

# PRODUCT NEWS

PN-E-012



## SHOULDER EXTREME

EXSAP/MSX type

for high efficient shoulder milling.



KALIP TEKNİK

[www.kalipteknik.com.tr](http://www.kalipteknik.com.tr)



High efficient & high precision shoulder milling cutter

## SHOULDER EXTREME EXSAP/MSX type

### Features



Facemill type



Modular head type



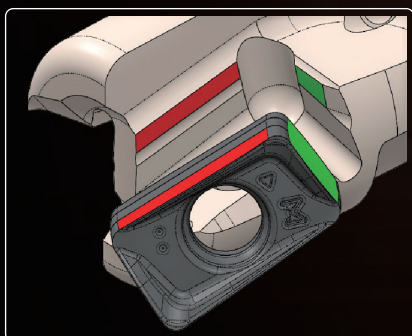
Endmill type

### Various line up

EXSAP/ MSX are **usable for wide applications** such as face milling, slotting and plunging

Arc geometry on the periphery cutting edge

Cusp height can be smaller even in case of large ap and **achieved high efficient & high precision machining** for vertical wall



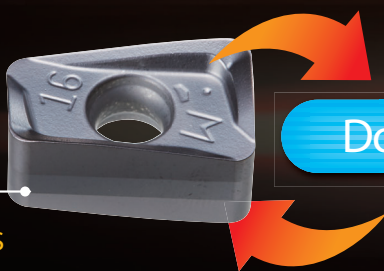
### Strongly clamp system

Due to unique clamp system possible to hold insert **achieved high efficient machining in roughing**

3D chipbreaker

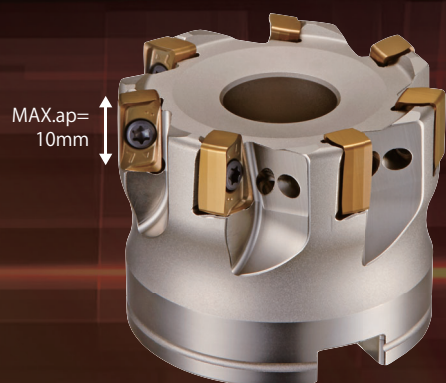
High precision G class periphery grinding

Applicable to **semi finishing process**



**Double-side usable!**

## EXSAP-11 type



Superior cutting performance by multi blades with small inserts.

Achieved high efficiency and high speed machining.

Accuracy of tool dia. with master insert 0~0.1

Achieves even higher precision semi finishing process



Grade : JC8050  
JC8118

PM breaker for general steel

Optimal breaker for mold steel &  
High hardened steel less than 50HRC



Grade : JC7550  
JC7518

SL breaker for hard-to-cut materials

Optimal breaker for Titanium alloy and Inconel

## EXSAP-17 type



Max.depth of cut (ap)=15mm is possible

Possible to applicate from roughing process to semi finishing even with large ap cutting

High rigidity insert

Achieved high precision machining even in large ap machining due to the thick insert



Grade : JC8050  
JC8118

PM breaker for general steel

Optimal breaker for Mold steel and  
High hardened steel less than 50HRC

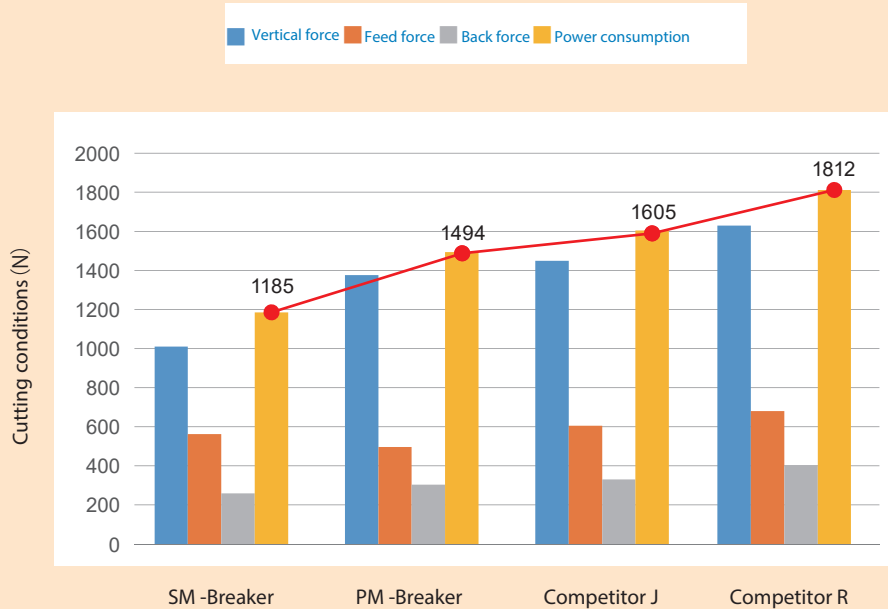
## Application

| ISO              | P   |     |        |     |     | M   |     |        |     |     | K   |        |     |     | S   |        |     |     | H   |        |     |
|------------------|-----|-----|--------|-----|-----|-----|-----|--------|-----|-----|-----|--------|-----|-----|-----|--------|-----|-----|-----|--------|-----|
|                  | P01 | P10 | P20    | P30 | P40 | M01 | M10 | M20    | M30 | M40 | K01 | K10    | K20 | K30 | S01 | S10    | S20 | S30 | H01 | H10    | H20 |
| Applicable range |     |     | JC8118 |     |     |     |     | JC8118 |     |     |     | JC8118 |     |     |     |        |     |     |     | JC8118 |     |
|                  |     |     | JC8050 |     |     |     |     | JC8050 |     |     |     |        |     |     |     |        |     |     |     |        |     |
|                  |     |     | JC7518 |     |     |     |     | JC7518 |     |     |     |        |     |     |     | JC7518 |     |     |     | JC7518 |     |
|                  |     |     | JC7550 |     |     |     |     | JC7550 |     |     |     |        |     |     |     | JC7550 |     |     |     |        |     |

## Cutting performance

EXSAP-11 type

### Cutting force comparison



Material : Ti-6AL-4V

● Tool dia. :  $\varnothing 16\text{mm}$

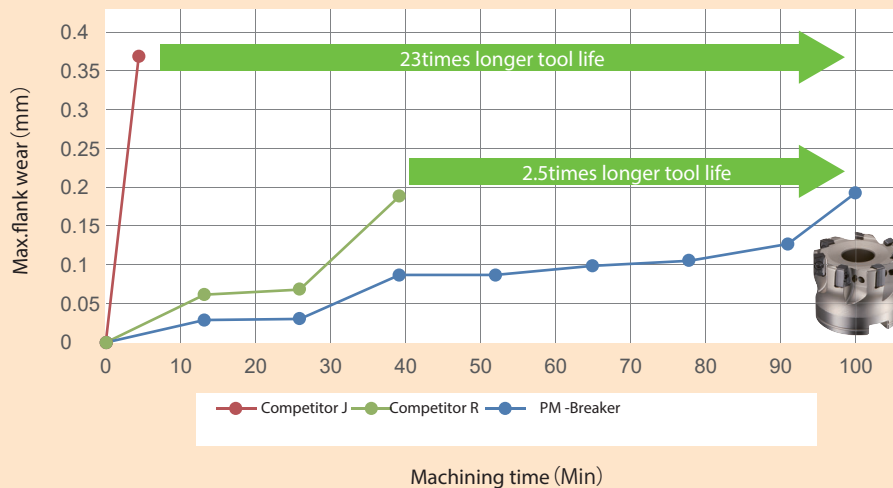
● Cutting conditions :

$V_c=60\text{m/min}$ ,  $f_z=0.1\text{mm/t}$   
 $a_p=5\text{mm}$ ,  $a_e=1\text{mm}$

Test by one insert  
 DOWN CUT  
 Air blow

SL breaker is 35% lower Cutting force than R company Even in the PM breaker Lower Cutting force than other companies.

### Tool life comparison (For roughing)



Material : NAK80

● Tool dia. :  $\varnothing 50\text{mm}$

● Cutting conditions :  
 $V_c=120\text{m/min}$ ,  $f_z=0.15\text{mm/t}$   
 $a_p=2\text{mm}$ ,  $a_e=35\text{mm}$

Test by one insert  
 DOWN CUT  
 Air blow

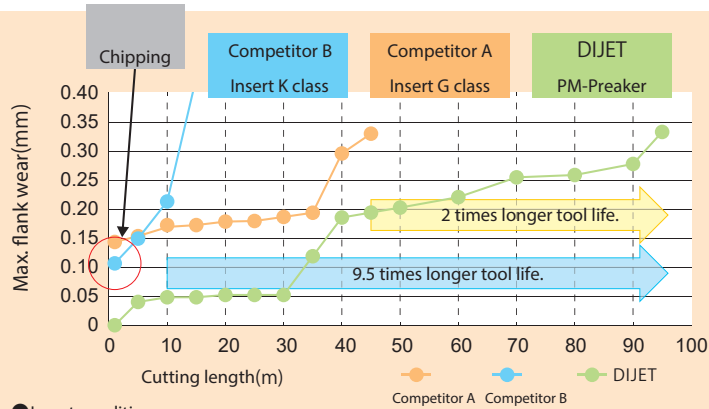
Because the initial wear is small and the cutting resistance is low, EXSAP achieves stable machining.

PM Breaker suppress rubbing. Both Ra and Rz are good. Achieved a beautiful finished surface.

| DIJETPM-Breaker               | Competitor J                  | Competitor R                  |
|-------------------------------|-------------------------------|-------------------------------|
|                               |                               |                               |
| $R_a=0.24\text{ }\mu\text{m}$ | $R_a=0.27\text{ }\mu\text{m}$ | $R_a=0.49\text{ }\mu\text{m}$ |
| $R_z=1.41\text{ }\mu\text{m}$ | $R_z=1.71\text{ }\mu\text{m}$ | $R_z=3.03\text{ }\mu\text{m}$ |

## EXSAP-17 type

### Tool life comparison (for roughing)



Material : P20

● Tool dia. :  $\phi 50\text{mm}$

Insert Grade : JC8118

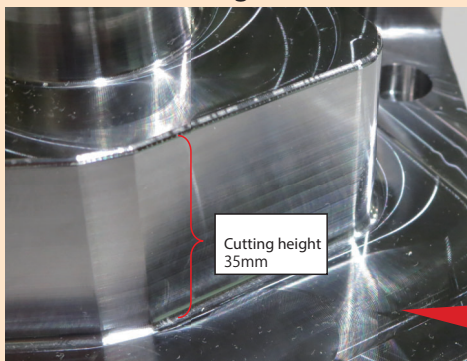
● Cutting conditions :  
 $V_c=150\text{m/min}$ ,  $f_z=0.3\text{mm/t}$ ,  
 $a_p=15\text{mm}$ ,  $a_e=3\text{mm}$

Test by one insert  
 UP & DOWN CUT  
 Air blow

Possible to stable roughing!

### Surface roughness comparison (for semi-finishing)

#### ● Shoulder milling



| Deflection (vertical wall)<br>(height: 30mm) | Feed direction    | Feed direction    |
|----------------------------------------------|-------------------|-------------------|
| $6\mu\text{m}$                               | $0.47\mu\text{m}$ | $2.92\mu\text{m}$ |

(※)  $\nabla\nabla\nabla \Rightarrow Ra \leq 1.6\mu\text{m}$   $Rz \leq 6.3\mu\text{m}$

Possible to high precision  
 machining at  $\nabla\nabla\nabla$  level!

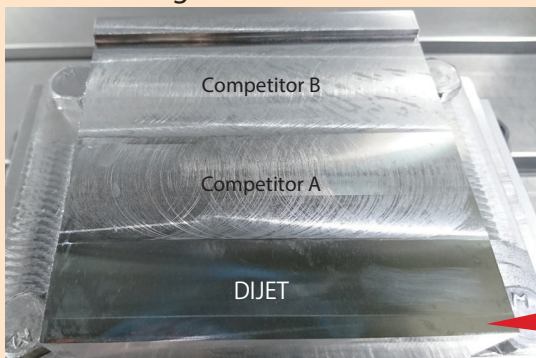
Material : HPM-MAGIC (P20)

● Tool dia. :  $\phi 25\text{mm}$

Insert grade : JC8050

● Cutting condition :  
 $V_c=250\text{m/min}$ ,  $f_z=0.15\text{mm/t}$ ,  
 $a_p=3\text{mm}$ ,  $a_e=0.2\text{mm}$   
 Test by two insert  
 DOWN CUT  
 Air blow

#### ● Face milling



Good surface  
 roughness!

Material : HPM-MAGIC (P20)

● Tool dia. :  $\phi 50\text{mm}$

Insert grade : JC8050

● Cutting condition :  
 $V_c=180\text{m/min}$ ,  $f_z=0.1\text{mm/t}$ ,  
 $a_p=3\text{mm}$ ,  $a_e=35\text{mm}$   
 Test by one insert  
 DOWN CUT  
 Air blow

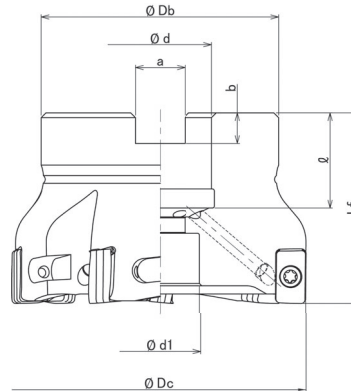
## Line up

EXSAP-11 type

● Facemill type



● Through coolant hole



| Type        | Cat. No.          | Stock | No. of inserts | Dimensions (mm) |       |               |             |               |      |     |        | Set bolt     |                                  | Weight (kg) | Inserts<br>          |
|-------------|-------------------|-------|----------------|-----------------|-------|---------------|-------------|---------------|------|-----|--------|--------------|----------------------------------|-------------|----------------------------------------------------------------------------------------------------------|
|             |                   |       |                | $\varphi D_c$   | $L_f$ | $\varphi D_b$ | $\varphi d$ | $\varphi d_1$ | a    | b   | $\ell$ |              |                                  |             |                                                                                                          |
| Metric Bore | EXSAP-6040R-11-16 | ●     | 6              | 40              | 40    | 35            | 16          | 14            | 8.4  | 5.6 | 18     | M8           | Head cap screw<br>(JIS Standard) | 0.22        | ZNGU1105**ZER-**<br> |
|             | EXSAP-7050R-11-22 | ●     | 7              | 50              | 40    | 47            | 22          | 16.5          | 10.4 | 6.3 | 20     | M10          |                                  | 0.38        |                                                                                                          |
|             | EXSAP-7052R-11-22 | ●     | 7              | 52              | 40    | 47            | 22          | 16.5          | 10.4 | 6.3 | 20     | M10          |                                  | 0.39        |                                                                                                          |
|             | EXSAP-7063R-11-22 | ●     | 7              | 63              | 40    | 50            | 22          | 17            | 10.4 | 6.3 | 20     | M10          |                                  | 0.53        |                                                                                                          |
|             | EXSAP-7063R-11-27 | ●     | 7              | 63              | 50    | 50            | 27          | 20            | 12.4 | 7   | 22     | M12×1.75×30★ |                                  | 0.62        |                                                                                                          |
|             | EXSAP-8080R-11-27 | ●     | 8              | 80              | 50    | 56            | 27          | 20            | 12.4 | 7   | 22     | M12×1.75×30★ |                                  | 0.99        |                                                                                                          |

●: Standard stock items □: Stock in Japan. (7 to 10 days delivery upon ordering)

Note) 1. All cutters are supplied without inserts.

2. All cutters are supplied without wrench & MOLY.

3. ★ mark shows these cutter bodies are equipped with the set bolt because of the specified bolt size.

Expect for these cutter bodies, please use the set bolt equipped with arbor.

4. Please see page 19-20 for recommended Cutting conditions for shoulder milling, 25-26 for recommended Cutting conditions for Facemilling.

| Parts                                                                               |                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Clamp screw                                                                         | Wrench(not be included)                                                             |
|  |  |
| TSW-307H                                                                            | A-10                                                                                |

| Clamp screw | Recommended torque (N·m) |
|-------------|--------------------------|
| TSW-307H    | 2.1                      |



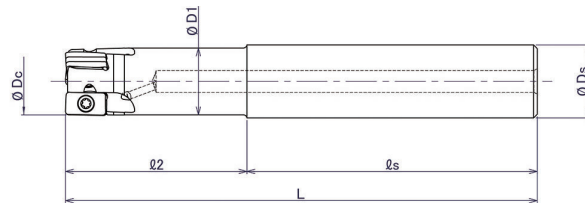
## EXSAP-11 type

### Endmill type



● Through coolant hole

Fig.1



| Cat. No.               | Stock | No. of inserts | Dimensions (mm)   |          |          |     |                   |                   | Fig. | Inserts                                                                                                  |
|------------------------|-------|----------------|-------------------|----------|----------|-----|-------------------|-------------------|------|----------------------------------------------------------------------------------------------------------|
|                        |       |                | $\varnothing D_c$ | $\ell_2$ | $\ell_s$ | $L$ | $\varnothing D_1$ | $\varnothing D_s$ |      |                                                                                                          |
| EXSAP-2016-11-50-S16+A | ●     | 2              | 16                | 50       | 60       | 110 | 14.6              | 16                | 1    | ZNGU1105**ZER-**<br> |
| EXSAP-3020-11-50-S20+A | ●     | 3              | 20                | 50       | 80       | 130 | 18.3              | 20                | 1    |                                                                                                          |
| EXSAP-3025-11-50-S25+A | ●     | 3              | 25                | 50       | 80       | 130 | 23.4              | 25                | 1    |                                                                                                          |
| EXSAP-4032-11-50-S32+A | ●     | 4              | 32                | 50       | 80       | 130 | 29                | 32                | 1    |                                                                                                          |

●: Standard stock items

Note)1. All cutters are supplied without inserts.

2. All cutters are supplied without wrench & MOLY.

3. Please see page 21-22 for recommended Cutting conditions for shoulder milling, 27-28 for recommended Cutting conditions for Facemilling.

| Parts                                                                               |                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Clamp screw                                                                         | Wrench(not be included)                                                             |
|  |  |
| TSW-307H                                                                            | A-10                                                                                |

| Clamp screw | Recommended torque (N·m) |
|-------------|--------------------------|
| TSW-307H    | 2.1                      |

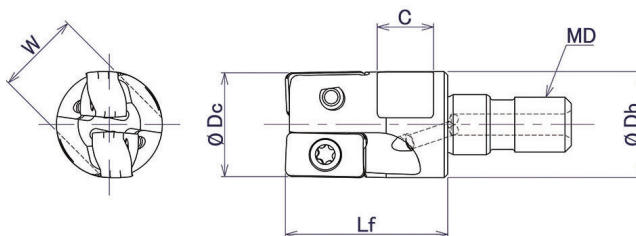
## Line up

EXSAP-11 type

● Modular head type



● Through coolant hole



| Cat. No.        | Stock | No. of inserts | Dimensions (mm)   |       |                   |      |     |     | Inserts                                                                                                  |
|-----------------|-------|----------------|-------------------|-------|-------------------|------|-----|-----|----------------------------------------------------------------------------------------------------------|
|                 |       |                | $\varnothing D_c$ | $L_f$ | $\varnothing D_b$ | $MD$ | $C$ | $W$ |                                                                                                          |
| MSX-2016-11-M8  | ●     | 2              | 16                | 23    | 15                | M8   | 8   | 12  | ZNGU1105**ZER-**<br> |
| MSX-3020-11-M10 | ●     | 3              | 20                | 30    | 18                | M10  | 9   | 14  |                                                                                                          |
| MSX-3025-11-M12 | ●     | 3              | 25                | 35    | 22                | M12  | 11  | 19  |                                                                                                          |
| MSX-4030-11-M16 | □     | 4              | 30                | 43    | 29                | M16  | 12  | 22  |                                                                                                          |
| MSX-4032-11-M16 | ●     | 4              | 32                | 43    | 29                | M16  | 12  | 22  |                                                                                                          |
| MSX-5040-11-M16 | ●     | 5              | 40                | 43    | 29                | M16  | 12  | 22  |                                                                                                          |

●: Standard stock items □: Stock in Japan. (7 to 10 days delivery upon ordering)

Note) 1. All cutters are supplied without inserts.

