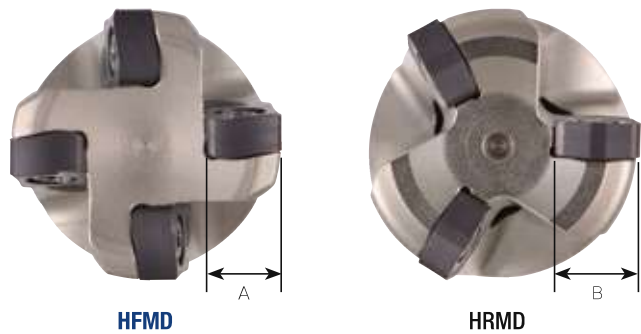
- Can use 4 corners with 1 insert by utilizing front/back face; High feed due to finer pitch.



Highly efficient insert due to fine pitch

- Able to use fine pitch at the same machining diameter with typical types of milling cutters due to smaller inscribed circle ($A < B$).

※ Tool diameter: $\varnothing 25$ mm





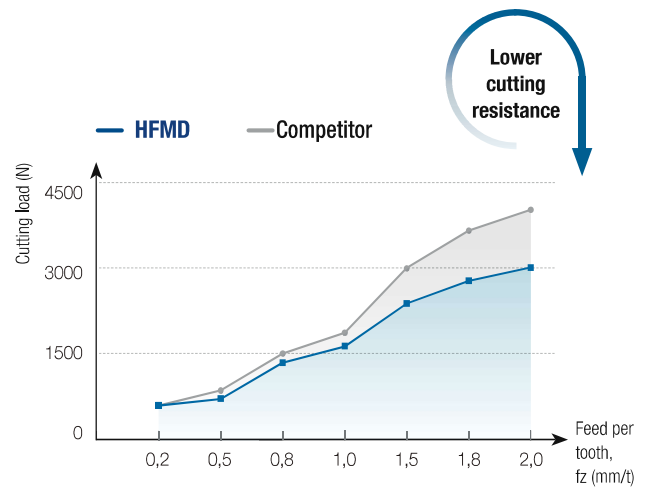
Insert designed for low cutting resistance

- High rake angle and helix angle minimize cutting resistance compared to competitors' products and positive type of inserts.



HFMD

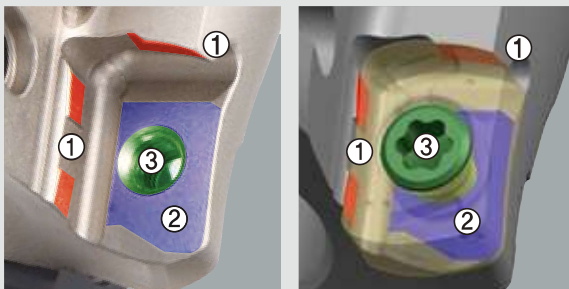
Competitor



▶ Able to check reduced cutting resistance with bright colored chips.

Insert with strong clamping force

- ① Concave clamping system
- ② Wider bottom face clamping area
- ③ Applied a bigger size of screw



HFMD


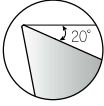

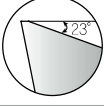

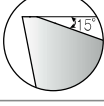
Competitor

▶ Enhanced HFMD clamping force ensures stable tool life in high feed machining.

▶ Competitor's unstable clamping causes fracture.



Application and Features of Chip Breakers

Chip breakers		Cutting-edge	Application	Features
ML			For hard-to-cut materials For Ti & inconel	Ensures superior machining quality by applying a low cutting resistance chip breaker and high-strength cutting edge design suitable for machining hard-to-cut materials.
MF			For light cutting	Suitable for light cutting with a low cutting resistance chip breaker design.
MM			For multi-purpose	Available for most cutting area with its exclusive design suitable for general high feed machining.