2. All cutters are supplied without wrench & MOLY.

3. Please see page 12 for recommended tightening torque.

4. Please see page 23-24 for recommended Cutting conditions for shoulder milling, 29-30 for recommended Cutting conditions for Facemilling.

| Parts                                                                               |                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Clamp screw                                                                         | Wrench(not be included)                                                             |
|  |  |
| TSW-307H                                                                            | A-10                                                                                |

| Clamp screw | Recommended torque (N·m) |
|-------------|--------------------------|
| TSW-307H    | 2.1                      |



## EXSAP-11 type

### Inserts

**NEW**

Fig.1



Fig.1

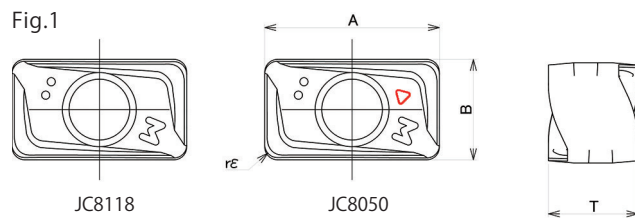
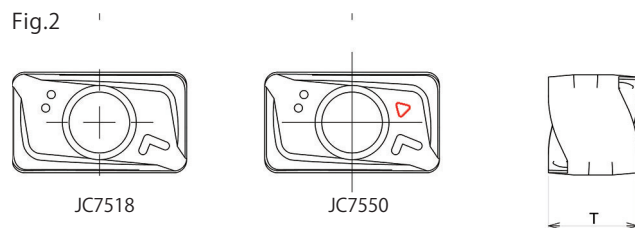


Fig.2



Fig.2

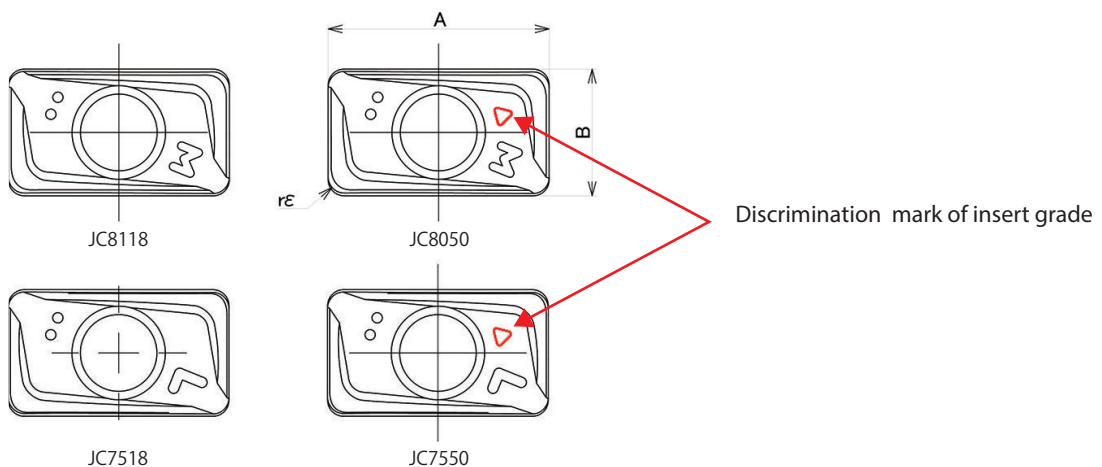


| Cat. No.         | Tolerance | PVD Coated |        |        |        | Dimensions(mm) |     |     |     | Fig. |
|------------------|-----------|------------|--------|--------|--------|----------------|-----|-----|-----|------|
|                  |           | JC8118     | JC8050 | JC7518 | JC7550 | A              | B   | T   | rε  |      |
| ZNGU110504ZER-PM | G         | ●          | ●      |        |        | 11             | 6.3 | 5.6 | 0.4 | 1    |
| ZNGU110508ZER-PM | G         | ●          | ●      |        |        | 11             | 6.3 | 5.6 | 0.8 | 1    |
| ZNGU110516ZER-PM | G         | ●          | ●      |        |        | 11             | 6.3 | 5.6 | 1.6 | 1    |
| ZNGU110504ZER-SL | G         |            |        | ●      | ●      | 11             | 6.3 | 5.6 | 0.4 | 2    |
| ZNGU110508ZER-SL | G         |            |        | ●      | ●      | 11             | 6.3 | 5.6 | 0.8 | 2    |
| ZNGU110516ZER-SL | G         |            |        | ●      | ●      | 11             | 6.3 | 5.6 | 1.6 | 2    |

●: Standard stock items  
10 inserts per case.

### Discrimination of grade for insert.

Each grade shows discrimination mark on the insert surface.



## Line up

EXSAP-17 type

Facemill type

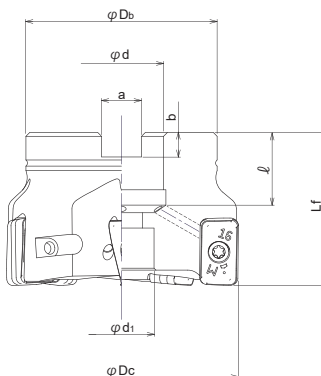
**G-Body**



● Through coolant hole



Body



| Type        | Cat. No.       | Stock | No. of inserts | Dimensions (mm) |    |     |    |     |      |     |    | Set bolt     |                                  | Weight (kg) | Inserts<br> |
|-------------|----------------|-------|----------------|-----------------|----|-----|----|-----|------|-----|----|--------------|----------------------------------|-------------|------------------------------------------------------------------------------------------------|
|             |                |       |                | φDc             | Lf | φDb | φd | φd1 | a    | b   | l  |              |                                  |             |                                                                                                |
| Metric Bore | EXSAP-4050R-22 | ●     | 4              | 50              | 40 | 47  | 22 | 17  | 10.4 | 6.3 | 20 | M10          | Head cap screw<br>(JIS Standard) | 0.38        | ZNGU1709**<br>ZER-PM                                                                           |
|             | EXSAP-5050R-22 | ●     | 5              | 50              | 40 | 47  | 22 | 17  | 10.4 | 6.3 | 20 | M10          |                                  | 0.38        |                                                                                                |
|             | EXSAP-5052R-22 | ●     | 5              | 52              | 40 | 47  | 22 | 17  | 10.4 | 6.3 | 20 | M10          |                                  | 0.41        |                                                                                                |
|             | EXSAP-5063R-22 | ●     | 5              | 63              | 40 | 50  | 22 | 17  | 10.4 | 6.3 | 20 | M10          |                                  | 0.58        |                                                                                                |
|             | EXSAP-7080R-27 | ●     | 7              | 80              | 50 | 56  | 27 | 20  | 12.4 | 7   | 22 | M12×1.75×30★ |                                  | 1.09        |                                                                                                |
|             | EXSAP-7100R-32 | ●     | 7              | 100             | 50 | 85  | 32 | 26  | 14.4 | 8   | 25 | M16×2×25★    |                                  | 1.93        |                                                                                                |
|             | EXSAP-8125R-40 | ●     | 8              | 125             | 63 | 100 | 40 | 32  | 16.4 | 9   | 32 | M20×2.5×40★  |                                  | 3.66        |                                                                                                |

●: Standard stock items

Note) 1. All cutters are supplied without inserts.

Note) 2. All cutters are supplied without wrench & MOLY.

Note) 3. ★ mark shows: these cutter bodies are equipped with the set bolt because of the specified bolt size.

Except for these cutter bodies, please use the set bolt equipped with arbor.

4. Attention to use 3.0mm corner radius insert (ZNGU170930ZER-PM); Body must be modified to 2.0mm radius or 1.5mm chamfer at corner.

5. Please see page 31-32 for recommended Cutting conditions for shoulder milling, 37-38 for recommended Cutting conditions for Facemilling.

| Parts                                                                               |                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Clamp screw                                                                         | Wrench(not be included)                                                             |
|  |  |
| TSW-410H                                                                            | A-15T                                                                               |

| Clamp screw | Recommended torque (N·m) |
|-------------|--------------------------|
| TSW-410H    | 3.5                      |



**G-Body**

Adopted GN surface-hardening treatment on thermal resistant high strength steel gives high hardness over 65HRC and secure insert pocket and holder against thermal deformation, improved body durability and tool life by 30% or more. Make it difficult to be damaged even under severe cutting conditions. Also rust-proof and anti-welding effect is much improved.

## EXSAP-17 type

### Endmill type



● Without coolant hole



| Cat. No.          | Stock | No. of inserts | Dimensions (mm)   |          |          |     |  |                   | Inserts          |
|-------------------|-------|----------------|-------------------|----------|----------|-----|--|-------------------|------------------|
|                   |       |                | $\varnothing D_c$ | $\ell_2$ | $\ell_s$ | $L$ |  | $\varnothing D_s$ |                  |
| EXSAP-2025-60-S25 | ●     | 2              | 25                | 60       | 80       | 140 |  | 25                | ZNGU1709**ZER-PM |
| EXSAP-3032-70-S32 | ●     | 3              | 32                | 70       | 80       | 150 |  | 32                |                  |

●: Standard stock items

Note) 1. All cutters are supplied without inserts.

2. All cutters are supplied without wrench & MOLY.

3. Attention to use 3.0mm corner radius insert (ZNGU170930ZER-PM); Body must be modified to 2.0mm radius or 1.5mm chamfer at corner.

4. Please see page 33-34 for recommended Cutting conditions for shoulder milling, 39-40 for recommended Cutting conditions for Facemilling.

| Parts                                                                               |                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Clamp screw                                                                         | Wrench(not be included)                                                             |
|  |  |
| TSW-410H                                                                            | A-15                                                                                |

| Clamp screw | Recommended torque (N·m) |
|-------------|--------------------------|
| TSW-410H    | 3.5                      |

## Line up

EXSAP-17type

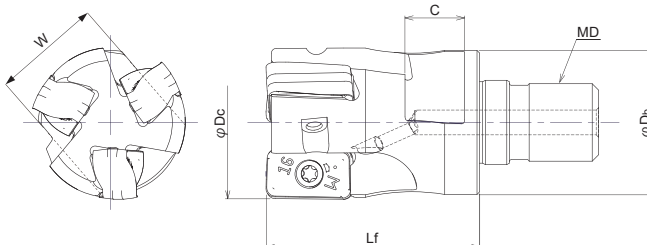
## Modular head type



**G-Body**



● Through coolant hole



## Body

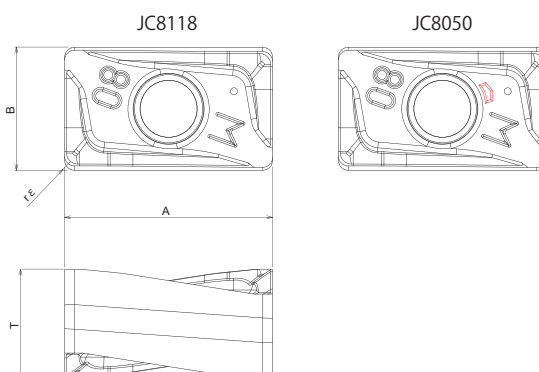
| Cat. No.     | Stock | No. of inserts | Dimensions (mm) |    |     |     |    |    | inserts          | Parts       |                         |
|--------------|-------|----------------|-----------------|----|-----|-----|----|----|------------------|-------------|-------------------------|
|              |       |                | φDc             | Lf | φDb | MD  | C  | W  |                  | Clamp screw | Wrench(not be included) |
| MSX-2025-M12 | ●     | 2              | 25              | 35 | 22  | M12 | 11 | 19 | ZNGU1709**ZER-PM | TSW-410H    | A-15                    |
| MSX-2026-M12 | □     | 2              | 26              | 35 | 22  | M12 | 11 | 19 |                  |             |                         |
| MSX-2028-M12 | □     | 2              | 28              | 35 | 22  | M12 | 11 | 19 |                  |             |                         |
| MSX-2030-M16 | □     | 2              | 30              | 43 | 29  | M16 | 12 | 22 |                  |             |                         |
| MSX-2032-M16 | ●     | 2              | 32              | 43 | 29  | M16 | 12 | 22 |                  |             |                         |
| MSX-3032-M16 | ●     | 3              | 32              | 43 | 29  | M16 | 12 | 22 |                  |             |                         |
| MSX-3033-M16 | □     | 3              | 33              | 43 | 29  | M16 | 12 | 22 |                  |             |                         |
| MSX-3035-M16 | □     | 3              | 35              | 43 | 29  | M16 | 12 | 22 |                  |             |                         |
| MSX-4040-M16 | ●     | 4              | 40              | 43 | 29  | M16 | 12 | 22 |                  |             |                         |

●: Standard stock items □: Stock in Japan. (7 to 10 days delivery upon ordering)

- Note) 1. All cutters are supplied without inserts.  
 2. All cutters are supplied without wrench & MOLY.  
 3. Please see page 12 for recommended tightening torque.  
 4. Attention to use 3.0mm corner radius insert (ZNGU170930ZER-PM);  
 Body must be modified to 2.0mm radius or 1.5mm chamfer at corner.  
 5. Please see page 35-36 for recommended Cutting conditions for shoulder milling,  
 41-42 for recommended Cutting conditions for Facemilling.

| Clamp screw | Recommended torque (N·m) |
|-------------|--------------------------|
| TSW-410H    | 3.5                      |

## Insert



| Cat. No.         | Tolerance | PVD Coated |        | Dimensions (mm) |    |     |     |
|------------------|-----------|------------|--------|-----------------|----|-----|-----|
|                  |           | JC8050     | JC8118 | A               | B  | T   | rε  |
| ZNGU170904ZER-PM | G         | ●          | ●      | 16.9            | 10 | 8.8 | 0.4 |
| ZNGU170908ZER-PM | G         | ●          | ●      | 16.9            | 10 | 8.8 | 0.8 |
| ZNGU170916ZER-PM | G         | ●          | ●      | 16.9            | 10 | 8.8 | 1.6 |
| ZNGU170920ZER-PM | G         | ●          | ●      | 16.9            | 10 | 8.8 | 2   |
| ZNGU170930ZER-PM | G         | ●          | ●      | 16.9            | 10 | 8.6 | 3   |

●: Standard stock items  
 10 inserts per case.

## Attention

 Attention to mounting head and MSN/ MGN shank arbor.

### ■ Tightening procedure

#### ① Cleaning

Remove dirt and chips with air from the connecting thread and face of modular head and MSN/MGN shank arbor.

#### ② Initial Tightening

Tighten by hand until the head and the shank arbor faces touch.

#### ③ Final Tightening

Tighten slowly with torque control spanner wrench or DIJET DS type spanner wrench and confirm that there is no gap.

### NOTE

- Note) 1. Only use the torque control spanner wrench or DIJET DS type spanner wrench.  
2. Please gently apply pressure on wrench.  
3. Please confirm that there is no gap between MSN/MGN shank arbor and modular head.

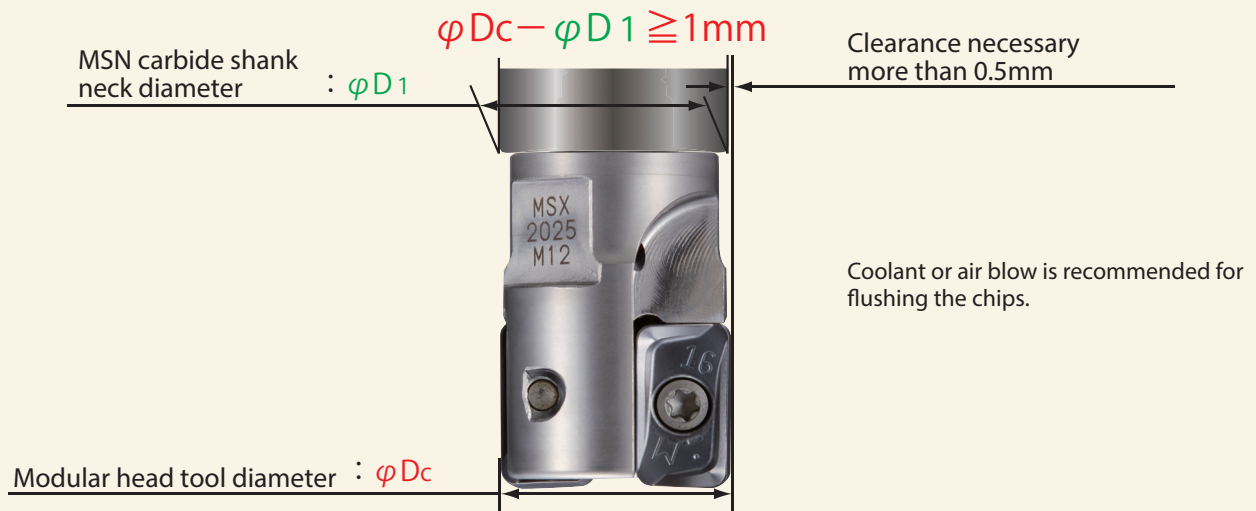
| Thread | Tightening torque | Spanner size W(mm) |
|--------|-------------------|--------------------|
| M6     | 8.0N·m            | 8☆                 |
| M8     | 16N·m             | 10, 12☆            |
| M10    | 16N·m             | 14, 15             |
| M12    | 20N·m             | 17, 19             |
| M16    | 25N·m             | 22, 26             |

- Note) 1. Modular heads are supplied without spanner wrench.  
2. In case of choosing torque control spanner wrench, confirm that the wrench size is match to the dimensions W & C of each modular head.  
(There are some cases that modifying the thickness of spanner)

Attention : Final tightening without initial tightening cause connecting thread damage.

 Selection of "MSN Carbide shank arbor"

In case of using modular head over  $\phi 16\text{mm}$ , please select **MSN carbide shank arbor that diameter ( $\phi D1$ ) is 1mm or more smaller than modular head ( $\phi Dc$ )**. A wrong selection causes damage to the carbide shank.



 Caution for the mounting to shrink fit holder.

When you use a carbide shank and a modular head on the shrink fit holder, please shrink fit the only carbide shank without mounting a modular head together. **Please mount a modular head after shrinking fit operation.**

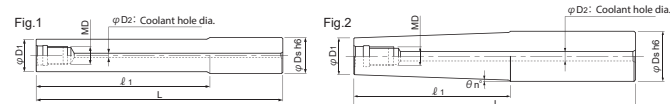
Note) In case of shrink fit MSN shank + modular head together, it will be difficult to loose due to heat desipation.

## Line up

### MSN Carbide shank arbor

#### ■ End mill shank type

- Through coolant hole ● For high productivity



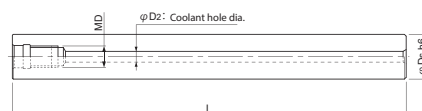
| Cat. No.          | Stock | Dimensions (mm) |     |     |      |       |     |     | Weight (kg) | Fig. |
|-------------------|-------|-----------------|-----|-----|------|-------|-----|-----|-------------|------|
|                   |       | φDs             | ℓ1  | L   | φD1  | θ n°  | MD  | φD2 |             |      |
| MSN-M8-20-S16C    | ●     | 16              | 20  | 75  | 15.5 | —     | M8  | 4   | 0.17        | 1    |
| MSN-M8-40-S16C    | ●     | 16              | 40  | 95  | 15.5 | —     |     |     | 0.22        | 1    |
| MSN-M8-40T-S20C   | □     | 20              | 40  | 100 | 14.5 | 3°30' |     |     | 0.36        | 2    |
| MSN-M8-77T-S20C   | ●     | 20              | 77  | 143 | 14.5 | 1°45' |     |     | 0.49        | 2    |
| MSN-M8-80-S16C    | ●     | 16              | 80  | 135 | 15.5 | —     |     |     | 0.32        | 1    |
| MSN-M8-120-S16C   | ●     | 16              | 120 | 175 | 15.5 | —     |     |     | 0.42        | 1    |
| MSN-M8-152-S16C   | ●     | 16              | 152 | 207 | 15.5 | —     |     |     | 0.51        | 1    |
| MSN-M10-20-S20C   | ●     | 20              | 20  | 80  | 19.5 | —     | M10 | 4   | 0.29        | 1    |
| MSN-M10-40-S20C   | ●     | 20              | 40  | 100 | 19.5 | —     |     |     | 0.39        | 1    |
| MSN-M10-40T-S20C  | ●     | 20              | 40  | 100 | 18.5 | 0°43' |     |     | 0.39        | 2    |
| MSN-M10-70-S20C   | ●     | 20              | 70  | 130 | 19.5 | —     |     |     | 0.5         | 1    |
| MSN-M10-85T-S25C  | ●     | 25              | 85  | 161 | 18.5 | 2°    |     |     | 0.9         | 2    |
| MSN-M10-90-S20C   | ●     | 20              | 90  | 150 | 19.5 | —     |     |     | 0.6         | 1    |
| MSN-M10-90T-S20C  | ●     | 20              | 90  | 150 | 18.5 | 0°19' |     |     | 0.58        | 2    |
| MSN-M10-140-S20C  | ●     | 20              | 140 | 200 | 19.5 | —     |     |     | 0.8         | 1    |
| MSN-M10-140T-S20C | ●     | 20              | 140 | 200 | 18.5 | 0°12' |     |     | 0.77        | 2    |
| MSN-M10-160-S20C  | ●     | 20              | 160 | 220 | 19.5 | —     |     |     | 0.87        | 1    |
| MSN-M10-210-S20C  | ●     | 20              | 210 | 270 | 19.5 | —     |     |     | 1.07        | 1    |
| MSN-M12-25-S25C   | ●     | 25              | 25  | 90  | 24   | —     | M12 | 6   | 0.53        | 1    |
| MSN-M12-55-S25C   | ●     | 25              | 55  | 120 | 24   | —     |     |     | 0.72        | 1    |
| MSN-M12-100T-S32C | □     | 32              | 100 | 180 | 23.5 | 2°    |     |     | 1.61        | 2    |
| MSN-M12-105-S25C  | ●     | 25              | 105 | 170 | 24   | —     |     |     | 1.03        | 1    |
| MSN-M12-135-S25C  | ●     | 25              | 135 | 215 | 24   | —     |     |     | 1.3         | 1    |
| MSN-M12-155-S25C  | ●     | 25              | 155 | 220 | 24   | —     |     |     | 1.34        | 1    |
| MSN-M12-200-S25C  | ●     | 25              | 200 | 265 | 24   | —     |     |     | 1.58        | 1    |
| MSN-M16-25-S32C   | ●     | 32              | 25  | 90  | 29   | —     | M16 | 8   | 0.85        | 1    |
| MSN-M16-55-S32C   | ●     | 32              | 55  | 120 | 29   | —     |     |     | 1.13        | 1    |
| MSN-M16-77-S32C   | ●     | 32              | 77  | 157 | 29   | —     |     |     | 1.47        | 1    |
| MSN-M16-97-S32C   | ●     | 32              | 97  | 177 | 29   | —     |     |     | 1.64        | 1    |
| MSN-M16-105-S32C  | ●     | 32              | 105 | 170 | 29   | —     |     |     | 1.59        | 1    |
| MSN-M16-117T-S32C | □     | 32              | 117 | 197 | 29   | 0°38' |     |     | 1.88        | 2    |
| MSN-M16-127-S32C  | ●     | 32              | 127 | 207 | 29   | —     |     |     | 1.89        | 1    |
| MSN-M16-127T-S32C | □     | 32              | 127 | 207 | 29   | 0°30' |     |     | 2.23        | 2    |
| MSN-M16-155-S32C  | ●     | 32              | 155 | 220 | 29   | —     |     |     | 2.04        | 1    |
| MSN-M16-177-S32C  | ●     | 32              | 177 | 257 | 29   | —     |     |     | 2.32        | 1    |
| MSN-M16-177T-S32C | ●     | 32              | 177 | 257 | 29   | 0°23' |     |     | 2.78        | 2    |
| MSN-M16-195-S32C  | ●     | 32              | 195 | 260 | 29   | —     |     |     | 2.4         | 1    |
| MSN-M16-197T-S32C | □     | 32              | 197 | 277 | 29   | 0°23' |     |     | 3           | 2    |
| MSN-M16-225-S32C  | ●     | 32              | 225 | 290 | 29   | —     |     |     | 2.57        | 1    |
| MSN-M16-245-S32C  | ●     | 32              | 245 | 310 | 29   | —     |     |     | 2.74        | 1    |
| MSN-M16-295-S32C  | ●     | 32              | 295 | 360 | 29   | —     |     |     | 3.17        | 1    |

● : Standard stock items □ : Stock in Japan(7 to 10 days delivery upon ordering)

Note) Please see page 12 for recommended tightening torque.

#### ■ Straight arbor type

- Through coolant hole ● For high productivity



| Cat. No.          | Stock | Dimensions (mm) |     |     |     | Weight (kg) |
|-------------------|-------|-----------------|-----|-----|-----|-------------|
|                   |       | φDs             | L   | MD  | φD2 |             |
| MSN-M8-87S-S14C   | ●     | 14              | 87  | M8  | 4   | 0.16        |
| MSN-M8-137S-S14C  | ●     |                 | 137 |     |     | 0.26        |
| MSN-M8-97S-S15C   | ●     | 15              | 97  | M8  | 4   | 0.21        |
| MSN-M8-147S-S15C  | ●     |                 | 147 |     |     | 0.33        |
| MSN-M8-197S-S15C  | ●     | 16              | 197 | M8  | 4   | 0.44        |
| MSN-M8-107S-S16C  | ●     |                 | 107 |     |     | 0.27        |
| MSN-M8-157S-S16C  | ●     | 18              | 157 | M10 | 4   | 0.4         |
| MSN-M10-130S-S18C | ●     |                 | 130 |     |     | 0.42        |
| MSN-M10-190S-S18C | ●     | 20              | 190 | M10 | 4   | 0.62        |
| MSN-M10-240S-S18C | ●     |                 | 240 |     |     | 0.89        |
| MSN-M10-130S-S20C | ●     | 23              | 130 | M12 | 6   | 0.53        |
| MSN-M10-190S-S20C | ●     |                 | 190 |     |     | 0.78        |
| MSN-M10-250S-S20C | ●     | 24              | 250 | M12 | 6   | 1.02        |
| MSN-M12-185S-S23C | ●     |                 | 185 |     |     | 0.98        |
| MSN-M12-265S-S23C | ●     | 25              | 265 | M12 | 6   | 1.42        |
| MSN-M12-185S-S24C | ●     |                 | 185 |     |     | 1.07        |
| MSN-M12-265S-S24C | ●     | 28              | 265 | M16 | 8   | 1.54        |
| MSN-M12-145S-S25C | ●     |                 | 145 |     |     | 0.91        |
| MSN-M12-215S-S25C | ●     | 32              | 215 | M16 | 8   | 1.36        |
| MSN-M12-285S-S25C | ●     |                 | 285 |     |     | 1.8         |
| MSN-M16-160S-S28C | ●     | 32              | 160 | M16 | 8   | 1.22        |
| MSN-M16-230S-S28C | □     |                 | 230 |     |     | 1.77        |
| MSN-M16-310S-S28C | ●     | 32              | 310 | M16 | 8   | 2.41        |
| MSN-M16-157S-S32C | ●     |                 | 157 |     |     | 1.61        |
| MSN-M16-217S-S32C | ●     | 32              | 217 | M16 | 8   | 2.22        |
| MSN-M16-287S-S32C | ●     |                 | 287 |     |     | 2.94        |
| MSN-M16-357S-S32C | ●     | 32              | 357 | M16 | 8   | 3.66        |

● : Standard stock items □ : Stock in Japan(7 to 10 days delivery upon ordering)

Note) Please see page 12 for recommended tightening torque.

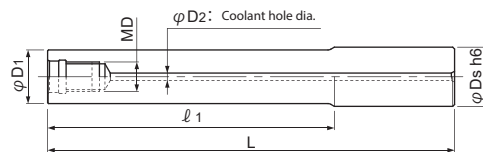
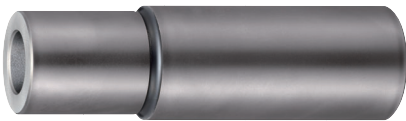
## ● MGN G-Body steel shank arbor

- Adopted ultra-rigid and improved body durability "G-Body".
- Short type
- Cost-effective and high strength steel shank arbor.

■ End mill shank type

● Through coolant hole

**G-Body**



| Cat. No.       | Stock                    | Dimensions (mm) |                |     |                 |      |     |                 | Weight (kg) |
|----------------|--------------------------|-----------------|----------------|-----|-----------------|------|-----|-----------------|-------------|
|                |                          | φDs             | ℓ <sub>1</sub> | L   | φD <sub>1</sub> | θ n° | MD  | φD <sub>2</sub> |             |
| MGN-M8-17-S16  | <input type="checkbox"/> | 16              | 17             | 97  | 15.5            | —    | M8  | 4               | 0.13        |
| MGN-M10-30-S20 | <input type="checkbox"/> | 20              | 30             | 100 | 19              | —    | M10 | 4               | 0.21        |
| MGN-M12-35-S25 | <input type="checkbox"/> | 25              | 35             | 105 | 24              | —    | M12 | 4               | 0.36        |
| MGN-M12-85-S25 | <input type="checkbox"/> | 25              | 85             | 165 | 24              | —    | M12 | 4               | 0.57        |
| MGN-M16-37-S32 | <input type="checkbox"/> | 32              | 37             | 107 | 29              | —    | M16 | 6               | 0.56        |
| MGN-M16-77-S32 | <input type="checkbox"/> | 32              | 77             | 157 | 29              | —    | M16 | 6               | 0.83        |

☐ : Stock in Japan(7 to 10 days delivery upon ordering)

Note) 1. In case of using modular head combined with MGN steel shank arbor, apply the recommended cutting conditions sheet (see page 16-22).  
2. Please see page 12 for recommended tightening torque.

## Cutting data

### EXSAP-11 type

#### ① Machining on Super duplex Stainless steel

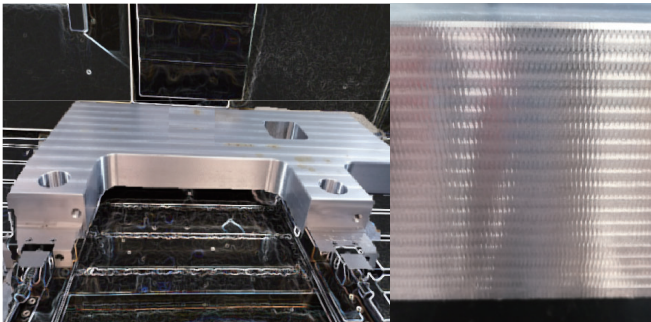


##### Result

Machining of three units completed compared to one unit with conventional products. In addition, reducing the cutting speed makes possible to machining four units.

|                    |                                |                              |                          |
|--------------------|--------------------------------|------------------------------|--------------------------|
| Work               | Part name                      | Parts                        |                          |
|                    | Material                       | Super duplex Stainless steel |                          |
|                    | Hardness                       | 32HRC                        |                          |
| Tool               | Tool No.                       | EXSAP-7050R-11-22            |                          |
|                    | Insert No.                     | ZNGU110508ZER-PM (JC8050)    |                          |
| Cutting conditions | Spindle speed<br>Cutting speed | $n$                          | 600 (min <sup>-1</sup> ) |
|                    |                                | $V_c$                        | 95 (m/min)               |
|                    | Feed speed                     | $V_f$                        | 700 (mm/min)             |
|                    |                                | $f_z$                        | 0.16 (mm/t)              |
|                    | $a_p$ (mm)                     |                              | 5 (mm)                   |
|                    | $a_e$ (mm)                     |                              | 6 (mm)                   |
|                    | Coolant                        |                              | Water coolant(internal)  |
|                    | Machine                        |                              | Vertical MC              |

#### ② Machining on Carbon steel

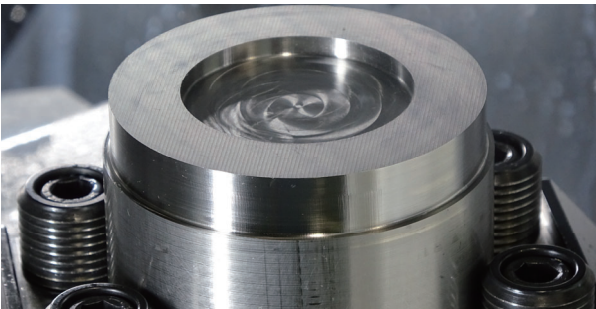


##### Result

It can be machined machine even high loading condition such as  $a_p=10\text{mm}$ ,  $a_e=1\text{mm}$ .

|                    |                                |                           |                          |
|--------------------|--------------------------------|---------------------------|--------------------------|
| Work               | Part name                      | Plate                     |                          |
|                    | Material                       | S45C                      |                          |
|                    | Hardness                       | 200HB                     |                          |
| Tool               | Tool No.                       | EXSAP-7050R-11-22         |                          |
|                    | Insert No.                     | ZNGU110508ZER-PM (JC8050) |                          |
| Cutting conditions | Spindle speed<br>Cutting speed | $n$                       | 900 (min <sup>-1</sup> ) |
|                    |                                | $V_c$                     | 140 (m/min)              |
|                    | Feed speed                     | $V_f$                     | 1,400 (mm/min)           |
|                    |                                | $f_z$                     | 0.22 (mm/t)              |
|                    | $a_p$ (mm)                     |                           | 10 (mm)                  |
|                    | $a_e$ (mm)                     |                           | 1 (mm)                   |
|                    | Coolant                        |                           | Air blow(internal)       |
|                    | Machine                        |                           | Vertical MC              |

#### ③ Machining on Ti-alloy



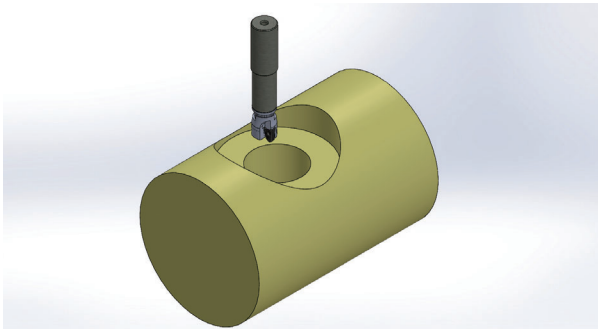
##### Result

No welding and beautiful surface finish even in shoulder milling of hard-to-cut materials. After 1-hour machining, it is still possible to use.

|                    |                                |                           |                            |
|--------------------|--------------------------------|---------------------------|----------------------------|
| Work               | Part name                      | Test piece                |                            |
|                    | Material                       | Ti-6AL-4V                 |                            |
|                    | Hardness                       | —                         |                            |
| Tool               | Tool No.                       | MSX-2016-11-M8            |                            |
|                    | Insert No.                     | ZNGU110508ZER-SL (JC7550) |                            |
| Cutting conditions | Spindle speed<br>Cutting speed | $n$                       | 1,200 (min <sup>-1</sup> ) |
|                    |                                | $V_c$                     | 60 (m/min)                 |
|                    | Feed speed                     | $V_f$                     | 300 (mm/min)               |
|                    |                                | $f_z$                     | 0.125 (mm/t)               |
|                    | $a_p$ (mm)                     |                           | 3 (mm)                     |
|                    | $a_e$ (mm)                     |                           | 1 (mm)                     |
|                    | Coolant                        |                           | Water coolant(internal)    |
|                    | Machine                        |                           | Vertical MC                |

## EXSAP-17 type

### ① Machining on Stainless steel

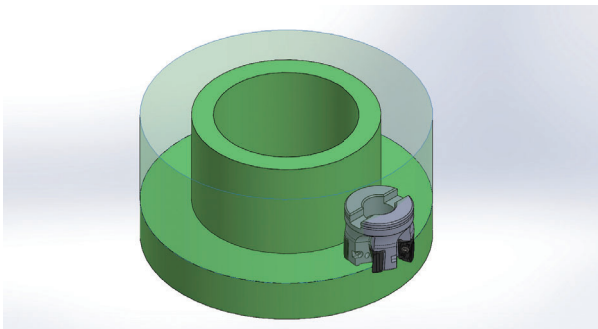


#### Result

Achieved 4 times longer tool life per corner compared with competitor's tool and has two more corners.

|                    |                                |                           |                            |
|--------------------|--------------------------------|---------------------------|----------------------------|
| Work               | Part name                      | Shaft                     |                            |
|                    | Material                       | SUS304                    |                            |
|                    | Hardness                       | —                         |                            |
| Tool               | ool No.                        | MSX-2032-M16              |                            |
|                    | Insert No.                     | ZNGU170908ZER-PM (JC8050) |                            |
| Cutting conditions | Spindle speed<br>Cutting speed | $n$                       | 1,230 (min <sup>-1</sup> ) |
|                    |                                | $V_c$                     | 124 (m/min)                |
|                    | Feed speed                     | $V_f$                     | 490 (mm/min)               |
|                    |                                | $f_z$                     | 0.2 (mm/t)                 |
|                    | $a_p$ (mm)                     |                           | 5.4 (mm)                   |
|                    | $a_e$ (mm)                     |                           | 4 (mm)                     |
|                    | Coolant                        | Oile coolant(External)    |                            |
|                    | Machine                        | Vertical MC               |                            |

### ② Machining on Hardend die steel

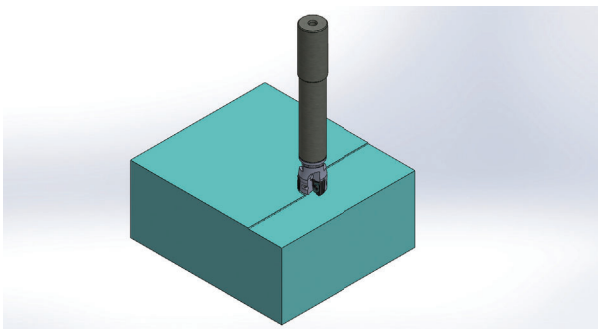


#### Result

Stable machining, better tool life and efficiency compared with conventional tool. EXSAP has 4 corners against 2 corners of conventional tool.