Recommended Cutting Conditions

※ Recommended chip breaker: ● 1st ○ 2nd



ISO	Workpiece					Grade	Cutting conditions				Available chip breaker				
	Workpiece materials	ISO (DIN)*	AISI	KS	HB (HrC)		vc (m/min)	fz (mm/t)	ap (mm)	ae	ML	MF	MM		
P	Mild steel	C25 (CK22)*	1020	SM20C	120-180	PC5400 (PC5300)	100-220	0,3-1,2	0,2-1,0	0,7D-0,1D	○	●	-		
	Carbon steel	C45/C45E4 (C45/CK45)*	1042 1045	SM45C	200	PC5400 (PC5300)	100-200	0,3-1,2	0,2-1,0	0,7D-0,1D	○	●	-		
	Alloy steel	41CrMo4	4140	SCM440	270 (28)	PC3700 (PC5300)	100-200	0,3-1,2	0,2-1,0	0,7D-0,1D	○	●	-		
	Prehardened steel	-	(1,2738)*	P20 (Improved)	KP4M	300 (32)	PC3700 (PC5300)	100-180	0,3-1,0	0,2-0,8	0,7D-0,1D	-	●	○	
		-	-	P21 (Improved)	NIMAX	370 (40)	PC3700 (PC5300)	100-180	0,3-1,0	0,2-0,8	0,7D-0,1D	-	●	○	
		-	-	P21 (Improved)	CENA1	370 (40)	PC3700 (PC5300)	100-180	0,3-1,0	0,2-0,8	0,7D-0,1D	-	●	○	
		-	-	P21 (Improved)	NAK80	400 (43)	PC3700 (PC5300)	100-180	0,3-1,0	0,2-0,8	0,7D-0,1D	-	●	○	
-	(X30Cr13)*	420	STAVAX	510 (52)	PC3700 (PC2510)	80-150	0,3-0,7	0,2-0,8	0,7D-0,1D	-	●	○			
Alloy tool steel	-	(X165CrVMo12-1 X40CrMoV5-1)*	D2 H13	STD11 STD61	- (40-50)	PC2510 (PC3700)	80-130	0,3-0,65	0,2-0,6	0,7D-0,1D	-	○	●		
M	Stainless steel	-	(X5CrNiMo17-12-2)*	316	STS316	Under 270	PC5400 (UNC840)	90-180	0,3-0,8	0,2-0,8	0,7D-0,1D	●	○	-	
K	Grey cast iron, Ductile cast iron	450-10 (GGG40,3)*	65-45-12	GCD450	Tensile Strength Over 450Mpa	PC5300 (PC5400)	130-220	0,3-0,9	0,2-1,0	0,7D-0,1D	-	●	○		
S	HRSA	Fe series	-	(WS 2,4662)*	N09901	Incoroy901	- (25-35)	UNC840 (PC5300)	30-100	0,3-0,6	0,2-0,6	0,4D-0,7D	●	○	-
		Ni or Co series	-	(WS 2,4668)*	N07718	Inconel718	- (35-45)	UNC840 (PC5300)	30-45	0,3-0,7	0,2-0,6	0,4D-0,7D	○	●	-
	Titanium	-	(TiAl6V4)*	R56400	Ti-6AL-4V	- (40-45)	UNC840 (PC5300)	30-50	0,3-1,0	0,2-0,6	0,7D-0,1D	●	○	-	

High Feed Tool Selection Guide

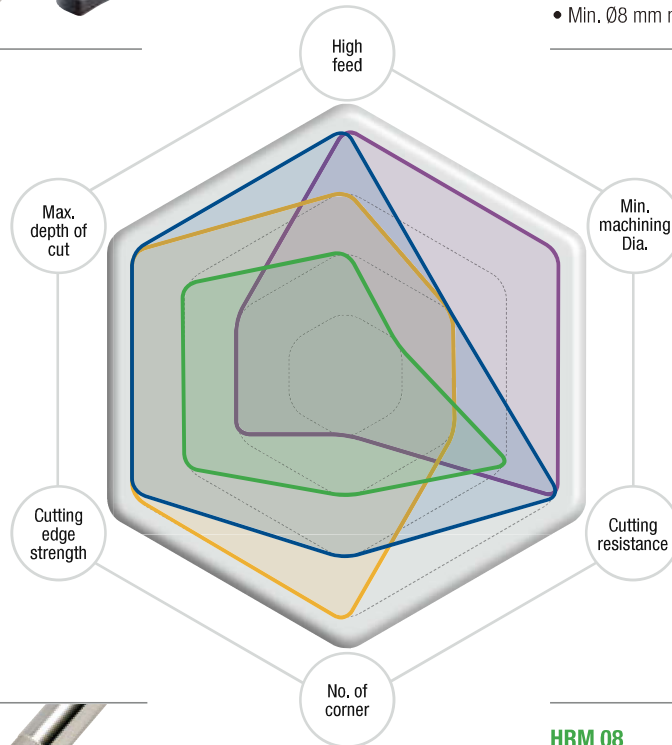
HFMD 06 new

- To increase productivity
- To machine workpiece with more edges



HFM 04

- To machine smaller diameter
- Min. Ø8 mm machining



HRMD 06

- To focus on economical feasibility
- Double-sided 6 corners machining



HRM 08

- For general machining
- Single-sided 3 corners machining

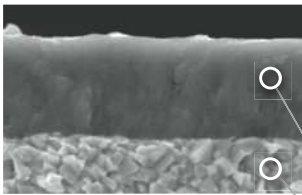


Product name	High feed	Min. machining Dia.	Cutting resistance	No. of corner	Cutting edge strength	Max. depth of cut
HFMD 06 <small>new</small>	★★★★★	★★	★★★★★	★★★	★★★★★	★★★★★
HFM 04	★★★★★	★★★★★	★★★★★	★	★★	★★
HRM 08	★★	★	★★★	★★	★★★	★★★
HRMD 06	★★★	★★	★★	★★★★★	★★★★★	★★★★★

Grade Selection Guide

Workpiece		Machining type	Grade	Recommended cutting speed (m/min)	ISO	Application range
P	Steel	Continuous cutting	PC2510 ^{new}	180 (140-220)	P10	PC2510 ^{new}
		Continuous cutting	PC3700 ^{new}	235 (180-290)	P20	
		Interrupted cutting	PC5300	195 (150-240)	P30	PC3700 ^{new} → PC5300
		Interrupted cutting	PC5400	145 (80-210)	P40	PC3700 ^{new} → PC5300 → PC5400 ^{new}
M	Stainless Steel	Continuous cutting	PC5300	130 (100-160)	M20	→ PC5300
		Interrupted cutting	PC5400	110 (80-140)	M30 M40	→ PC5400 ^{new}
K	Cast iron	Continuous cutting	PC5300	145 (110-180)	K20	→ PC5300
		Interrupted cutting	PC5400	125 (85-160)	K30	→ PC5400 ^{new}
S	HRSA	Continuous cutting	PC5300	55 (40-70)	S10 S20	→ PC5300
		Interrupted cutting	UNC840 ^{new}	60 (40-80)	S30 S40	→ UNC840 ^{new}

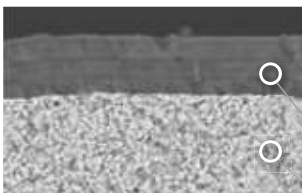
Grade Selection



PC5300

Ultra fine highly tough substrate & high temperature and high hardness coating technology

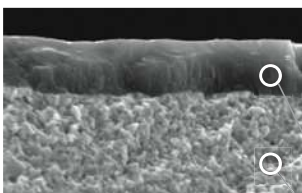
- Superior wear resistance, chipping resistance with high temperature, high hardness, and oxidation resistance coating technology.
- Superior chipping resistance and machining stability with ultra fine highly tough substrate.



PC3700 ^{new}

General steel milling substrate & PVD coating technology

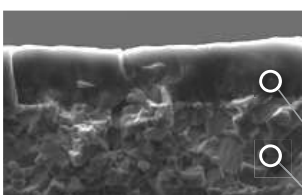
- Increased wear resistance, welding resistance, wear resistance with high hardness, lubricative multi-layer coating technology.
- Attained general machinability by applying wear and breakage resistant materials optimized for steel milling machining.



PC2510 ^{new}

Exclusive substrate for high hardness workpiece and coating surface treatment technology

- Improved welding resistance, chipping resistance, machining stability by adding surface treatment technology to high hardness coating.
- Wear resistance, chipping resistance, and machining stability with high hardness substrate.



UNC840 ^{new}

Exclusive substrate for Hard-to-cut materials & CVD coating technology

- 40 GPa coating hardness, 0.3 μm coating surface finish, improved heat resistance, chipping resistance, and welding resistance
- Applying specialized substrate strengthens the welding resistance and chipping resistance during machining of hard-to-cut materials

Cutting Performance

Carbon steel (C45, HB200)

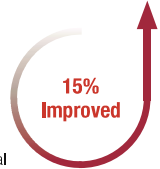
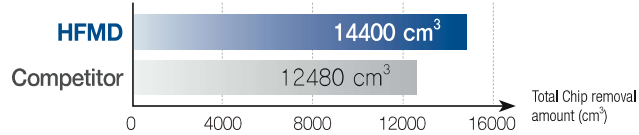
- **Workpiece** Steel rectangular tube (300×200×100)
- **Cutting conditions** vc (m/min) = 200, fz (mm/t) = 1.2, ap (mm) = 0.8, ae (mm) = 20, wet
- **Tool** **Insert** LNMX060310R-MF **Holder** HFMS032R-5C32-200-LN06 (Ø32, 5T)



[HFMD]



[Competitor]



-Chip removal rate Q (cm³/min): 191,0
 -Cutting time (min): 75,4

Alloy steel (41CrMo4, HB250)

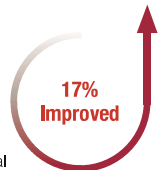
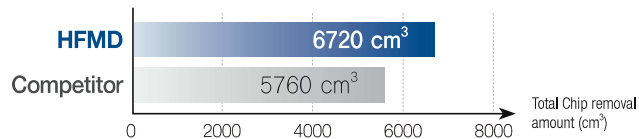
- **Workpiece** Steel rectangular tube (300×200×100)
- **Cutting conditions** vc (m/min) = 180, fz (mm/t) = 1.0, ap (mm) = 0.8, ae (mm) = 20, wet
- **Tool** **Insert** LNMX060310R-MF **Holder** HFMS032R-5C32-200-LN06 (Ø32, 5T)



[HFMD]



[Competitor]



-Chip removal rate Q (cm³/min): 143,2
 -Cutting time (min): 46,9

(*: DIN)

Pre-hardened steel (1,2738*, HRC30)

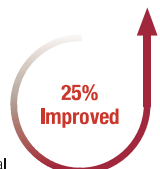
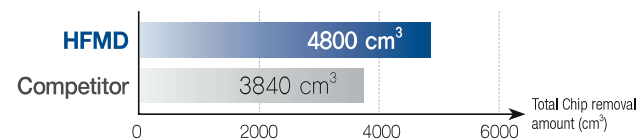
- **Workpiece** Steel rectangular tube (300×200×100)
- **Cutting conditions** vc (m/min) = 160, fz (mm/t) = 1.2, ap (mm) = 0.8, ae (mm) = 20, wet
- **Tool** **Insert** LNMX060310R-MF **Holder** HFMS032R-5C32-200-LN06 (Ø32, 5T)



[HFMD]