|                    |                                |                           |                          |
|--------------------|--------------------------------|---------------------------|--------------------------|
| Work               | Part name                      | Forging die               |                          |
|                    | Material                       | DAC10                     |                          |
|                    | Hardness                       | 48-52HRC                  |                          |
| Tool               | Tool No.                       | EXSAP-5050R-22            |                          |
|                    | Insert No.                     | ZNGU170908ZER-PM (JC8118) |                          |
| Cutting conditions | Spindle speed<br>Cutting speed | $n$                       | 570 (min <sup>-1</sup> ) |
|                    |                                | $V_c$                     | 90 (m/min)               |
|                    | Feed speed                     | $V_f$                     | 300 (mm/min)             |
|                    |                                | $f_z$                     | 0.11 (mm/t)              |
|                    | $a_p$ (mm)                     |                           | 0.5 (mm)                 |
|                    | $a_e$ (mm)                     |                           | 35 (mm)                  |
|                    | Coolant                        | Water coolant(External)   |                          |
|                    | Machine                        | Vertical MC               |                          |

### ③ Machining on Carbon steel



#### Result

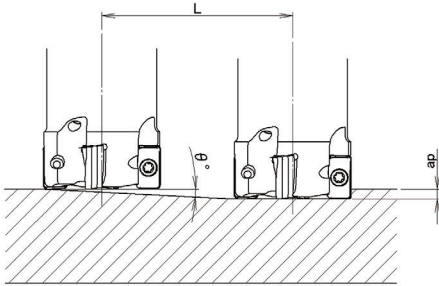
EXSAP could integrate roughing process with finishing process and achieved excellent surface roughness.

|                    |                                |                           |                            |
|--------------------|--------------------------------|---------------------------|----------------------------|
| Work               | Part name                      | Parts                     |                            |
|                    | Material                       | S50C                      |                            |
|                    | Hardness                       | —                         |                            |
| Tool               | Tool No.                       | MSX-3032-M16              |                            |
|                    | Insert No.                     | ZNGU170908ZER-PM (JC8050) |                            |
| Cutting conditions | Spindle speed<br>Cutting speed | $n$                       | 1,400 (min <sup>-1</sup> ) |
|                    |                                | $V_c$                     | 140 (m/min)                |
|                    | Feed speed                     | $V_f$                     | 1,200 (mm/min)             |
|                    |                                | $f_z$                     | 0.29 (mm/t)                |
|                    | $a_p$ (mm)                     |                           | 1.0 (mm)                   |
|                    | $a_e$ (mm)                     |                           | 20 (mm)                    |
|                    | Coolant                        | Water coolant(External)   |                            |
|                    | Machine                        | Vertical MC               |                            |

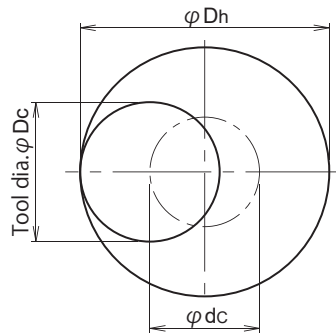
## Attention for profile milling

### EXSAP-11 type

#### Ramping



#### Helical interpolation



- In case of ramping and helical interpolation, apply 80% or less feed speed from standard cutting condition table.
- In case of helical interpolation, recommend wet cutting by coolant through the tool.

#### ● Calculation of tool pass dia.

$$\phi dc = \phi Dh - \phi Dc$$

Tool pass dia.      Bore dia.      Tool dia.

- Eff. cutting dia.  
 $= \phi Dc - 2 \times re \text{ (CornerR)} - 0.3 \text{ (Overlapping parts)}$
- Min. bore dia.  $\phi Dh \text{ min.}$   
 $= 2 \times \{ \phi Dc - re \text{ (CornerR)} - 0.4 \text{ (Overlapping parts)} - B \text{ (Width of insert)} \}$
- Max. bore dia.  $\phi Dh \text{ max.}$   
 $= 2 \times \{ \phi Dc - re \text{ (CornerR)} - 0.4 \text{ (Overlapping parts)} \}$

- Depth of cut per one circuit should not exceed max. depth of cut  $ap$ .

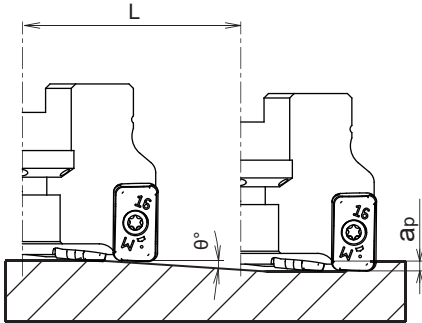
- Down cutting is recommended, so tool pass rotation should be counterclockwise.

| Cat. No.             | Tool dia.<br>(mm) | Eff. Cutting dia.<br>(mm) | Max. depth<br>of cut : $ap$<br>(mm) | Ramping                                             |                                                 | Helical interpolation                        |                                              |
|----------------------|-------------------|---------------------------|-------------------------------------|-----------------------------------------------------|-------------------------------------------------|----------------------------------------------|----------------------------------------------|
|                      |                   |                           |                                     | Max. ramping<br>angle $\theta$ (°)                  | Total cutting length at<br>Max. $ap$ : $L$ (mm) | Min. bore dia.<br>$\phi Dh \text{ min}$ (mm) | Max. bore dia.<br>$\phi Dh \text{ max}$ (mm) |
| MSX-2016-11-M8       | 16                | 14.1                      | 1.5                                 | 1.0°                                                | 86                                              | 18                                           | 29.6                                         |
| MSX-3020-11-M10      | 20                | 18.1                      | 1.5                                 | 0.7°                                                | 123                                             | 26                                           | 37.6                                         |
| MSX-3025-11-M12      | 25                | 23.1                      | 1.5                                 | 0.4°                                                | 215                                             | 36                                           | 47.6                                         |
| MSX-4030-11-M16      | 30                | 28.1                      | 1.5                                 | 0.3°                                                | 286                                             | 46                                           | 57.6                                         |
| MSX-4032-11-M16      | 32                | 30.1                      | 1.5                                 | 0.3°                                                | 286                                             | 50                                           | 61.6                                         |
| MSX-5040-11-M16      | 40                | 38.1                      | 1.5                                 | 0.2°                                                | 430                                             | 66                                           | 77.6                                         |
| EXSAP-2016-11-**-S16 | 16                | 14.1                      | 1.5                                 | 1.0°                                                | 86                                              | 18                                           | 29.6                                         |
| EXSAP-3020-11-**-S20 | 20                | 18.1                      | 1.5                                 | 0.7°                                                | 123                                             | 26                                           | 37.6                                         |
| EXSAP-3025-11-**-S25 | 25                | 23.1                      | 1.5                                 | 0.4°                                                | 215                                             | 36                                           | 47.6                                         |
| EXSAP-4030-11-**-S32 | 30                | 28.1                      | 1.5                                 | 0.3°                                                | 286                                             | 46                                           | 57.6                                         |
| EXSAP-4032-11-**-S32 | 32                | 30.1                      | 1.5                                 | 0.3°                                                | 286                                             | 50                                           | 61.6                                         |
| EXSAP-5040-11-**-S32 | 40                | 38.1                      | 1.5                                 | 0.2°                                                | 430                                             | 66                                           | 77.6                                         |
| EXSAP-6040R-11-16    | 40                | 38.1                      | 1.5                                 | 0.2°                                                | 430                                             | 66                                           | 77.6                                         |
| EXSAP-7050R-11-22    | 50                | 48.1                      | 1.5                                 | 0.15°                                               | 573                                             | 86                                           | 97.6                                         |
| EXSAP-7052R-11-22    | 52                | 50.1                      | 1.5                                 | 0.15°                                               | 573                                             | 90                                           | 101.6                                        |
| EXSAP-7063R-11-22    | 63                | 61.1                      | 1.5                                 | ※ Ramping&helical interpolation is not recommended. |                                                 |                                              |                                              |
| EXSAP-7063R-11-27    | 63                | 61.1                      | 1.5                                 |                                                     |                                                 |                                              |                                              |
| EXSAP-8080R-11-27    | 80                | 78.1                      | 1.5                                 |                                                     |                                                 |                                              |                                              |

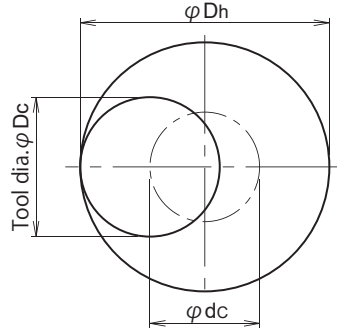
Note: Above figures at this table is for R0.8, so in case of the other corner radius, please calculate eff. cutting dia. and Min. & Max. bore dia. according to the above table for "Calculation of tool pass dia."

## EXSAP-17 type

### Ramping



### Helical interpolation



- In case of ramping and helical interpolation, apply 80% or less feed speed from standard cutting condition table.
- In case of helical interpolation, recommend wet cutting by coolant through the tool.

#### ● Calculation of tool pass dia.

$$\phi dc = \phi Dh - \phi Dc$$

Tool pass dia.      Bore dia.      Tool dia.

- Eff. cutting dia.  
 $= \phi Dc - 2 \times r\epsilon \text{ ( CornerR ) } - 0.3 \text{ ( Overlapped parts )}$
- Min. bore dia.  $\phi Dh \text{ min.}$   
 $= 2 \times \{ \phi Dc - r\epsilon \text{ ( CornerR ) } - 0.4 \text{ ( Overlapped parts ) } - B \text{ ( Width of insert ) } \}$
- Max. bore dia.  $\phi Dh \text{ max.}$   
 $= 2 \times \{ \phi Dc - r\epsilon \text{ ( CornerR ) } - 0.4 \text{ ( Overlapped parts ) } \}$
- Depth of cut per one circuit should not exceed max. depth of cut  $ap$ .
- Down cutting is recommended, so tool pass rotation should be counterclockwise.

| Cat. No.       | Tool dia.<br>(mm) | Eff. Cutting dia.<br>(mm) | Max. depth<br>of cut : $ap$<br>(mm)                 | Ramping                              |                                               | Helical interpolation         |                               |
|----------------|-------------------|---------------------------|-----------------------------------------------------|--------------------------------------|-----------------------------------------------|-------------------------------|-------------------------------|
|                |                   |                           |                                                     | Max. ramping<br>angle $\theta^\circ$ | Total cutting length at<br>Max. $ap$ : L (mm) | Min. bore dia.<br>Dh min (mm) | Max. bore dia.<br>Dh max (mm) |
| EXSAP/MSX-2025 | 25                | 21.5                      | 1.5                                                 | 0.7°                                 | 123                                           | 34                            | 46                            |
| MSX-2026-M12   | 26                | 22.5                      | 1.5                                                 | 0.7°                                 | 123                                           | 36                            | 48                            |
| MSX-2028-M12   | 28                | 25.5                      | 1.5                                                 | 0.6°                                 | 143                                           | 40                            | 52                            |
| MSX-2030-M16   | 30                | 26.5                      | 1.5                                                 | 0.6°                                 | 143                                           | 44                            | 56                            |
| EXSAP/MSX-*032 | 32                | 28.5                      | 1.5                                                 | 0.5°                                 | 172                                           | 48                            | 60                            |
| MSX-3033-M16   | 33                | 29.5                      | 1.5                                                 | 0.5°                                 | 172                                           | 50                            | 62                            |
| MSX-3035-M16   | 35                | 31.5                      | 1.5                                                 | 0.4°                                 | 215                                           | 54                            | 66                            |
| MSX-4040-M16   | 40                | 36.5                      | 1.5                                                 | 0.4°                                 | 215                                           | 64                            | 76                            |
| EXSAP-*050R-22 | 50                | 46.5                      | 1.5                                                 | 0.3°                                 | 286                                           | 84                            | 96                            |
| EXSAP-5052R-22 | 52                | 48.5                      | 1.5                                                 | 0.3°                                 | 286                                           | 88                            | 100                           |
| EXSAP-5063R-22 | 63                | 59.5                      | 1.5                                                 | 0.2°                                 | 430                                           | 110                           | 122                           |
| EXSAP-7080R-27 | 80                | 76.5                      | 1.5                                                 | 0.15°                                | 573                                           | 144                           | 156                           |
| EXSAP-7100R-32 | 100               | 96.5                      | ※ Ramping&helical interpolation is not recommended. |                                      |                                               |                               |                               |
| EXSAP-8125R-40 | 125               | 121.5                     |                                                     |                                      |                                               |                               |                               |

Note: Above figures at this table is for R1.6, so in case of the other corner radius, please calculate eff. cutting dia. and Min. & Max. bore dia. according to the above table for "Calculation of tool pass dia."

Recommended cutting conditions for shoulder milling

EXSAP-11 type

FaceMill type

| Work materials                                                  | Grades             | Tool dia. (mm)  |               |                                        |                             |                   |                 |               |                                        |                             |                   |
|-----------------------------------------------------------------|--------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|
|                                                                 |                    | 40              |               |                                        |                             |                   | 50/52           |               |                                        |                             |                   |
|                                                                 |                    | No. of teeth 6N |               |                                        |                             |                   | No. of teeth 7N |               |                                        |                             |                   |
|                                                                 |                    | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50,C55)<br>Below 250HB                           | JC8050<br>(JC8118) | ~150            | ~8            | ~20                                    | 1,430                       | 1,540             | ~200            | ~8            | ~24                                    | 1,150                       | 1,610             |
|                                                                 |                    | 200             | ~6            | ~6                                     | 1,270                       | 1,220             | 250             | ~6            | ~7.3                                   | 1,020                       | 1,290             |
|                                                                 |                    | 250             | ~4            | ~2                                     | 1,110                       | 930               | 300             | ~5            | ~2.4                                   | 890                         | 1,000             |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050<br>(JC8118) | ~150            | ~8            | ~20                                    | 1,430                       | 1,540             | ~200            | ~8            | ~24                                    | 1,150                       | 1,610             |
|                                                                 |                    | 200             | ~6            | ~6                                     | 1,270                       | 1,220             | 250             | ~6            | ~7.3                                   | 1,020                       | 1,290             |
|                                                                 |                    | 250             | ~4            | ~2                                     | 1,110                       | 930               | 300             | ~5            | ~2.4                                   | 890                         | 1,000             |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050<br>(JC8118) | ~150            | ~8            | ~20                                    | 1,430                       | 1,540             | ~200            | ~8            | ~24                                    | 1,150                       | 1,610             |
|                                                                 |                    | 200             | ~6            | ~6                                     | 1,270                       | 1,220             | 250             | ~6            | ~7.3                                   | 1,020                       | 1,290             |
|                                                                 |                    | 250             | ~4            | ~2                                     | 1,110                       | 930               | 300             | ~5            | ~2.4                                   | 890                         | 1,000             |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118<br>(JC8050) | ~150            | ~8            | ~20                                    | 1,030                       | 870               | ~200            | ~8            | ~24                                    | 830                         | 1,050             |
|                                                                 |                    | 200             | ~6            | ~6                                     | 950                         | 680               | 250             | ~6            | ~7.3                                   | 760                         | 850               |
|                                                                 |                    | 250             | ~4            | ~2                                     | 880                         | 530               | 300             | ~5            | ~2.4                                   | 700                         | 690               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118<br>(JC8050) | ~150            | ~8            | ~16                                    | 950                         | 800               | ~200            | ~8            | ~20                                    | 760                         | 960               |
|                                                                 |                    | 200             | ~6            | ~4.8                                   | 840                         | 600               | 250             | ~6            | ~6                                     | 670                         | 750               |
|                                                                 |                    | 250             | ~4            | ~1.6                                   | 720                         | 430               | 300             | ~5            | ~2                                     | 570                         | 560               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118             | ~150            | ~5            | ~4.8                                   | 800                         | 580               | ~200            | ~6            | ~8                                     | 640                         | 540               |
|                                                                 |                    | 200             | ~4            | ~1.6                                   | 720                         | 430               | 250             | ~5            | ~2.4                                   | 570                         | 400               |
|                                                                 |                    | 250             | ~3            | ~0.5                                   | 640                         | 310               | 300             | ~4            | ~0.8                                   | 510                         | 290               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118<br>(JC8050) | ~150            | ~8            | ~22                                    | 1,590                       | 1,720             | ~200            | ~8            | ~28                                    | 1,270                       | 1,780             |
|                                                                 |                    | 200             | ~6            | ~6.7                                   | 1,430                       | 1,200             | 250             | ~6            | ~8.5                                   | 1,150                       | 1,450             |
|                                                                 |                    | 250             | ~4            | ~2.2                                   | 1,270                       | 910               | 300             | ~5            | ~2.8                                   | 1,020                       | 1,140             |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118<br>(JC8050) | ~150            | ~8            | ~22                                    | 1,430                       | 1,370             | ~200            | ~8            | ~28                                    | 1,150                       | 1,610             |
|                                                                 |                    | 200             | ~6            | ~6.7                                   | 1,270                       | 1,070             | 250             | ~6            | ~8.5                                   | 1,020                       | 1,290             |
|                                                                 |                    | 250             | ~4            | ~2.2                                   | 1,110                       | 800               | 300             | ~5            | ~2.8                                   | 890                         | 1,000             |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050<br>(JC7550) | ~150            | ~8            | ~20                                    | 950                         | 800               | ~200            | ~8            | ~24                                    | 760                         | 960               |
|                                                                 |                    | 200             | ~6            | ~6                                     | 880                         | 630               | 250             | ~6            | ~7.3                                   | 700                         | 780               |
|                                                                 |                    | 250             | ~4            | ~2                                     | 800                         | 480               | 300             | ~5            | ~2.4                                   | 640                         | 630               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8050<br>(JC7550) | ~150            | ~8            | ~20                                    | 1,110                       | 930               | ~200            | ~8            | ~24                                    | 890                         | 1,120             |
|                                                                 |                    | 200             | ~6            | ~6                                     | 950                         | 680               | 250             | ~6            | ~7.3                                   | 760                         | 850               |
|                                                                 |                    | 250             | ~4            | ~2                                     | 800                         | 480               | 300             | ~5            | ~2.4                                   | 640                         | 630               |
| Titanium alloy<br>35~43HRC                                      | JC7550<br>(JC7518) | ~150            | ~8            | ~14                                    | 560                         | 440               | ~200            | ~8            | ~20                                    | 450                         | 410               |
|                                                                 |                    | 200             | ~6            | ~4.2                                   | 480                         | 350               | 250             | ~6            | ~6                                     | 380                         | 320               |
|                                                                 |                    | 250             | ~4            | ~1.4                                   | 400                         | 260               | 300             | ~5            | ~2                                     | 320                         | 250               |
| Inconel<br>35~43HRC                                             | JC7550<br>(JC7518) | ~150            | ~8            | ~14                                    | 240                         | 140               | ~200            | ~8            | ~20                                    | 190                         | 130               |
|                                                                 |                    | 200             | ~6            | ~4.2                                   | 200                         | 110               | 250             | ~6            | ~6                                     | 160                         | 100               |
|                                                                 |                    | 250             | ~4            | ~1.4                                   | 160                         | 80                | 300             | ~5            | ~2                                     | 130                         | 70                |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.