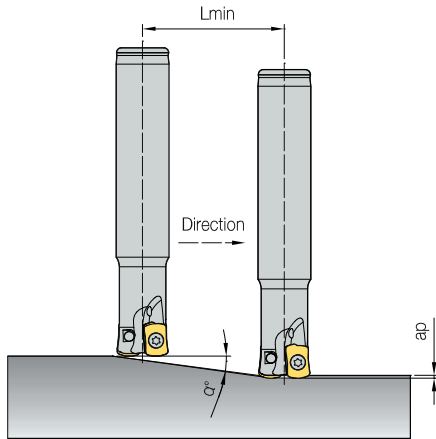
[Competitor]



-Chip removal rate Q (cm³/min): 152,8
 -Cutting time (min): 31,4

Ramping and Helical Cutting

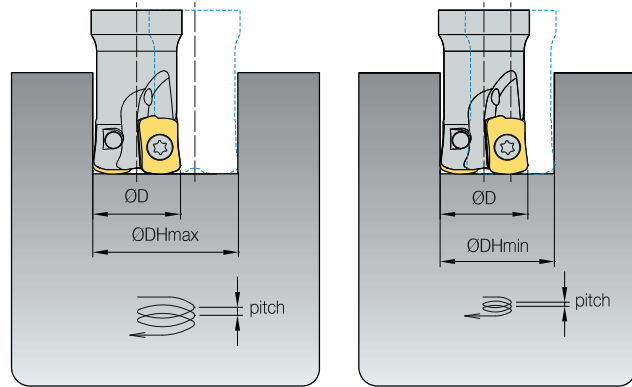
Ramping



$$L_{min} = \frac{ap}{\tan \alpha} \text{ (mm)}$$

- ※ Lmin: Min. inclination cutting length
- α°: Max. rake angle for ramping
- ap: Depth of cut

Helical cutting



ØD = Tool dia. (mm)

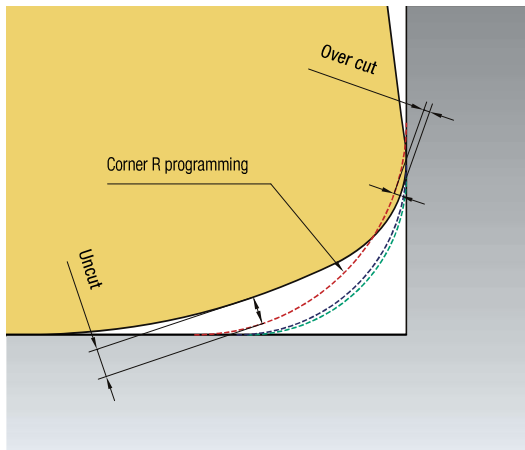
• Ød = Tool path. (mm) = ØDHmin, max - ØD

(mm)

Designation	Tool dia. ØD	ap	Ramping		Blind hole helical cutting				Through hole helical cutting	
			Max. rake angle α°	Lmin	Max. machining dia. DHmax	Max. pitch	Min. machining dia. ØDHmin	Max. pitch	Min. machining dia. ØDHmin	Max. pitch
HFMS016	16	0,7	3,0	13	30	0,7	22	0,7	21	0,7
HFMS017	17	1,0	2,3	25	32	1,0	24	1,0	22	1,0
HFMS018	18	1,0	2,1	27	34	1,0	26	1,0	24	1,0
HFMS019	19	1,0	1,9	30	36	1,0	28	1,0	26	1,0
HFMS020	20	1,0	1,5	37	38	1,0	30	1,0	28	1,0
HFMS021	21	1,0	1,5	39	40	1,0	32	1,0	30	1,0
HFMS025	25	1,0	1,4	40	48	1,0	40	1,0	38	1,0
HFMS026	26	1,0	1,4	42	50	1,0	42	1,0	40	1,0
HFMS030	30	1,0	1,1	51	58	1,0	50	1,0	48	1,0
HFMS032	32	1,0	1,0	55	62	1,0	54	1,0	52	1,0
HFMS033	33	1,0	1,0	57	64	1,0	56	1,0	54	1,0
HFMS035	35	1,0	0,9	61	68	1,0	60	1,0	58	1,0
HFMS040	40	1,0	0,8	71	78	1,0	70	1,0	68	1,0
HFMC042	42	1,0	0,8	76	82	1,0	74	1,0	72	1,0
HFMC050	50	1,0	0,6	92	98	1,0	90	1,0	88	1,0
HFMC052	52	1,0	0,6	96	102	1,0	94	1,0	92	1,0
HFMC063	63	1,0	0,5	119	124	1,0	116	1,0	114	1,0
HFMC066	66	1,0	0,5	126	130	1,0	122	1,0	120	1,0

- Adjust feed [vf (mm/min)] to under 70% of recommended cutting condition when ramping & helical cutting.
- In helical ramping, max. cutting depth (dmax) per 1 helical revolution of cutter should not exceed max. cutting depth (ap) as per insert size.
- In ramping, max. cutting depth per 1 ramping process of cutter should not exceed max. depth of cut as per used insert size.

Caution for Corner R Programming



----- R2.0 - - - - - R1.6 - R1.5

(mm)

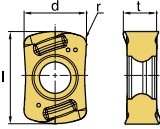
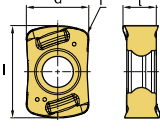
Insert	Corner R programming	Conditions de coupe		Over cut	Uncut
		Nose R	Max. ap		
LNMX060310R-ML LNMX060310R-MF LNMX060310R-MM	R1.5			0	0,41
	R1.6 (Standard)	1,0	1,0	0	0,38
	R2.0			0,057	0,27

During usage of CNC program, over cut & uncut would be occurred on the corner processing site if entering the correct program corner R value for each insert.

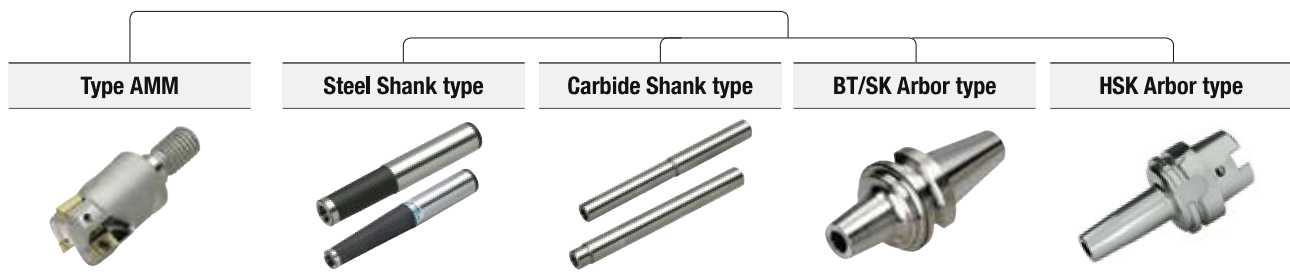
To prevent overcut, you will need to complete a CNC program considering the above overcut.

Insert

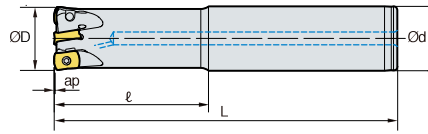
(mm)

Designation	Application	Dimensions				Picture	Configuration
		l	d	t	r		
LNMX060310R	ML For hard-to-cut materials Ti & inconel	10	6,8	3,6	1		
	MF For light cutting	10	6,8	3,6	1		
	MM For general cutting	10	6,8	3,6	1		

Modular Adaptors



HFMD5-LN06

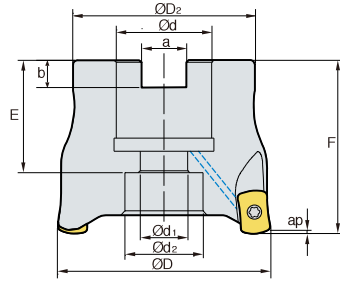
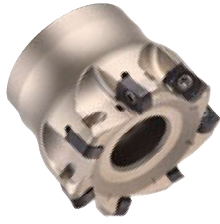


• AR: -9°
• RR: 10°-15°

(mm)

Designation			ØD	Ød	ℓ	L	ap	
HFMD5	016R-2C16-100-LN06	2	16	16	30	100	0,7	0,13
	016R-2C16-150-LN06	2	16	16	50	150	0,7	0,19
	017R-2C16-100-LN06	2	17	16	30	100	1,0	0,13
	017R-2C16-150-LN06	2	17	16	40	150	1,0	0,20
	017R-2C16-200-LN06	2	17	16	40	200	1,0	0,27
	018R-2C16-100-LN06	2	18	16	40	100	1,0	0,14
	018R-2C16-160-LN06	2	18	16	40	160	1,0	0,18
	018R-2C16-200-LN06	2	18	16	40	200	1,0	0,28
	019R-2C16-100-LN06	2	19	16	40	100	1,0	0,15
	019R-2C16-160-LN06	2	19	16	40	160	1,0	0,19
	019R-2C16-200-LN06	2	19	16	40	200	1,0	0,29
	020R-3C20-100-LN06	3	20	20	40	100	1,0	0,20
	020R-3C20-130-LN06	3	20	20	50	130	1,0	0,26
	020R-3C20-160-LN06	3	20	20	80	160	1,0	0,31
	020R-3C20-200-LN06	3	20	20	120	200	1,0	0,40
	021R-3C20-100-LN06	3	21	20	30	100	1,0	0,21
	021R-3C20-130-LN06	3	21	20	40	130	1,0	0,27
	021R-3C20-160-LN06	3	21	20	40	160	1,0	0,34
	021R-3C20-200-LN06	3	21	20	40	200	1,0	0,42
	025R-4C25-100-LN06	4	25	25	40	100	1,0	0,33
	025R-4C25-140-LN06	4	25	25	60	140	1,0	0,46
	025R-4C25-180-LN06	4	25	25	100	180	1,0	0,58
	025R-4C25-250-LN06	4	25	25	150	250	1,0	0,67
	026R-4C25-100-LN06	4	26	25	30	100	1,0	0,34
	026R-4C25-140-LN06	4	26	25	40	140	1,0	0,48
	026R-4C25-180-LN06	4	26	25	40	180	1,0	0,63
	026R-4C25-250-LN06	4	26	25	40	250	1,0	0,72
	032R-5C32-150-LN06	5	32	32	70	150	1,0	0,82
	032R-5C32-200-LN06	5	32	32	120	200	1,0	1,08
	032R-5C32-250-LN06	5	32	32	150	250	1,0	1,20
	033R-5C32-150-LN06	5	33	32	40	150	1,0	0,82
	033R-5C32-200-LN06	5	33	32	40	200	1,0	1,08
	033R-5C32-250-LN06	5	33	32	40	250	1,0	1,20
	035R-5C32-150-LN06	5	35	32	40	150	1,0	0,87
035R-5C32-200-LN06	5	35	32	40	200	1,0	1,13	
035R-5C32-250-LN06	5	35	32	40	250	1,0	1,25	
040R-6C32-150-LN06	6	40	32	40	150	1,0	0,97	
040R-6C32-200-LN06	6	40	32	40	200	1,0	1,28	
040R-6C32-250-LN06	6	40	32	40	250	1,0	1,38	