## FaceMill type

| Work materials                                                  | Grades             | Tool dia. (mm)  |               |                                        |                             |                   |                 |               |                                        |                             |                   |
|-----------------------------------------------------------------|--------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|
|                                                                 |                    | 63              |               |                                        |                             |                   | 80              |               |                                        |                             |                   |
|                                                                 |                    | No. of teeth 7N |               |                                        |                             |                   | No. of teeth 8N |               |                                        |                             |                   |
|                                                                 |                    | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50, C55)<br>Below 250HB                          | JC8050<br>(JC8118) | ~250            | ~9            | ~30                                    | 910                         | 1,270             | ~300            | ~9            | ~36                                    | 720                         | 1,150             |
|                                                                 |                    | 300             | ~7            | ~9                                     | 810                         | 1,020             | ~350            | ~7            | ~11                                    | 640                         | 920               |
|                                                                 |                    | 350             | ~5            | ~3                                     | 710                         | 800               | ~400            | ~5            | ~3.6                                   | 560                         | 720               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050<br>(JC8118) | ~250            | ~9            | ~30                                    | 910                         | 1,270             | ~300            | ~9            | ~36                                    | 720                         | 1,150             |
|                                                                 |                    | 300             | ~7            | ~9                                     | 810                         | 1,020             | ~350            | ~7            | ~11                                    | 640                         | 920               |
|                                                                 |                    | 350             | ~5            | ~3                                     | 710                         | 800               | ~400            | ~5            | ~3.6                                   | 560                         | 720               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050<br>(JC8118) | ~250            | ~9            | ~30                                    | 910                         | 1,270             | ~300            | ~9            | ~36                                    | 720                         | 1,150             |
|                                                                 |                    | 300             | ~7            | ~9                                     | 810                         | 1,020             | ~350            | ~7            | ~11                                    | 640                         | 920               |
|                                                                 |                    | 350             | ~5            | ~3                                     | 710                         | 800               | ~400            | ~5            | ~3.6                                   | 560                         | 720               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118<br>(JC8050) | ~250            | ~9            | ~30                                    | 660                         | 830               | ~300            | ~9            | ~36                                    | 520                         | 750               |
|                                                                 |                    | 300             | ~7            | ~9                                     | 610                         | 680               | ~350            | ~7            | ~11                                    | 480                         | 610               |
|                                                                 |                    | 350             | ~5            | ~3                                     | 560                         | 550               | ~400            | ~5            | ~3.6                                   | 440                         | 490               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118<br>(JC8050) | ~250            | ~9            | ~24                                    | 610                         | 770               | ~300            | ~9            | ~28                                    | 480                         | 690               |
|                                                                 |                    | 300             | ~7            | ~7.3                                   | 530                         | 590               | ~350            | ~7            | ~8.5                                   | 420                         | 540               |
|                                                                 |                    | 350             | ~5            | ~2.4                                   | 450                         | 440               | ~400            | ~5            | ~2.8                                   | 360                         | 400               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118             | ~250            | ~9            | ~9                                     | 510                         | 430               | ~300            | ~9            | ~10                                    | 400                         | 380               |
|                                                                 |                    | 300             | ~7            | ~2.7                                   | 450                         | 320               | ~350            | ~7            | ~3                                     | 360                         | 290               |
|                                                                 |                    | 350             | ~5            | ~0.9                                   | 400                         | 220               | ~400            | ~5            | ~1                                     | 320                         | 200               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118<br>(JC8050) | ~250            | ~9            | ~34                                    | 1,010                       | 1,410             | ~300            | ~9            | ~40                                    | 800                         | 1,280             |
|                                                                 |                    | 300             | ~7            | ~10                                    | 910                         | 1,150             | ~350            | ~7            | ~12                                    | 720                         | 1,040             |
|                                                                 |                    | 350             | ~5            | ~3.4                                   | 810                         | 910               | ~400            | ~5            | ~4                                     | 640                         | 820               |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118<br>(JC8050) | ~250            | ~9            | ~34                                    | 910                         | 1,270             | ~300            | ~9            | ~40                                    | 720                         | 1,150             |
|                                                                 |                    | 300             | ~7            | ~10                                    | 810                         | 1,020             | ~350            | ~7            | ~12                                    | 640                         | 920               |
|                                                                 |                    | 350             | ~5            | ~3.4                                   | 710                         | 800               | ~400            | ~5            | ~4                                     | 560                         | 720               |
| Stainless steel Austenitic<br>(AISI 304 316, 317)               | JC8050<br>(JC7550) | ~250            | ~9            | ~30                                    | 610                         | 770               | ~300            | ~9            | ~36                                    | 480                         | 690               |
|                                                                 |                    | 300             | ~7            | ~9                                     | 560                         | 630               | ~350            | ~7            | ~11                                    | 440                         | 560               |
|                                                                 |                    | 350             | ~5            | ~3                                     | 510                         | 500               | ~400            | ~5            | ~3.6                                   | 400                         | 450               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8050<br>(JC7550) | ~250            | ~9            | ~30                                    | 710                         | 890               | ~300            | ~9            | ~36                                    | 560                         | 810               |
|                                                                 |                    | 300             | ~7            | ~9                                     | 610                         | 680               | ~350            | ~7            | ~11                                    | 480                         | 610               |
|                                                                 |                    | 350             | ~5            | ~3                                     | 510                         | 500               | ~400            | ~5            | ~3.6                                   | 400                         | 450               |
| Titanium alloy<br>35~43HRC                                      | JC7550<br>(JC7518) | ~250            | ~9            | ~26                                    | 350                         | 320               | ~300            | ~9            | ~30                                    | 280                         | 290               |
|                                                                 |                    | 300             | ~7            | ~8                                     | 300                         | 250               | ~350            | ~7            | ~9                                     | 240                         | 230               |
|                                                                 |                    | 350             | ~5            | ~2                                     | 250                         | 190               | ~400            | ~5            | ~3                                     | 200                         | 180               |
| Inconel<br>35~43HRC                                             | JC7550<br>(JC7518) | ~250            | ~9            | ~26                                    | 150                         | 110               | ~300            | ~9            | ~30                                    | 120                         | 100               |
|                                                                 |                    | 300             | ~7            | ~8                                     | 130                         | 80                | ~350            | ~7            | ~9                                     | 100                         | 70                |
|                                                                 |                    | 350             | ~5            | ~2.6                                   | 100                         | 60                | ~400            | ~5            | ~3                                     | 80                          | 50                |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

## Recommended cutting conditions for shoulder milling

EXSAP-11 type

### Endmill type

| Work materials                                                  | Grades             | Tool dia. (mm)  |               |                                        |                             |                   |                 |               |                                        |                             |                   |                 |               |                                        |                             |                   |
|-----------------------------------------------------------------|--------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|
|                                                                 |                    | 16              |               |                                        |                             |                   | 20              |               |                                        |                             |                   | 25              |               |                                        |                             |                   |
|                                                                 |                    | No. of teeth 2N |               |                                        |                             |                   | No. of teeth 3N |               |                                        |                             |                   | No. of teeth 3N |               |                                        |                             |                   |
|                                                                 |                    | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50,C55)<br>Below 250HB                           | JC8050<br>(JC8118) | ~30             | ~5            | ~4                                     | 3,580                       | 1,000             | ~50             | ~5            | ~5                                     | 2,860                       | 1,370             | ~70             | ~6            | ~7.2                                   | 2,290                       | 1,100             |
|                                                                 |                    | 70              | ~3            | ~1.2                                   | 3,180                       | 760               | ~120            | ~3            | ~1.5                                   | 2,550                       | 1,070             | 120             | ~4            | ~2.2                                   | 2,040                       | 860               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050<br>(JC8118) | ~30             | ~5            | ~4                                     | 3,580                       | 1,000             | ~50             | ~5            | ~5                                     | 2,860                       | 1,370             | ~70             | ~6            | ~7.2                                   | 2,290                       | 1,100             |
|                                                                 |                    | 70              | ~3            | ~1.2                                   | 3,180                       | 760               | 120             | ~3            | ~1.5                                   | 2,550                       | 1,070             | 120             | ~4            | ~2.2                                   | 2,040                       | 860               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050<br>(JC8118) | ~30             | ~5            | ~4                                     | 3,580                       | 1,000             | ~50             | ~5            | ~5                                     | 2,860                       | 1,370             | ~70             | ~6            | ~7.2                                   | 2,290                       | 1,100             |
|                                                                 |                    | 70              | ~3            | ~1.2                                   | 3,180                       | 760               | ~120            | ~3            | ~1.5                                   | 2,550                       | 1,070             | 120             | ~4            | ~2.2                                   | 2,040                       | 860               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118<br>(JC8050) | ~30             | ~5            | ~4                                     | 2,590                       | 620               | ~50             | ~5            | ~5                                     | 2,070                       | 870               | ~70             | ~6            | ~7.2                                   | 1,660                       | 700               |
|                                                                 |                    | 70              | ~3            | ~1.2                                   | 2,390                       | 480               | 120             | ~3            | ~1.5                                   | 1,910                       | 690               | 120             | ~4            | ~2.2                                   | 1,530                       | 550               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118<br>(JC8050) | ~30             | ~5            | ~3.4                                   | 2,390                       | 570               | ~50             | ~5            | ~4                                     | 1,910                       | 800               | ~70             | ~6            | ~6                                     | 1,530                       | 640               |
|                                                                 |                    | 70              | ~3            | ~1                                     | 2,090                       | 420               | ~120            | ~3            | ~1.2                                   | 1,670                       | 600               | 120             | ~4            | ~1.8                                   | 1,340                       | 480               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118             | ~30             | ~3            | ~1.6                                   | 1,990                       | 320               | ~50             | ~3.5          | ~2                                     | 1,590                       | 480               | ~70             | ~4            | ~3.2                                   | 1,270                       | 380               |
|                                                                 |                    | 70              | ~2            | ~0.6                                   | 1,790                       | 250               | 120             | ~2.5          | ~0.6                                   | 1,430                       | 390               | 120             | ~3            | ~1                                     | 1,150                       | 310               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118<br>(JC8050) | ~30             | ~5            | ~5                                     | 3,980                       | 1,110             | ~50             | ~5            | ~6                                     | 3,180                       | 1,530             | ~70             | ~6            | ~9.8                                   | 2,550                       | 1,220             |
|                                                                 |                    | 70              | ~3            | ~1.5                                   | 3,580                       | 860               | ~120            | ~3            | ~1.8                                   | 2,860                       | 1,200             | 120             | ~4            | ~3                                     | 2,290                       | 960               |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118<br>(JC8050) | ~30             | ~5            | ~5                                     | 3,580                       | 1,000             | ~50             | ~5            | ~6                                     | 2,860                       | 1,370             | ~70             | ~6            | ~9.8                                   | 2,290                       | 1,100             |
|                                                                 |                    | 70              | ~3            | ~1.5                                   | 3,180                       | 760               | 120             | ~3            | ~1.8                                   | 2,550                       | 1,070             | 120             | ~4            | ~3                                     | 2,040                       | 860               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050<br>(JC7550) | ~30             | ~5            | ~4                                     | 2,390                       | 570               | ~50             | ~5            | ~5                                     | 1,910                       | 800               | ~70             | ~6            | ~7.2                                   | 1,530                       | 640               |
|                                                                 |                    | 70              | ~3            | ~1.2                                   | 2,190                       | 440               | ~120            | ~3            | ~1.5                                   | 1,750                       | 630               | 120             | ~4            | ~2.2                                   | 1,400                       | 500               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8050<br>(JC7550) | ~30             | ~5            | ~3.2                                   | 2,790                       | 670               | ~50             | ~5            | ~5                                     | 2,230                       | 940               | ~70             | ~6            | ~7.2                                   | 1,780                       | 750               |
|                                                                 |                    | 70              | ~3            | ~1                                     | 2,390                       | 480               | 120             | ~3            | ~1.5                                   | 1,910                       | 690               | 120             | ~4            | ~2.2                                   | 1,530                       | 550               |
| Titanium alloy<br>35~43HRC                                      | JC7550<br>(JC7518) | ~30             | ~5            | ~3.2                                   | 1,390                       | 330               | ~50             | ~5            | ~4                                     | 1,110                       | 430               | ~70             | ~6            | ~6                                     | 890                         | 350               |
|                                                                 |                    | 70              | ~3            | ~1                                     | 1,190                       | 260               | ~120            | ~3            | ~1.2                                   | 950                         | 340               | 120             | ~4            | ~1.8                                   | 760                         | 270               |
| Inconel<br>35~43HRC                                             | JC7550<br>(JC7518) | ~30             | ~5            | ~3.2                                   | 600                         | 110               | ~50             | ~5            | ~4                                     | 480                         | 140               | ~70             | ~6            | ~6                                     | 380                         | 110               |
|                                                                 |                    | 70              | ~3            | ~1                                     | 500                         | 80                | 120             | ~3            | ~1.2                                   | 400                         | 110               | 120             | ~4            | ~1.8                                   | 320                         | 90                |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.



## Endmill type

| Work materials                                                  | Grades             | Tool dia. (mm)  |               |                                        |                             |                   |                 |               |                                        |                             |                   |
|-----------------------------------------------------------------|--------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|
|                                                                 |                    | 30/32           |               |                                        |                             |                   | 40              |               |                                        |                             |                   |
|                                                                 |                    | No. of teeth 4N |               |                                        |                             |                   | No. of teeth 5N |               |                                        |                             |                   |
|                                                                 |                    | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50, C55)<br>Below 250HB                          | JC8050<br>(JC8118) | ~70             | ~6            | ~9.8                                   | 1,790                       | 1,150             | ~70             | ~7            | ~14                                    | 1,430                       | 1,290             |
|                                                                 |                    | 120             | ~4            | ~3                                     | 1,590                       | 890               | 170             | ~5            | ~4.2                                   | 1,270                       | 1,020             |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050<br>(JC8118) | ~70             | ~6            | ~9.8                                   | 1,790                       | 1,150             | ~70             | ~7            | ~14                                    | 1,430                       | 1,290             |
|                                                                 |                    | 120             | ~4            | ~3                                     | 1,590                       | 890               | 170             | ~5            | ~4.2                                   | 1,270                       | 1,020             |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050<br>(JC8118) | ~70             | ~6            | ~9.8                                   | 1,790                       | 1,150             | ~70             | ~7            | ~14                                    | 1,430                       | 1,290             |
|                                                                 |                    | 120             | ~4            | ~3                                     | 1,590                       | 890               | 170             | ~5            | ~4.2                                   | 1,270                       | 1,020             |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118<br>(JC8050) | ~70             | ~6            | ~9.8                                   | 1,290                       | 720               | ~70             | ~7            | ~14                                    | 1,030                       | 720               |
|                                                                 |                    | 120             | ~4            | ~3                                     | 1,190                       | 570               | 170             | ~5            | ~4.2                                   | 950                         | 570               |
| Mold Steel (1.2311, P21)<br>38~43HRC                            | JC8118<br>(JC8050) | ~70             | ~6            | ~8                                     | 1,190                       | 670               | ~70             | ~7            | ~10                                    | 950                         | 670               |
|                                                                 |                    | 120             | ~4            | ~2.4                                   | 1,040                       | 500               | 170             | ~5            | ~3                                     | 840                         | 500               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118             | ~70             | ~4            | ~3.6                                   | 990                         | 400               | ~70             | ~4.5          | ~4                                     | 800                         | 480               |
|                                                                 |                    | 120             | ~3            | ~1                                     | 900                         | 320               | 170             | ~3.5          | ~1.2                                   | 720                         | 360               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118<br>(JC8050) | ~70             | ~6            | ~12                                    | 1,990                       | 1,270             | ~70             | ~7            | ~16                                    | 1,590                       | 1,430             |
|                                                                 |                    | 120             | ~4            | ~3.6                                   | 1,790                       | 1,000             | 170             | ~5            | ~4.8                                   | 1,430                       | 1,000             |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118<br>(JC8050) | ~70             | ~6            | ~12                                    | 1,790                       | 1,150             | ~70             | ~7            | ~16                                    | 1,430                       | 1,140             |
|                                                                 |                    | 120             | ~4            | ~3.6                                   | 1,590                       | 890               | 170             | ~5            | ~4.8                                   | 1,270                       | 890               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050<br>(JC7550) | ~70             | ~6            | ~9.8                                   | 1,190                       | 670               | ~70             | ~7            | ~14                                    | 950                         | 670               |
|                                                                 |                    | 120             | ~4            | ~3                                     | 1,090                       | 520               | 170             | ~5            | ~4.2                                   | 880                         | 530               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8050<br>(JC7550) | ~70             | ~6            | ~9.8                                   | 1,390                       | 780               | ~70             | ~7            | ~14                                    | 1,110                       | 780               |
|                                                                 |                    | 120             | ~4            | ~3                                     | 1,190                       | 570               | 170             | ~5            | ~4.2                                   | 950                         | 570               |
| Titanium alloy<br>35~43HRC                                      | JC7550<br>(JC7518) | ~70             | ~6            | ~8                                     | 700                         | 360               | ~70             | ~7            | ~10                                    | 560                         | 360               |
|                                                                 |                    | 120             | ~4            | ~2.4                                   | 600                         | 290               | 170             | ~5            | ~3                                     | 480                         | 290               |
| Inconel<br>35~43HRC                                             | JC7550<br>(JC7518) | ~70             | ~6            | ~8                                     | 300                         | 120               | ~70             | ~7            | ~10                                    | 240                         | 120               |
|                                                                 |                    | 120             | ~4            | ~2.4                                   | 250                         | 90                | 170             | ~5            | ~3                                     | 200                         | 90                |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