HFMDCM-LN06

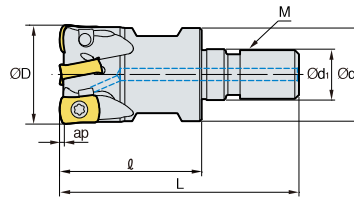


• AR: -9°
• RR: 10°-12°

(mm)

Designation			ØD	ØD ²	Ød	Ød ¹	Ød ²	a	b	E	F	ap	
HFMDCM	032R-16-5-LN06	5	32	30	16	9	13,5	8,4	5,6	19	40	1,0	0,12
	040R-16-6-LN06	6	40	34	16	9	14	8,4	5,6	19	40	1,0	0,21
	050R-22-6-LN06	6	50	42	22	11	18	10,4	6,3	21	40	1,0	0,32
	050R-22-7-LN06	7	50	42	22	11	18	10,4	6,3	21	40	1,0	0,32
	050R-22-8-LN06	8	50	42	22	11	18	10,4	6,3	21	40	1,0	0,32
	052R-22-7-LN06	7	52	42	22	11	18	10,4	6,3	21	40	1,0	0,34
	052R-22-8-LN06	8	52	42	22	11	18	10,4	6,3	21	40	1,0	0,34
	063R-22-8-LN06	8	63	49	22	11	18	10,4	6,3	21	40	1,0	0,53
	063R-22-9-LN06	9	63	49	22	11	18	10,4	6,3	21	40	1,0	0,53
	066R-22-8-LN06	8	66	49	22	11	18	10,4	6,3	21	40	1,0	0,57
	066R-22-9-LN06	9	66	49	22	11	18	10,4	6,3	21	40	1,0	0,57

HFMDM-LN06



• AR: -9°
• RR: 10°-15°

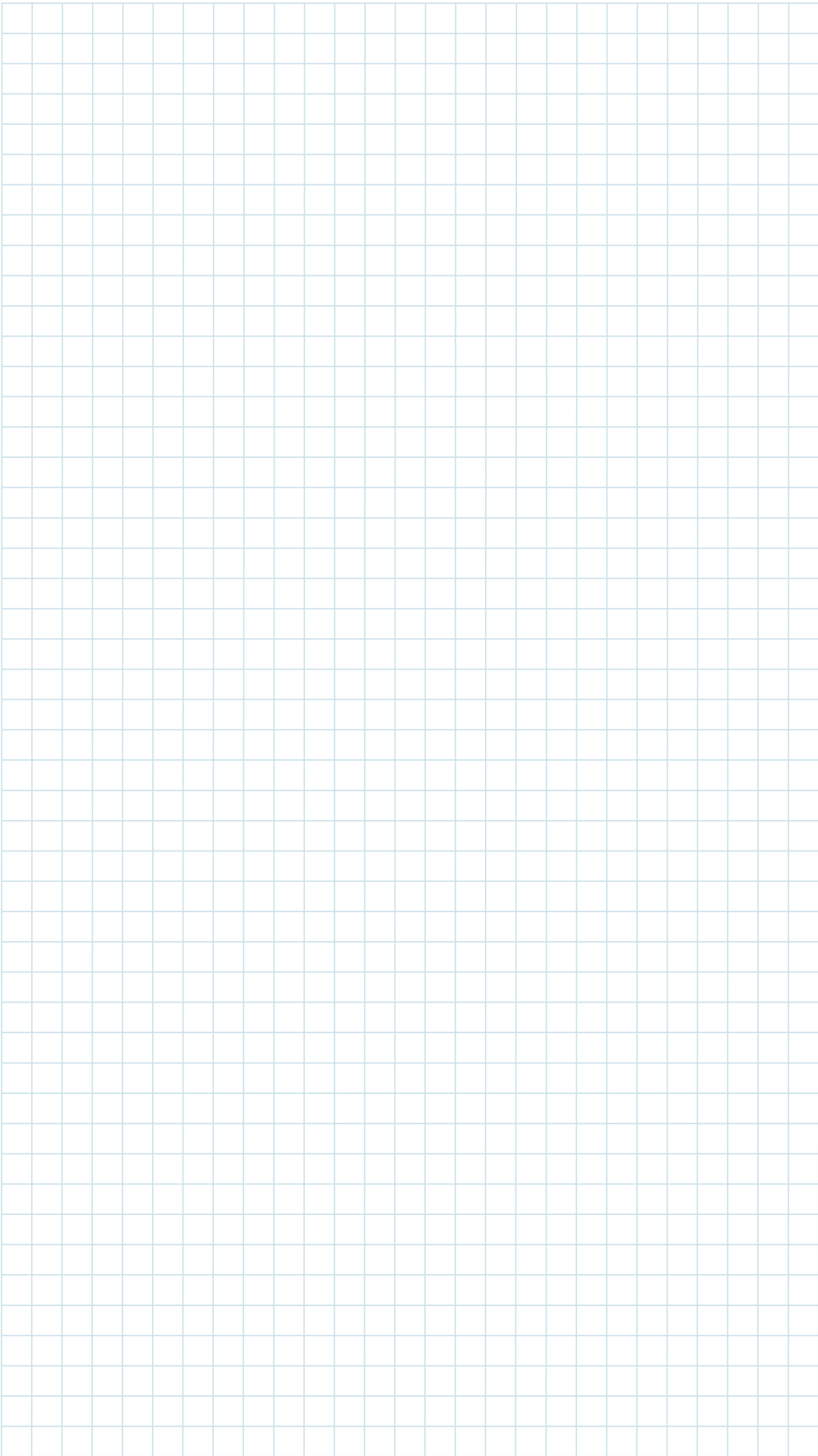
(mm)

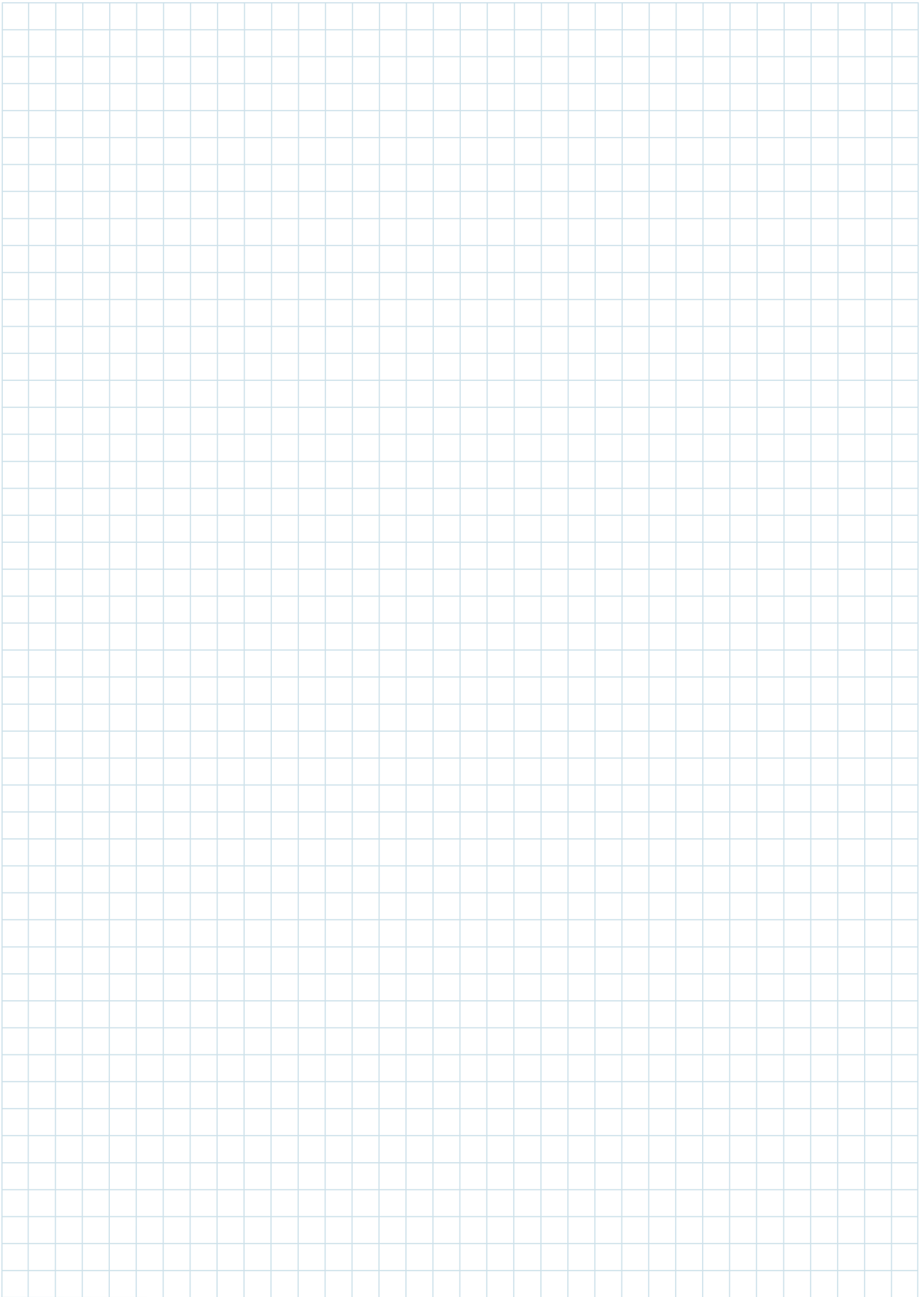
Designation			ØD	Ød	Ød ¹	l	L	M	ap	
HFMDM	016R-2-M08-LN06	2	16	14,5	8,5	25	42	M08	0,7	0,03
	017R-2-M08-LN06	2	17	14,5	8,5	25	42	M08	1,0	0,03
	018R-2-M08-LN06	2	18	14,5	8,5	25	42	M08	1,0	0,04
	019R-2-M08-LN06	2	19	14,5	8,5	25	42	M08	1,0	0,05
	020R-3-M10-LN06	3	20	18	10,5	30	51	M10	1,0	0,06
	021R-3-M10-LN06	3	21	18	10,5	30	51	M10	1,0	0,07
	025R-4-M12-LN06	4	25	23	12,5	35	59	M12	1,0	0,10
	026R-4-M12-LN06	4	26	23	12,5	35	59	M12	1,0	0,10
	032R-5-M16-LN06	5	32	29	17	40	67	M16	1,0	0,20
	033R-5-M16-LN06	5	33	29	17	40	67	M16	1,0	0,20
	035R-5-M16-LN06	5	35	29	17	40	67	M16	1,0	0,21
	040R-6-M16-LN06	6	40	29	17	40	67	M16	1,0	0,24
	042R-6-M16-LN06	6	42	29	17	40	67	M16	1,0	0,25