## Recommended cutting conditions for shoulder milling

EXSAP-11 type

### MSX and MSN type

| Work materials                                                  | Grades             | Tool dia. (mm)  |               |                                        |                             |                   |                 |               |                                        |                             |                   |                 |               |                                        |                             |                   |
|-----------------------------------------------------------------|--------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|
|                                                                 |                    | 16              |               |                                        |                             |                   | 20              |               |                                        |                             |                   | 25              |               |                                        |                             |                   |
|                                                                 |                    | No. of teeth 2N |               |                                        |                             |                   | No. of teeth 3N |               |                                        |                             |                   | No. of teeth 3N |               |                                        |                             |                   |
|                                                                 |                    | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50,C55)<br>Below 250HB                           | JC8050<br>(JC8118) | ~80             | ~5            | ~4                                     | 3,580                       | 1,000             | ~100            | ~5            | ~5                                     | 2,860                       | 1,370             | ~120            | ~6            | ~7.2                                   | 2,290                       | 1,100             |
|                                                                 |                    | 120             | ~3            | ~1.2                                   | 3,180                       | 760               | 150             | ~3            | ~1.5                                   | 2,550                       | 1,070             | 190             | ~4            | ~2.2                                   | 2,040                       | 860               |
|                                                                 |                    | 160             | ~2            | ~0.4                                   | 2,790                       | 560               | 190             | ~2            | ~0.5                                   | 2,230                       | 800               | 235             | ~3            | ~0.7                                   | 1,780                       | 640               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050<br>(JC8118) | ~80             | ~5            | ~4                                     | 3,580                       | 1,000             | ~100            | ~5            | ~5                                     | 2,860                       | 1,370             | ~120            | ~6            | ~7.2                                   | 2,290                       | 1,100             |
|                                                                 |                    | 120             | ~3            | ~1.2                                   | 3,180                       | 760               | 150             | ~3            | ~1.5                                   | 2,550                       | 1,070             | 190             | ~4            | ~2.2                                   | 2,040                       | 860               |
|                                                                 |                    | 160             | ~2            | ~0.4                                   | 2,790                       | 560               | 190             | ~2            | ~0.5                                   | 2,230                       | 800               | 235             | ~3            | ~0.7                                   | 1,780                       | 640               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050<br>(JC8118) | ~80             | ~5            | ~4                                     | 3,580                       | 1,000             | ~100            | ~5            | ~5                                     | 2,860                       | 1,370             | ~120            | ~6            | ~7.2                                   | 2,290                       | 1,100             |
|                                                                 |                    | 120             | ~3            | ~1.2                                   | 3,180                       | 760               | 150             | ~3            | ~1.5                                   | 2,550                       | 1,070             | 190             | ~4            | ~2.2                                   | 2,040                       | 860               |
|                                                                 |                    | 160             | ~2            | ~0.4                                   | 2,790                       | 560               | 190             | ~2            | ~0.5                                   | 2,230                       | 800               | 235             | ~3            | ~0.7                                   | 1,780                       | 640               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118<br>(JC8050) | ~80             | ~5            | ~4                                     | 2,590                       | 620               | ~100            | ~5            | ~5                                     | 2,070                       | 870               | ~120            | ~6            | ~7.2                                   | 1,660                       | 700               |
|                                                                 |                    | 120             | ~3            | ~1.2                                   | 2,390                       | 480               | 150             | ~3            | ~1.5                                   | 1,910                       | 690               | 190             | ~4            | ~2.2                                   | 1,530                       | 550               |
|                                                                 |                    | 160             | ~2            | ~0.4                                   | 2,190                       | 350               | 190             | ~2            | ~0.5                                   | 1,750                       | 530               | 235             | ~3            | ~0.7                                   | 1,400                       | 420               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118<br>(JC8050) | ~80             | ~5            | ~3.4                                   | 2,390                       | 570               | ~100            | ~5            | ~4                                     | 1,910                       | 800               | ~120            | ~6            | ~6                                     | 1,530                       | 640               |
|                                                                 |                    | 120             | ~3            | ~1                                     | 2,090                       | 420               | 150             | ~3            | ~1.2                                   | 1,670                       | 600               | 190             | ~4            | ~1.8                                   | 1,340                       | 480               |
|                                                                 |                    | 160             | ~2            | ~0.3                                   | 1,790                       | 290               | 190             | ~2            | ~0.4                                   | 1,430                       | 430               | 235             | ~3            | ~0.6                                   | 1,150                       | 350               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118             | ~80             | ~3            | ~1.6                                   | 1,990                       | 320               | ~100            | ~3.5          | ~2                                     | 1,590                       | 480               | ~120            | ~4            | ~3.2                                   | 1,270                       | 380               |
|                                                                 |                    | 120             | ~2            | ~0.6                                   | 1,790                       | 250               | 150             | ~2.5          | ~0.6                                   | 1,430                       | 390               | 190             | ~3            | ~1                                     | 1,150                       | 310               |
|                                                                 |                    | 160             | ~1            | ~0.2                                   | 1,590                       | 190               | 190             | ~1.5          | ~0.2                                   | 1,270                       | 300               | 235             | ~2            | ~0.3                                   | 1,020                       | 240               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118<br>(JC8050) | ~80             | ~5            | ~5                                     | 3,980                       | 1,110             | ~100            | ~5            | ~6                                     | 3,180                       | 1,530             | ~120            | ~6            | ~9.8                                   | 2,550                       | 1,220             |
|                                                                 |                    | 120             | ~3            | ~1.5                                   | 3,580                       | 860               | 150             | ~3            | ~1.8                                   | 2,860                       | 1,200             | 190             | ~4            | ~3                                     | 2,290                       | 960               |
|                                                                 |                    | 160             | ~2            | ~0.5                                   | 3,180                       | 640               | 190             | ~2            | ~0.6                                   | 2,550                       | 920               | 235             | ~3            | ~1                                     | 2,040                       | 730               |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118<br>(JC8050) | ~80             | ~5            | ~5                                     | 3,580                       | 1,000             | ~100            | ~5            | ~6                                     | 2,860                       | 1,370             | ~120            | ~6            | ~9.8                                   | 2,290                       | 1,100             |
|                                                                 |                    | 120             | ~3            | ~1.5                                   | 3,180                       | 760               | 150             | ~3            | ~1.8                                   | 2,550                       | 1,070             | 190             | ~4            | ~3                                     | 2,040                       | 860               |
|                                                                 |                    | 160             | ~2            | ~0.5                                   | 2,790                       | 560               | 190             | ~2            | ~0.6                                   | 2,230                       | 800               | 235             | ~3            | ~1                                     | 1,780                       | 640               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050<br>(JC7550) | ~80             | ~5            | ~4                                     | 2,390                       | 570               | ~100            | ~5            | ~5                                     | 1,910                       | 800               | ~120            | ~6            | ~7.2                                   | 1,530                       | 640               |
|                                                                 |                    | 120             | ~3            | ~1.2                                   | 2,190                       | 440               | 150             | ~3            | ~1.5                                   | 1,750                       | 630               | 190             | ~4            | ~2.2                                   | 1,400                       | 500               |
|                                                                 |                    | 160             | ~2            | ~0.4                                   | 1,990                       | 320               | 190             | ~2            | ~0.5                                   | 1,590                       | 480               | 235             | ~3            | ~0.7                                   | 1,270                       | 380               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8050<br>(JC7550) | ~80             | ~5            | ~3.2                                   | 2,790                       | 670               | ~100            | ~5            | ~5                                     | 2,230                       | 940               | ~120            | ~6            | ~7.2                                   | 1,780                       | 750               |
|                                                                 |                    | 120             | ~3            | ~1                                     | 2,390                       | 480               | 150             | ~3            | ~1.5                                   | 1,910                       | 690               | 190             | ~4            | ~2.2                                   | 1,530                       | 550               |
|                                                                 |                    | 160             | ~2            | ~0.4                                   | 1,990                       | 320               | 190             | ~2            | ~0.5                                   | 1,590                       | 480               | 235             | ~3            | ~0.7                                   | 1,270                       | 380               |
| Titanium alloy<br>35~43HRC                                      | JC7550<br>(JC7518) | ~80             | ~5            | ~3.2                                   | 1,390                       | 330               | ~100            | ~5            | ~4                                     | 1,110                       | 430               | ~120            | ~6            | ~6                                     | 890                         | 350               |
|                                                                 |                    | 120             | ~3            | ~1                                     | 1,190                       | 260               | 150             | ~3            | ~1.2                                   | 950                         | 340               | 190             | ~4            | ~1.8                                   | 760                         | 270               |
|                                                                 |                    | 160             | ~2            | ~0.3                                   | 990                         | 200               | 190             | ~2            | ~0.4                                   | 800                         | 260               | 235             | ~3            | ~0.6                                   | 640                         | 210               |
| Inconel<br>35~43HRC                                             | JC7550<br>(JC7518) | ~80             | ~5            | ~3.2                                   | 600                         | 110               | ~100            | ~5            | ~4                                     | 480                         | 140               | ~120            | ~6            | ~6.0                                   | 380                         | 110               |
|                                                                 |                    | 120             | ~3            | ~1                                     | 500                         | 80                | 150             | ~3            | ~1.2                                   | 400                         | 110               | 190             | ~4            | ~1.8                                   | 320                         | 90                |
|                                                                 |                    | 160             | ~2            | ~0.3                                   | 400                         | 60                | 190             | ~2            | ~0.4                                   | 320                         | 80                | 235             | ~3            | ~0.6                                   | 250                         | 60                |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.



## MSX and MSN type

| Work materials                                                  | Grades             | Tool dia. (mm)  |               |                                        |                             |                   |                 |               |                                        |                             |                   |
|-----------------------------------------------------------------|--------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|
|                                                                 |                    | 30/32           |               |                                        |                             |                   | 40              |               |                                        |                             |                   |
|                                                                 |                    | No. of teeth 4N |               |                                        |                             |                   | No. of teeth 5N |               |                                        |                             |                   |
|                                                                 |                    | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50, C55)<br>Below 250HB                          | JC8050<br>(JC8118) | ~160            | ~6            | ~9.8                                   | 1,790                       | 1,150             | ~160            | ~7            | ~14                                    | 1,430                       | 1,290             |
|                                                                 |                    | 240             | ~4            | ~3                                     | 1,590                       | 890               | 240             | ~5            | ~4.2                                   | 1,270                       | 1,020             |
|                                                                 |                    | 290             | ~3            | ~1                                     | 1,390                       | 670               | 290             | ~3            | ~1.4                                   | 1,110                       | 780               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050<br>(JC8118) | ~160            | ~6            | ~9.8                                   | 1,790                       | 1,150             | ~160            | ~7            | ~14                                    | 1,430                       | 1,290             |
|                                                                 |                    | 240             | ~4            | ~3                                     | 1,590                       | 890               | 240             | ~5            | ~4.2                                   | 1,270                       | 1,020             |
|                                                                 |                    | 290             | ~3            | ~1                                     | 1,390                       | 670               | 290             | ~3            | ~1.4                                   | 1,110                       | 780               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050<br>(JC8118) | ~160            | ~6            | ~9.8                                   | 1,790                       | 1,150             | ~160            | ~7            | ~14                                    | 1,430                       | 1,290             |
|                                                                 |                    | 240             | ~4            | ~3                                     | 1,590                       | 890               | 240             | ~5            | ~4.2                                   | 1,270                       | 1,020             |
|                                                                 |                    | 290             | ~3            | ~1                                     | 1,390                       | 670               | 290             | ~3            | ~1.4                                   | 1,110                       | 780               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118<br>(JC8050) | ~160            | ~6            | ~9.8                                   | 1,290                       | 720               | ~160            | ~7            | ~14                                    | 1,030                       | 720               |
|                                                                 |                    | 240             | ~4            | ~3                                     | 1,190                       | 570               | 240             | ~5            | ~4.2                                   | 950                         | 570               |
|                                                                 |                    | 290             | ~3            | ~1                                     | 1,090                       | 440               | 290             | ~3            | ~1.4                                   | 880                         | 440               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118<br>(JC8050) | ~160            | ~6            | ~8                                     | 1,190                       | 670               | ~160            | ~7            | ~10                                    | 950                         | 670               |
|                                                                 |                    | 240             | ~4            | ~2.4                                   | 1,040                       | 500               | 240             | ~5            | ~3                                     | 840                         | 500               |
|                                                                 |                    | 290             | ~3            | ~0.8                                   | 900                         | 360               | 290             | ~3            | ~1                                     | 720                         | 360               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118             | ~160            | ~4            | ~3.6                                   | 990                         | 400               | ~160            | ~4.5          | ~4                                     | 800                         | 480               |
|                                                                 |                    | 240             | ~3            | ~1                                     | 900                         | 320               | 240             | ~3.5          | ~1.2                                   | 720                         | 360               |
|                                                                 |                    | 290             | ~2            | ~0.4                                   | 800                         | 260               | 290             | ~2.5          | ~0.4                                   | 640                         | 260               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118<br>(JC8050) | ~160            | ~6            | ~12                                    | 1,990                       | 1,270             | ~160            | ~7            | ~16                                    | 1,590                       | 1,430             |
|                                                                 |                    | 240             | ~4            | ~3.6                                   | 1,790                       | 1,000             | 240             | ~5            | ~4.8                                   | 1,430                       | 1,000             |
|                                                                 |                    | 290             | ~3            | ~1.2                                   | 1,590                       | 760               | 290             | ~3            | ~1.6                                   | 1,270                       | 760               |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118<br>(JC8050) | ~160            | ~6            | ~12                                    | 1,790                       | 1,150             | ~160            | ~7            | ~16                                    | 1,430                       | 1,140             |
|                                                                 |                    | 240             | ~4            | ~3.6                                   | 1,590                       | 890               | 240             | ~5            | ~4.8                                   | 1,270                       | 890               |
|                                                                 |                    | 290             | ~3            | ~1.2                                   | 1,390                       | 670               | 290             | ~3            | ~1.6                                   | 1,110                       | 670               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050<br>(JC7550) | ~160            | ~6            | ~9.8                                   | 1,190                       | 670               | ~160            | ~7            | ~14                                    | 950                         | 670               |
|                                                                 |                    | 240             | ~4            | ~3                                     | 1,090                       | 520               | 240             | ~5            | ~4.2                                   | 880                         | 530               |
|                                                                 |                    | 290             | ~3            | ~1                                     | 990                         | 400               | 290             | ~3            | ~1.4                                   | 800                         | 400               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8050<br>(JC7550) | ~160            | ~6            | ~9.8                                   | 1,390                       | 780               | ~160            | ~7            | ~14                                    | 1,110                       | 780               |
|                                                                 |                    | 240             | ~4            | ~3                                     | 1,190                       | 570               | 240             | ~5            | ~4.2                                   | 950                         | 570               |
|                                                                 |                    | 290             | ~3            | ~1                                     | 990                         | 400               | 290             | ~3            | ~1.4                                   | 800                         | 400               |
| Titanium alloy<br>35~43HRC                                      | JC7550<br>(JC7518) | ~160            | ~6            | ~8                                     | 700                         | 360               | ~160            | ~7            | ~10                                    | 560                         | 360               |
|                                                                 |                    | 240             | ~4            | ~2.4                                   | 600                         | 290               | 240             | ~5            | ~3                                     | 480                         | 290               |
|                                                                 |                    | 290             | ~3            | ~0.8                                   | 500                         | 220               | 290             | ~3            | ~1                                     | 400                         | 220               |
| Inconel<br>35~43HRC                                             | JC7550<br>(JC7518) | ~160            | ~6            | ~8                                     | 300                         | 120               | ~160            | ~7            | ~10                                    | 240                         | 120               |
|                                                                 |                    | 240             | ~4            | ~2.4                                   | 250                         | 90                | 240             | ~5            | ~3                                     | 200                         | 90                |
|                                                                 |                    | 290             | ~3            | ~0.8                                   | 200                         | 60                | 290             | ~3            | ~1                                     | 160                         | 60                |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

## Recommended cutting conditions for facemilling

EXSAP-11 type

### FaceMill type

| Work materials                                                  | Grades             | Tool dia. (mm)  |               |               |                             |                   |                 |               |               |                             |                   |
|-----------------------------------------------------------------|--------------------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|
|                                                                 |                    | 40              |               |               |                             |                   | 50/52           |               |               |                             |                   |
|                                                                 |                    | No. of teeth 6N |               |               |                             |                   | No. of teeth 7N |               |               |                             |                   |
|                                                                 |                    | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50,C55)<br>Below 250HB                           | JC8050<br>(JC8118) | ~150            | ~2            | ~24           | 1,430                       | 1,720             | ~200            | ~2            | ~30           | 1,150                       | 1,610             |
|                                                                 |                    | 200             | ~1.2          | ~24           | 1,270                       | 1,300             | 250             | ~1.2          | ~30           | 1,020                       | 1,210             |
|                                                                 |                    | 250             | ~0.5          | ~24           | 1,110                       | 930               | 300             | ~0.5          | ~30           | 890                         | 870               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050<br>(JC8118) | ~150            | ~2            | ~24           | 1,430                       | 1,720             | ~200            | ~2            | ~30           | 1,150                       | 1,610             |
|                                                                 |                    | 200             | ~1.2          | ~24           | 1,270                       | 1,300             | 250             | ~1.2          | ~30           | 1,020                       | 1,210             |
|                                                                 |                    | 250             | ~0.5          | ~24           | 1,110                       | 930               | 300             | ~0.5          | ~30           | 890                         | 870               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050<br>(JC8118) | ~150            | ~2            | ~24           | 1,430                       | 1,720             | ~200            | ~2            | ~30           | 1,150                       | 1,610             |
|                                                                 |                    | 200             | ~1.2          | ~24           | 1,270                       | 1,300             | 250             | ~1.2          | ~30           | 1,020                       | 1,210             |
|                                                                 |                    | 250             | ~0.5          | ~24           | 1,110                       | 930               | 300             | ~0.5          | ~30           | 890                         | 870               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118<br>(JC8050) | ~150            | ~2            | ~24           | 1,030                       | 1,110             | ~200            | ~2            | ~30           | 830                         | 1,050             |
|                                                                 |                    | 200             | ~1.2          | ~24           | 950                         | 860               | 250             | ~1.2          | ~30           | 760                         | 800               |
|                                                                 |                    | 250             | ~0.5          | ~24           | 880                         | 630               | 300             | ~0.5          | ~30           | 700                         | 590               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118<br>(JC8050) | ~150            | ~1.8          | ~24           | 950                         | 910               | ~200            | ~1.8          | ~30           | 760                         | 850               |
|                                                                 |                    | 200             | ~1            | ~24           | 840                         | 660               | 250             | ~1            | ~30           | 670                         | 610               |
|                                                                 |                    | 250             | ~0.5          | ~24           | 720                         | 430               | 300             | ~0.5          | ~30           | 570                         | 400               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118             | ~150            | ~1            | ~16           | 800                         | 580               | ~200            | ~1            | ~20           | 640                         | 540               |
|                                                                 |                    | 200             | ~0.5          | ~16           | 720                         | 430               | 250             | ~0.5          | ~20           | 570                         | 400               |
|                                                                 |                    | 250             | ~0.3          | ~16           | 640                         | 310               | 300             | ~0.3          | ~20           | 510                         | 290               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118<br>(JC8050) | ~150            | ~2            | ~24           | 1,590                       | 1,910             | ~200            | ~2            | ~30           | 1,270                       | 1,780             |
|                                                                 |                    | 200             | ~1.2          | ~24           | 1,430                       | 1,460             | 250             | ~1.2          | ~30           | 1,150                       | 1,370             |
|                                                                 |                    | 250             | ~0.5          | ~24           | 1,270                       | 1,070             | 300             | ~0.5          | ~30           | 1,020                       | 1,000             |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118<br>(JC8050) | ~150            | ~2            | ~24           | 1,430                       | 1,720             | ~200            | ~2            | ~30           | 1,150                       | 1,610             |
|                                                                 |                    | 200             | ~1.2          | ~24           | 1,270                       | 1,300             | 250             | ~1            | ~30           | 1,020                       | 1,210             |
|                                                                 |                    | 250             | ~0.5          | ~24           | 1,110                       | 930               | 300             | ~0.5          | ~30           | 890                         | 870               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050<br>(JC7550) | ~150            | ~2            | ~16           | 950                         | 1,030             | ~200            | ~2            | ~20           | 760                         | 960               |
|                                                                 |                    | 200             | ~1.2          | ~16           | 880                         | 900               | 250             | ~1.2          | ~20           | 700                         | 830               |
|                                                                 |                    | 250             | ~0.5          | ~16           | 800                         | 670               | 300             | ~0.5          | ~20           | 640                         | 630               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8050<br>(JC7550) | ~150            | ~2            | ~24           | 1,110                       | 1,200             | ~200            | ~2            | ~30           | 890                         | 1,120             |
|                                                                 |                    | 200             | ~1.2          | ~24           | 950                         | 970               | 250             | ~1.2          | ~30           | 760                         | 900               |
|                                                                 |                    | 250             | ~0.5          | ~24           | 800                         | 670               | 300             | ~0.5          | ~30           | 640                         | 630               |
| Titanium alloy<br>35~43HRC                                      | JC7550<br>(JC7518) | ~150            | ~1.8          | ~16           | 560                         | 400               | ~200            | ~1.8          | ~20           | 450                         | 380               |
|                                                                 |                    | 200             | ~1            | ~16           | 480                         | 290               | 250             | ~1            | ~20           | 380                         | 270               |
|                                                                 |                    | 250             | ~0.4          | ~16           | 400                         | 190               | 300             | ~0.4          | ~20           | 320                         | 180               |
| Inconel<br>35~43HRC                                             | JC7550<br>(JC7518) | ~150            | ~1.8          | ~16           | 240                         | 160               | ~200            | ~1.8          | ~20           | 190                         | 150               |
|                                                                 |                    | 200             | ~1            | ~16           | 200                         | 110               | 250             | ~1            | ~20           | 160                         | 100               |
|                                                                 |                    | 250             | ~0.4          | ~16           | 160                         | 70                | 300             | ~0.4          | ~20           | 130                         | 60                |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.



## FaceMill type

| Work materials                                                  | Grades             | Tool dia. (mm)  |               |               |                             |                   |                 |               |               |                             |                   |
|-----------------------------------------------------------------|--------------------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|
|                                                                 |                    | 63              |               |               |                             |                   | 80              |               |               |                             |                   |
|                                                                 |                    | No. of teeth 7N |               |               |                             |                   | No. of teeth 8N |               |               |                             |                   |
|                                                                 |                    | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50,C55)<br>Below 250HB                           | JC8050<br>(JC8118) | ~250            | ~2            | ~38           | 910                         | 1,270             | ~300            | ~2            | ~48           | 720                         | 1,150             |
|                                                                 |                    | 300             | ~1.2          | ~38           | 810                         | 960               | ~350            | ~1.2          | ~48           | 640                         | 870               |
|                                                                 |                    | 350             | ~0.5          | ~38           | 710                         | 700               | ~400            | ~0.5          | ~48           | 560                         | 630               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050<br>(JC8118) | ~250            | ~2            | ~38           | 910                         | 1,270             | ~300            | ~2            | ~48           | 720                         | 1,150             |
|                                                                 |                    | 300             | ~1.2          | ~38           | 810                         | 960               | ~350            | ~1.2          | ~48           | 640                         | 870               |
|                                                                 |                    | 350             | ~0.5          | ~38           | 710                         | 700               | ~400            | ~0.5          | ~48           | 560                         | 630               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050<br>(JC8118) | ~250            | ~2            | ~38           | 910                         | 1,270             | ~300            | ~2            | ~48           | 720                         | 1,150             |
|                                                                 |                    | 300             | ~1.2          | ~38           | 810                         | 960               | ~350            | ~1.2          | ~48           | 640                         | 870               |
|                                                                 |                    | 350             | ~0.5          | ~38           | 710                         | 700               | ~400            | ~0.5          | ~48           | 560                         | 630               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118<br>(JC8050) | ~250            | ~2            | ~38           | 660                         | 830               | ~300            | ~2            | ~48           | 520                         | 750               |
|                                                                 |                    | 300             | ~1.2          | ~38           | 610                         | 640               | ~350            | ~1.2          | ~48           | 480                         | 580               |
|                                                                 |                    | 350             | ~0.5          | ~38           | 560                         | 470               | ~400            | ~0.5          | ~48           | 440                         | 420               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118<br>(JC8050) | ~250            | ~1.8          | ~38           | 610                         | 680               | ~300            | ~1.8          | ~48           | 480                         | 610               |
|                                                                 |                    | 300             | ~1            | ~38           | 530                         | 480               | ~350            | ~1            | ~48           | 420                         | 440               |
|                                                                 |                    | 350             | ~0.5          | ~38           | 450                         | 320               | ~400            | ~0.5          | ~48           | 360                         | 290               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118             | ~250            | ~1            | ~25           | 510                         | 430               | ~300            | ~1            | ~32           | 400                         | 380               |
|                                                                 |                    | 300             | ~0.5          | ~25           | 450                         | 320               | ~350            | ~0.5          | ~32           | 360                         | 290               |
|                                                                 |                    | 350             | ~0.3          | ~25           | 400                         | 220               | ~400            | ~0.3          | ~32           | 320                         | 200               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118<br>(JC8050) | ~250            | ~2            | ~38           | 1,010                       | 1,410             | ~300            | ~2            | ~48           | 800                         | 1,280             |
|                                                                 |                    | 300             | ~1.2          | ~38           | 910                         | 1,080             | ~350            | ~1.2          | ~48           | 720                         | 980               |
|                                                                 |                    | 350             | ~0.5          | ~38           | 810                         | 790               | ~400            | ~0.5          | ~48           | 640                         | 720               |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118<br>(JC8050) | ~250            | ~2            | ~38           | 910                         | 1,270             | ~300            | ~2            | ~48           | 720                         | 1,150             |
|                                                                 |                    | 300             | ~1.2          | ~38           | 810                         | 960               | ~350            | ~1.2          | ~48           | 640                         | 870               |
|                                                                 |                    | 350             | ~0.5          | ~38           | 710                         | 700               | ~400            | ~0.5          | ~48           | 560                         | 630               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050<br>(JC7550) | ~250            | ~2            | ~25           | 610                         | 770               | ~300            | ~2            | ~32           | 480                         | 690               |
|                                                                 |                    | 300             | ~1.2          | ~25           | 560                         | 670               | ~350            | ~1.2          | ~32           | 440                         | 600               |
|                                                                 |                    | 350             | ~0.5          | ~25           | 510                         | 500               | ~400            | ~0.5          | ~32           | 400                         | 450               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8050<br>(JC7550) | ~250            | ~2            | ~38           | 710                         | 890               | ~300            | ~2            | ~48           | 560                         | 810               |
|                                                                 |                    | 300             | ~1.2          | ~38           | 610                         | 730               | ~350            | ~1.2          | ~48           | 480                         | 650               |
|                                                                 |                    | 350             | ~0.5          | ~38           | 510                         | 500               | ~400            | ~0.5          | ~48           | 400                         | 450               |
| Titanium alloy<br>35~43HRC                                      | JC7550<br>(JC7518) | ~250            | ~1.8          | ~25           | 350                         | 290               | ~300            | ~1.8          | ~32           | 280                         | 270               |
|                                                                 |                    | 300             | ~1            | ~25           | 300                         | 210               | ~350            | ~1            | ~32           | 240                         | 190               |
|                                                                 |                    | 350             | ~0.4          | ~25           | 250                         | 140               | ~400            | ~0.4          | ~32           | 200                         | 130               |
| Inconel<br>35~43HRC                                             | JC7550<br>(JC7518) | ~250            | ~1.8          | ~25           | 150                         | 120               | ~300            | ~1.8          | ~32           | 120                         | 110               |
|                                                                 |                    | 300             | ~1            | ~25           | 130                         | 80                | ~350            | ~1            | ~32           | 100                         | 70                |
|                                                                 |                    | 350             | ~0.4          | ~25           | 100                         | 50                | ~400            | ~0.4          | ~32           | 80                          | 40                |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut ap or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut ap or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed (Vf) to 50% or below of the above date.

Recommended cutting conditions for facemilling

EXSAP-11 type

## Endmill type

| Work materials                                                  | Grades             | Tool dia. (mm)  |               |               |                             |                   |                 |               |               |                             |                   |                 |               |               |                             |                   |
|-----------------------------------------------------------------|--------------------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|
|                                                                 |                    | 16              |               |               |                             |                   | 20              |               |               |                             |                   | 25              |               |               |                             |                   |
|                                                                 |                    | No. of teeth 2N |               |               |                             |                   | No. of teeth 3N |               |               |                             |                   | No. of teeth 3N |               |               |                             |                   |
|                                                                 |                    | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50,C55)<br>Below 250HB                           | JC8050<br>(JC8118) | ~30             | ~1            | ~10           | 2,980                       | 830               | ~70             | ~1.2          | ~12           | 2,390                       | 1,150             | ~70             | ~1.2          | ~15           | 1,910                       | 920               |
|                                                                 |                    | 70              | ~0.5          | ~10           | 2,590                       | 570               | 120             | ~0.6          | ~12           | 2,070                       | 810               | 120             | ~0.6          | ~15           | 1,660                       | 650               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050<br>(JC8118) | ~30             | ~1            | ~10           | 2,980                       | 830               | ~70             | ~1.2          | ~12           | 2,390                       | 1,150             | ~70             | ~1.2          | ~15           | 1,910                       | 920               |
|                                                                 |                    | 70              | ~0.5          | ~10           | 2,590                       | 570               | 120             | ~0.6          | ~12           | 2,070                       | 810               | 120             | ~0.6          | ~15           | 1,660                       | 650               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050<br>(JC8118) | ~30             | ~1            | ~10           | 2,980                       | 830               | ~70             | ~1.2          | ~12           | 2,390                       | 1,150             | ~70             | ~1.2          | ~15           | 1,910                       | 920               |
|                                                                 |                    | 70              | ~0.5          | ~10           | 2,590                       | 570               | 120             | ~0.6          | ~12           | 2,070                       | 810               | 120             | ~0.6          | ~15           | 1,660                       | 650               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118<br>(JC8050) | ~30             | ~1            | ~10           | 2,590                       | 670               | ~70             | ~1.2          | ~12           | 2,070                       | 930               | ~70             | ~1.2          | ~15           | 1,660                       | 750               |
|                                                                 |                    | 70              | ~0.5          | ~10           | 2,390                       | 480               | 120             | ~0.6          | ~12           | 1,910                       | 690               | 120             | ~0.6          | ~15           | 1,530                       | 550               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118<br>(JC8050) | ~30             | ~0.8          | ~10           | 2,190                       | 530               | ~70             | ~1            | ~12           | 1,750                       | 740               | ~70             | ~1            | ~15           | 1,400                       | 590               |
|                                                                 |                    | 70              | ~0.4          | ~10           | 1,990                       | 360               | 120             | ~0.5          | ~12           | 1,590                       | 520               | 120             | ~0.5          | ~15           | 1,270                       | 420               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118             | ~30             | ~0.4          | ~6            | 1,790                       | 360               | ~70             | ~0.5          | ~8            | 1,430                       | 430               | ~70             | ~0.5          | ~10           | 1,150                       | 350               |
|                                                                 |                    | 70              | ~0.3          | ~6            | 1,590                       | 250               | 120             | ~0.4          | ~8            | 1,270                       | 300               | 120             | ~0.4          | ~10           | 1,020                       | 240               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118<br>(JC8050) | ~30             | ~1            | ~10           | 3,580                       | 1,000             | ~70             | ~1.2          | ~12           | 2,860                       | 1,370             | ~70             | ~1.2          | ~15           | 2,290                       | 1,100             |
|                                                                 |                    | 70              | ~0.5          | ~10           | 3,180                       | 700               | 120             | ~0.6          | ~12           | 2,550                       | 990               | 120             | ~0.6          | ~15           | 2,040                       | 800               |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118<br>(JC8050) | ~30             | ~1            | ~10           | 2,790                       | 780               | ~70             | ~1.2          | ~12           | 2,230                       | 1,070             | ~70             | ~1.2          | ~15           | 1,780                       | 850               |
|                                                                 |                    | 70              | ~0.5          | ~10           | 2,590                       | 570               | 120             | ~0.6          | ~12           | 2,070                       | 810               | 120             | ~0.6          | ~15           | 1,660                       | 650               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050<br>(JC7550) | ~30             | ~1            | ~6            | 2,190                       | 610               | ~70             | ~1.2          | ~8            | 1,750                       | 840               | ~70             | ~1.2          | ~10           | 1,400                       | 670               |
|                                                                 |                    | 70              | ~0.5          | ~6            | 1,990                       | 440               | 120             | ~0.6          | ~8            | 1,590                       | 620               | 120             | ~0.6          | ~10           | 1,270                       | 500               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8050<br>(JC7550) | ~30             | ~1            | ~10           | 2,980                       | 830               | ~70             | ~1.2          | ~12           | 2,390                       | 1,150             | ~70             | ~1.2          | ~15           | 1,910                       | 920               |
|                                                                 |                    | 70              | ~0.5          | ~10           | 2,590                       | 570               | 120             | ~0.6          | ~12           | 2,070                       | 810               | 120             | ~0.6          | ~15           | 1,660                       | 650               |
| Titanium alloy<br>35~43HRC                                      | JC7550<br>(JC7518) | ~30             | ~0.8          | ~6            | 1,190                       | 240               | ~70             | ~1            | ~8            | 950                         | 290               | ~70             | ~1            | ~10           | 760                         | 230               |
|                                                                 |                    | 70              | ~0.4          | ~6            | 990                         | 160               | 120             | ~0.5          | ~8            | 800                         | 190               | 120             | ~0.5          | ~10           | 640                         | 150               |
| Inconel<br>35~43HRC                                             | JC7550<br>(JC7518) | ~30             | ~0.8          | ~6            | 600                         | 110               | ~70             | ~1            | ~8            | 480                         | 130               | ~70             | ~1            | ~10           | 380                         | 110               |
|                                                                 |                    | 70              | ~0.4          | ~6            | 500                         | 70                | 120             | ~0.5          | ~8            | 400                         | 80                | 120             | ~0.5          | ~10           | 320                         | 80                |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.



## Endmill type

| Work materials                                                  | Grades             | Tool dia. (mm)  |               |               |                             |                   |                 |               |               |                             |                   |
|-----------------------------------------------------------------|--------------------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|
|                                                                 |                    | 30/32           |               |               |                             |                   | 40              |               |               |                             |                   |
|                                                                 |                    | No. of teeth 4N |               |               |                             |                   | No. of teeth 5N |               |               |                             |                   |
|                                                                 |                    | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50, C55)<br>Below 250HB                          | JC8050<br>(JC8118) | ~70             | ~1.5          | ~18           | 1,590                       | 1,020             | ~70             | ~1.6          | ~24           | 1,430                       | 1,290             |
|                                                                 |                    | 120             | ~0.8          | ~18           | 1,380                       | 720               | 170             | ~1            | ~24           | 1,270                       | 950               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050<br>(JC8118) | ~70             | ~1.5          | ~18           | 1,590                       | 1,020             | ~70             | ~1.6          | ~24           | 1,430                       | 1,290             |
|                                                                 |                    | 120             | ~0.8          | ~18           | 1,380                       | 720               | 170             | ~1            | ~24           | 1,270                       | 950               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050<br>(JC8118) | ~70             | ~1.5          | ~18           | 1,590                       | 1,020             | ~70             | ~1.6          | ~24           | 1,430                       | 1,290             |
|                                                                 |                    | 120             | ~0.8          | ~18           | 1,380                       | 720               | 170             | ~1            | ~24           | 1,270                       | 950               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118<br>(JC8050) | ~70             | ~1.5          | ~18           | 1,380                       | 830               | ~70             | ~1.6          | ~24           | 1,030                       | 820               |
|                                                                 |                    | 120             | ~0.8          | ~18           | 1,270                       | 610               | 170             | ~1            | ~24           | 950                         | 620               |
| Mold Steel (1.2311, P21)<br>38~43HRC                            | JC8118<br>(JC8050) | ~70             | ~1.2          | ~18           | 1,170                       | 660               | ~70             | ~1.4          | ~24           | 950                         | 710               |
|                                                                 |                    | 120             | ~0.6          | ~18           | 1,060                       | 470               | 170             | ~0.8          | ~24           | 840                         | 500               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118             | ~70             | ~0.6          | ~12           | 950                         | 380               | ~70             | ~0.8          | ~16           | 800                         | 440               |
|                                                                 |                    | 120             | ~0.4          | ~12           | 850                         | 270               | 170             | ~0.4          | ~16           | 720                         | 320               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118<br>(JC8050) | ~70             | ~1.5          | ~18           | 1,910                       | 1,220             | ~70             | ~1.6          | ~24           | 1,590                       | 1,430             |
|                                                                 |                    | 120             | ~0.8          | ~18           | 1,700                       | 880               | 170             | ~1            | ~24           | 1,430                       | 1,070             |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118<br>(JC8050) | ~70             | ~1.5          | ~18           | 1,490                       | 950               | ~70             | ~1.6          | ~24           | 1,430                       | 5,720             |
|                                                                 |                    | 120             | ~0.8          | ~18           | 1,380                       | 720               | 170             | ~1            | ~24           | 1,270                       | 640               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050<br>(JC7550) | ~70             | ~1.5          | ~12           | 1,170                       | 750               | ~70             | ~1.6          | ~16           | 950                         | 860               |
|                                                                 |                    | 120             | ~0.8          | ~12           | 1,060                       | 550               | 170             | ~1            | ~16           | 880                         | 660               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8050<br>(JC7550) | ~70             | ~1.5          | ~18           | 1,590                       | 1,020             | ~70             | ~1.6          | ~24           | 1,110                       | 1,000             |
|                                                                 |                    | 120             | ~0.8          | ~18           | 1,380                       | 720               | 170             | ~1            | ~24           | 950                         | 710               |
| Titanium alloy<br>35~43HRC                                      | JC7550<br>(JC7518) | ~70             | ~0.8          | ~12           | 640                         | 260               | ~70             | ~1.4          | ~16           | 560                         | 310               |
|                                                                 |                    | 120             | ~0.5          | ~12           | 530                         | 170               | 170             | ~0.8          | ~16           | 480                         | 220               |
| Inconel<br>35~43HRC                                             | JC7550<br>(JC7518) | ~70             | ~0.8          | ~12           | 320                         | 130               | ~70             | ~1.4          | ~16           | 240                         | 120               |
|                                                                 |                    | 120             | ~0.5          | ~12           | 270                         | 90                | 170             | ~0.8          | ~16           | 200                         | 80                |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and

Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.