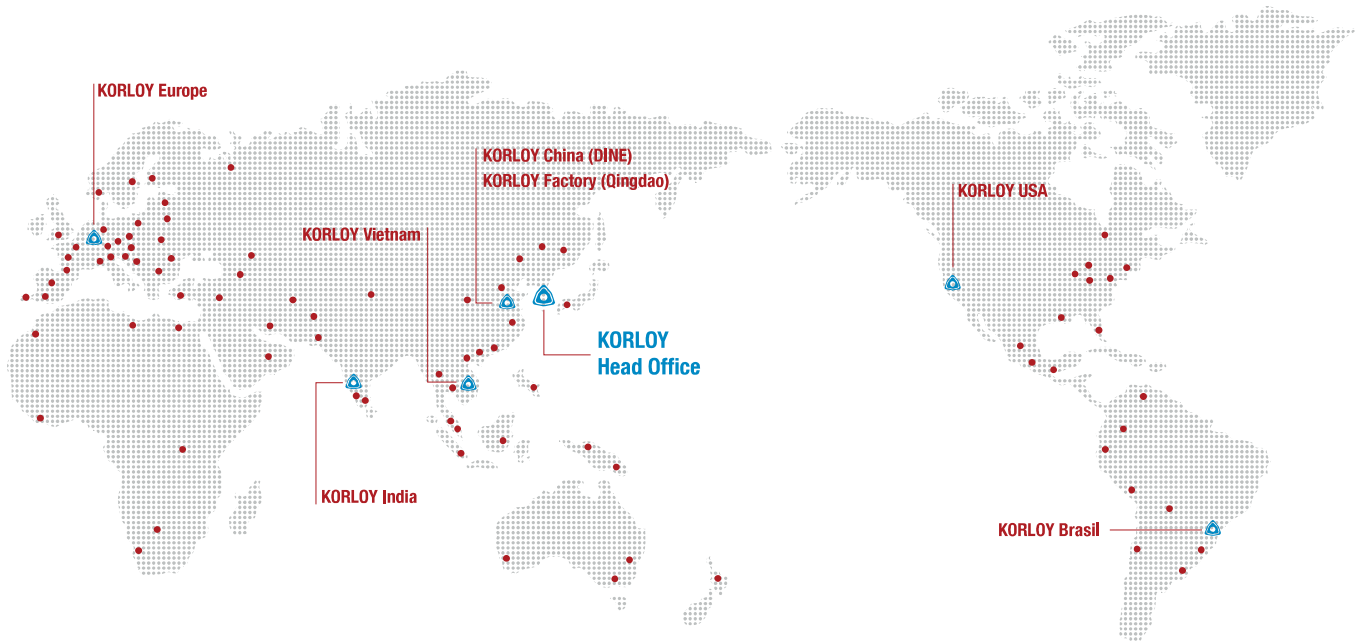
Parts

Specification	Screw	Wrench
Ø16-Ø66	FTNA0306	TW09S

Notes








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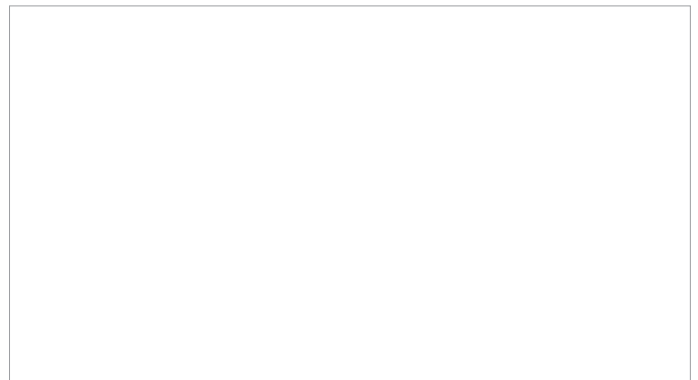
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