Recommended cutting conditions for facemilling

EXSAP-11 type

## MSX and MSN type

| Work materials                                                 | Grades             | Tool dia. (mm)  |               |               |                             |                   |                 |               |               |                             |                   |                 |               |               |                             |                   |
|----------------------------------------------------------------|--------------------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|
|                                                                |                    | 16              |               |               |                             |                   | 20              |               |               |                             |                   | 25              |               |               |                             |                   |
|                                                                |                    | No. of teeth 2N |               |               |                             |                   | No. of teeth 3N |               |               |                             |                   | No. of teeth 3N |               |               |                             |                   |
|                                                                |                    | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50,C55)<br>Below 250HB                          | JC8050<br>(JC8118) | ~80             | ~1            | ~10           | 2,980                       | 830               | ~100            | ~1.2          | ~12           | 2,390                       | 1,150             | ~120            | ~1.2          | ~15           | 1,910                       | 920               |
|                                                                |                    | 120             | ~0.5          | ~10           | 2,590                       | 570               | 150             | ~0.6          | ~12           | 2,070                       | 810               | 190             | ~0.6          | ~15           | 1,660                       | 650               |
|                                                                |                    | 160             | ~0.2          | ~10           | 2,190                       | 350               | 190             | ~0.3          | ~12           | 1,750                       | 530               | 235             | ~0.3          | ~15           | 1,400                       | 420               |
| Cast steel (1.7225)<br>Below 285HB                             | JC8050<br>(JC8118) | ~80             | ~1            | ~10           | 2,980                       | 830               | ~100            | ~1.2          | ~12           | 2,390                       | 1,150             | ~120            | ~1.2          | ~15           | 1,910                       | 920               |
|                                                                |                    | 120             | ~0.5          | ~10           | 2,590                       | 570               | 150             | ~0.6          | ~12           | 2,070                       | 810               | 190             | ~0.6          | ~15           | 1,660                       | 650               |
|                                                                |                    | 160             | ~0.2          | ~10           | 2,190                       | 350               | 190             | ~0.3          | ~12           | 1,750                       | 530               | 235             | ~0.3          | ~15           | 1,400                       | 420               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                      | JC8050<br>(JC8118) | ~80             | ~1            | ~10           | 2,980                       | 830               | ~100            | ~1.2          | ~12           | 2,390                       | 1,150             | ~120            | ~1.2          | ~15           | 1,910                       | 920               |
|                                                                |                    | 120             | ~0.5          | ~10           | 2,590                       | 570               | 150             | ~0.6          | ~12           | 2,070                       | 810               | 190             | ~0.6          | ~15           | 1,660                       | 650               |
|                                                                |                    | 160             | ~0.2          | ~10           | 2,190                       | 350               | 190             | ~0.3          | ~12           | 1,750                       | 530               | 235             | ~0.3          | ~15           | 1,400                       | 420               |
| Mold steel (1.2311, P20)<br>30~36HRC                           | JC8118<br>(JC8050) | ~80             | ~1            | ~10           | 2,590                       | 670               | ~100            | ~1.2          | ~12           | 2,070                       | 930               | ~120            | ~1.2          | ~15           | 1,660                       | 750               |
|                                                                |                    | 120             | ~0.5          | ~10           | 2,390                       | 480               | 150             | ~0.6          | ~12           | 1,910                       | 690               | 190             | ~0.6          | ~15           | 1,530                       | 550               |
|                                                                |                    | 160             | ~0.2          | ~10           | 2,190                       | 310               | 190             | ~0.3          | ~12           | 1,750                       | 470               | 235             | ~0.3          | ~15           | 1,400                       | 380               |
| Mold steel (1.2311, P21)<br>38~43HRC                           | JC8118<br>(JC8050) | ~80             | ~0.8          | ~10           | 2,190                       | 530               | ~100            | ~1            | ~12           | 1,750                       | 740               | ~120            | ~1            | ~15           | 1,400                       | 590               |
|                                                                |                    | 120             | ~0.4          | ~10           | 1,990                       | 360               | 150             | ~0.5          | ~12           | 1,590                       | 520               | 190             | ~0.5          | ~15           | 1,270                       | 420               |
|                                                                |                    | 160             | ~0.2          | ~10           | 1,790                       | 210               | 190             | ~0.3          | ~12           | 1,430                       | 340               | 235             | ~0.3          | ~15           | 1,150                       | 280               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                | JC8118             | ~80             | ~0.4          | ~6            | 1,790                       | 360               | ~100            | ~0.5          | ~8            | 1,430                       | 430               | ~120            | ~0.5          | ~10           | 1,150                       | 350               |
|                                                                |                    | 120             | ~0.3          | ~6            | 1,590                       | 250               | 150             | ~0.4          | ~8            | 1,270                       | 300               | 190             | ~0.4          | ~10           | 1,020                       | 240               |
|                                                                |                    | 160             | ~0.2          | ~6            | 1,390                       | 170               | 190             | ~0.2          | ~8            | 1,110                       | 200               | 235             | ~0.2          | ~10           | 890                         | 160               |
| Cast iron (GG25)<br>160~260HB                                  | JC8118<br>(JC8050) | ~80             | ~1            | ~10           | 3,580                       | 1,000             | ~100            | ~1.2          | ~12           | 2,860                       | 1,370             | ~120            | ~1.2          | ~15           | 2,290                       | 1,100             |
|                                                                |                    | 120             | ~0.5          | ~10           | 3,180                       | 700               | 150             | ~0.6          | ~12           | 2,550                       | 990               | 190             | ~0.6          | ~15           | 2,040                       | 800               |
|                                                                |                    | 160             | ~0.2          | ~10           | 2,790                       | 450               | 190             | ~0.3          | ~12           | 2,230                       | 670               | 235             | ~0.3          | ~15           | 1,780                       | 530               |
| Nodular cast iron (GGG70)<br>170~300HB                         | JC8118<br>(JC8050) | ~80             | ~1            | ~10           | 2,790                       | 780               | ~100            | ~1.2          | ~12           | 2,230                       | 1,070             | ~120            | ~1.2          | ~15           | 1,780                       | 850               |
|                                                                |                    | 120             | ~0.5          | ~10           | 2,590                       | 570               | 150             | ~0.6          | ~12           | 2,070                       | 810               | 190             | ~0.6          | ~15           | 1,660                       | 650               |
|                                                                |                    | 160             | ~0.2          | ~10           | 2,390                       | 380               | 190             | ~0.3          | ~12           | 1,910                       | 570               | 235             | ~0.3          | ~15           | 1,530                       | 460               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)             | JC8050<br>(JC7550) | ~80             | ~1            | ~6            | 2,190                       | 610               | ~100            | ~1.2          | ~8            | 1,750                       | 840               | ~120            | ~1.2          | ~10           | 1,400                       | 670               |
|                                                                |                    | 120             | ~0.5          | ~6            | 1,990                       | 440               | 150             | ~0.6          | ~8            | 1,590                       | 620               | 190             | ~0.6          | ~10           | 1,270                       | 500               |
|                                                                |                    | 160             | ~0.2          | ~6            | 1,790                       | 290               | 190             | ~0.3          | ~8            | 1,430                       | 430               | 235             | ~0.3          | ~10           | 1,150                       | 350               |
| Stainless steel Ferritic/Martensitic<br>(AISI 403, 420J2, 430) | JC8050<br>(JC7550) | ~80             | ~1            | ~10           | 2,980                       | 830               | ~100            | ~1.2          | ~12           | 2,390                       | 1,150             | ~120            | ~1.2          | ~15           | 1,910                       | 920               |
|                                                                |                    | 120             | ~0.5          | ~10           | 2,590                       | 570               | 150             | ~0.6          | ~12           | 2,070                       | 810               | 190             | ~0.6          | ~15           | 1,660                       | 650               |
|                                                                |                    | 160             | ~0.2          | ~10           | 2,190                       | 350               | 190             | ~0.3          | ~12           | 1,750                       | 530               | 235             | ~0.3          | ~15           | 1,400                       | 420               |
| Titanium alloy<br>35~43HRC                                     | JC7550<br>(JC7518) | ~80             | ~0.8          | ~6            | 1,190                       | 240               | ~100            | ~1            | ~8            | 950                         | 290               | ~120            | ~1            | ~10           | 760                         | 230               |
|                                                                |                    | 120             | ~0.4          | ~6            | 990                         | 160               | 150             | ~0.5          | ~8            | 800                         | 190               | 190             | ~0.5          | ~10           | 640                         | 150               |
|                                                                |                    | 160             | ~0.2          | ~6            | 800                         | 100               | 190             | ~0.3          | ~8            | 640                         | 120               | 235             | ~0.3          | ~10           | 510                         | 90                |
| Inconel<br>35~43HRC                                            | JC7550<br>(JC7518) | ~80             | ~0.8          | ~6            | 600                         | 110               | ~100            | ~1            | ~8            | 480                         | 130               | ~120            | ~1            | ~10           | 380                         | 110               |
|                                                                |                    | 120             | ~0.4          | ~6            | 500                         | 70                | 150             | ~0.5          | ~8            | 400                         | 80                | 190             | ~0.5          | ~10           | 320                         | 80                |
|                                                                |                    | 160             | ~0.2          | ~6            | 400                         | 40                | 190             | ~0.3          | ~8            | 320                         | 50                | 235             | ~0.3          | ~10           | 250                         | 50                |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

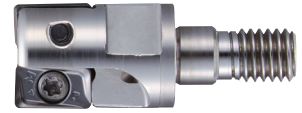
\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.



## MSX and MSN type

| Work materials                                                  | Grades             | Tool dia. (mm)  |               |               |                             |                   |                 |               |               |                             |                   |
|-----------------------------------------------------------------|--------------------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|
|                                                                 |                    | 30/32           |               |               |                             |                   | 40              |               |               |                             |                   |
|                                                                 |                    | No. of teeth 4N |               |               |                             |                   | No. of teeth 5N |               |               |                             |                   |
|                                                                 |                    | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50,C55)<br>Below 250HB                           | JC8050<br>(JC8118) | ~160            | ~1.5          | ~18           | 1,590                       | 1,020             | ~160            | ~1.6          | ~24           | 1,430                       | 1,290             |
|                                                                 |                    | 240             | ~0.8          | ~18           | 1,380                       | 720               | 240             | ~1            | ~24           | 1,270                       | 950               |
|                                                                 |                    | 290             | ~0.3          | ~18           | 1,170                       | 470               | 290             | ~0.4          | ~24           | 1,110                       | 670               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050<br>(JC8118) | ~160            | ~1.5          | ~18           | 1,590                       | 1,020             | ~160            | ~1.6          | ~24           | 1,430                       | 1,290             |
|                                                                 |                    | 240             | ~0.8          | ~18           | 1,380                       | 720               | 240             | ~1            | ~24           | 1,270                       | 950               |
|                                                                 |                    | 290             | ~0.3          | ~18           | 1,170                       | 470               | 290             | ~0.4          | ~24           | 1,110                       | 670               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050<br>(JC8118) | ~160            | ~1.5          | ~18           | 1,590                       | 1,020             | ~160            | ~1.6          | ~24           | 1,430                       | 1,290             |
|                                                                 |                    | 240             | ~0.8          | ~18           | 1,380                       | 720               | 240             | ~1            | ~24           | 1,270                       | 950               |
|                                                                 |                    | 290             | ~0.3          | ~18           | 1,170                       | 470               | 290             | ~0.4          | ~24           | 1,110                       | 670               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118<br>(JC8050) | ~160            | ~1.5          | ~18           | 1,380                       | 830               | ~160            | ~1.6          | ~24           | 1,030                       | 820               |
|                                                                 |                    | 240             | ~0.8          | ~18           | 1,270                       | 610               | 240             | ~1            | ~24           | 950                         | 620               |
|                                                                 |                    | 290             | ~0.3          | ~18           | 1,170                       | 420               | 290             | ~0.4          | ~24           | 880                         | 440               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118<br>(JC8050) | ~160            | ~1.2          | ~18           | 1,170                       | 660               | ~160            | ~1.4          | ~24           | 950                         | 710               |
|                                                                 |                    | 240             | ~0.6          | ~18           | 1,060                       | 470               | 240             | ~0.8          | ~24           | 840                         | 500               |
|                                                                 |                    | 290             | ~0.3          | ~18           | 950                         | 300               | 290             | ~0.4          | ~24           | 720                         | 320               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118             | ~160            | ~0.6          | ~12           | 950                         | 380               | ~160            | ~0.8          | ~16           | 800                         | 440               |
|                                                                 |                    | 240             | ~0.4          | ~12           | 850                         | 270               | 240             | ~0.4          | ~16           | 720                         | 320               |
|                                                                 |                    | 290             | ~0.2          | ~12           | 740                         | 180               | 290             | ~0.2          | ~16           | 640                         | 220               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118<br>(JC8050) | ~160            | ~1.5          | ~18           | 1,910                       | 1,220             | ~160            | ~1.6          | ~24           | 1,590                       | 1,430             |
|                                                                 |                    | 240             | ~0.8          | ~18           | 1,700                       | 880               | 240             | ~1            | ~24           | 1,430                       | 1,070             |
|                                                                 |                    | 290             | ~0.3          | ~18           | 1,490                       | 600               | 290             | ~0.4          | ~24           | 1,270                       | 760               |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118<br>(JC8050) | ~160            | ~1.5          | ~18           | 1,490                       | 950               | ~160            | ~1.6          | ~24           | 1,430                       | 5,720             |
|                                                                 |                    | 240             | ~0.8          | ~18           | 1,380                       | 720               | 240             | ~1            | ~24           | 1,270                       | 640               |
|                                                                 |                    | 290             | ~0.3          | ~18           | 1,270                       | 510               | 290             | ~0.4          | ~24           | 1,110                       | 670               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050<br>(JC7550) | ~160            | ~1.5          | ~12           | 1,170                       | 750               | ~160            | ~1.6          | ~16           | 950                         | 860               |
|                                                                 |                    | 240             | ~0.8          | ~12           | 1,060                       | 550               | 240             | ~1            | ~16           | 880                         | 660               |
|                                                                 |                    | 290             | ~0.3          | ~12           | 950                         | 380               | 290             | ~0.4          | ~16           | 800                         | 480               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8050<br>(JC7550) | ~160            | ~1.5          | ~18           | 1,590                       | 1,020             | ~160            | ~1.6          | ~24           | 1,110                       | 1,000             |
|                                                                 |                    | 240             | ~0.8          | ~18           | 1,380                       | 720               | 240             | ~1            | ~24           | 950                         | 710               |
|                                                                 |                    | 290             | ~0.3          | ~18           | 1,170                       | 470               | 290             | ~0.4          | ~24           | 800                         | 480               |
| Titanium alloy<br>35~43HRC                                      | JC7550<br>(JC7518) | ~160            | ~0.8          | ~12           | 640                         | 260               | ~160            | ~1.4          | ~16           | 560                         | 310               |
|                                                                 |                    | 240             | ~0.5          | ~12           | 530                         | 170               | 240             | ~0.8          | ~16           | 480                         | 220               |
|                                                                 |                    | 290             | ~0.2          | ~12           | 420                         | 100               | 290             | ~0.3          | ~16           | 400                         | 140               |
| Inconel<br>35~43HRC                                             | JC7550<br>(JC7518) | ~160            | ~0.8          | ~12           | 320                         | 130               | ~160            | ~1.4          | ~16           | 240                         | 120               |
|                                                                 |                    | 240             | ~0.5          | ~12           | 270                         | 90                | 240             | ~0.8          | ~16           | 200                         | 80                |
|                                                                 |                    | 290             | ~0.2          | ~12           | 210                         | 50                | 290             | ~0.3          | ~16           | 160                         | 50                |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.

## Recommended cutting conditions for shoulder milling

EXSAP-17 type

### Facemill type

| Work materials                                                  | Grades | Tool dia. (mm)  |               |                                        |                             |                   |                 |               |                                        |                             |                   |                 |               |                                        |                             |                   |
|-----------------------------------------------------------------|--------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|
|                                                                 |        | 50              |               |                                        |                             |                   | 50/52           |               |                                        |                             |                   | 63              |               |                                        |                             |                   |
|                                                                 |        | No. of teeth 4N |               |                                        |                             |                   | No. of teeth 5N |               |                                        |                             |                   | No. of teeth 5N |               |                                        |                             |                   |
|                                                                 |        | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50,C55)<br>Below 250HB                           | JC8050 | ~100            | ~15           | ~40                                    | 1,270                       | 1,520             | ~100            | ~15           | ~40                                    | 1,270                       | 1,910             | ~100            | ~15           | ~45                                    | 1,010                       | 1,770             |
|                                                                 |        | 150             | ~12           | ~25                                    | 1,150                       | 1,150             | 150             | ~12           | ~25                                    | 1,150                       | 1,440             | 150             | ~12           | ~30                                    | 910                         | 1,370             |
|                                                                 |        | 200             | ~10           | ~15                                    | 1,020                       | 820               | 200             | ~10           | ~15                                    | 1,020                       | 1,020             | 200             | ~10           | ~20                                    | 810                         | 1,010             |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050 | ~100            | ~15           | ~40                                    | 1,150                       | 1,380             | ~100            | ~15           | ~40                                    | 1,150                       | 1,730             | ~100            | ~15           | ~45                                    | 910                         | 1,590             |
|                                                                 |        | 150             | ~12           | ~25                                    | 1,020                       | 1,020             | 150             | ~12           | ~25                                    | 1,020                       | 1,280             | 150             | ~12           | ~30                                    | 810                         | 1,220             |
|                                                                 |        | 200             | ~10           | ~15                                    | 890                         | 710               | 200             | ~10           | ~15                                    | 890                         | 890               | 200             | ~10           | ~20                                    | 710                         | 890               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050 | ~100            | ~15           | ~40                                    | 1,270                       | 1,520             | ~100            | ~15           | ~40                                    | 1,270                       | 1,910             | ~100            | ~15           | ~45                                    | 1,010                       | 1,770             |
|                                                                 |        | 150             | ~12           | ~25                                    | 1,150                       | 1,150             | 150             | ~12           | ~25                                    | 1,150                       | 1,440             | 150             | ~12           | ~30                                    | 910                         | 1,370             |
|                                                                 |        | 200             | ~10           | ~15                                    | 1,020                       | 820               | 200             | ~10           | ~15                                    | 1,020                       | 1,020             | 200             | ~10           | ~20                                    | 810                         | 1,010             |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118 | ~100            | ~15           | ~40                                    | 950                         | 1,140             | ~100            | ~15           | ~40                                    | 950                         | 1,430             | ~100            | ~15           | ~45                                    | 760                         | 1,330             |
|                                                                 |        | 150             | ~12           | ~25                                    | 860                         | 860               | 150             | ~12           | ~25                                    | 860                         | 1,080             | 150             | ~12           | ~30                                    | 680                         | 1,020             |
|                                                                 |        | 200             | ~10           | ~15                                    | 760                         | 610               | 200             | ~10           | ~15                                    | 760                         | 760               | 200             | ~10           | ~20                                    | 610                         | 760               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118 | ~100            | ~15           | ~30                                    | 760                         | 760               | ~100            | ~15           | ~30                                    | 760                         | 950               | ~100            | ~15           | ~30                                    | 610                         | 760               |
|                                                                 |        | 150             | ~12           | ~20                                    | 670                         | 540               | 150             | ~12           | ~20                                    | 670                         | 670               | 150             | ~12           | ~25                                    | 530                         | 530               |
|                                                                 |        | 200             | ~10           | ~12                                    | 570                         | 340               | 200             | ~10           | ~12                                    | 570                         | 430               | 200             | ~10           | ~15                                    | 450                         | 340               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118 | ~100            | ~15           | ~18                                    | 640                         | 510               | ~100            | ~15           | ~18                                    | 640                         | 640               | ~100            | ~15           | ~25                                    | 510                         | 510               |
|                                                                 |        | 150             | ~12           | ~12                                    | 570                         | 340               | 150             | ~12           | ~12                                    | 570                         | 430               | 150             | ~12           | ~15                                    | 450                         | 340               |
|                                                                 |        | 200             | ~10           | ~5                                     | 510                         | 200               | 200             | ~10           | ~5                                     | 510                         | 260               | 200             | ~10           | ~8                                     | 400                         | 200               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118 | ~100            | ~15           | ~40                                    | 1,590                       | 1,910             | ~100            | ~15           | ~40                                    | 1,590                       | 2,390             | ~100            | ~15           | ~45                                    | 1,260                       | 2,210             |
|                                                                 |        | 150             | ~12           | ~25                                    | 1,460                       | 1,460             | 150             | ~12           | ~25                                    | 1,460                       | 1,830             | 150             | ~12           | ~30                                    | 1,160                       | 1,740             |
|                                                                 |        | 200             | ~10           | ~15                                    | 1,340                       | 1,070             | 200             | ~10           | ~15                                    | 1,340                       | 1,340             | 200             | ~10           | ~20                                    | 1,060                       | 1,330             |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118 | ~100            | ~15           | ~40                                    | 950                         | 950               | ~100            | ~15           | ~40                                    | 950                         | 1,190             | ~100            | ~15           | ~45                                    | 760                         | 1,140             |
|                                                                 |        | 150             | ~12           | ~25                                    | 830                         | 660               | 150             | ~12           | ~25                                    | 830                         | 830               | 150             | ~12           | ~30                                    | 660                         | 830               |
|                                                                 |        | 200             | ~10           | ~15                                    | 700                         | 420               | 200             | ~10           | ~15                                    | 700                         | 530               | 200             | ~10           | ~20                                    | 560                         | 560               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050 | ~100            | ~15           | ~40                                    | 760                         | 610               | ~100            | ~15           | ~40                                    | 760                         | 760               | ~100            | ~15           | ~45                                    | 610                         | 610               |
|                                                                 |        | 150             | ~12           | ~25                                    | 700                         | 420               | 150             | ~12           | ~25                                    | 700                         | 530               | 150             | ~12           | ~30                                    | 560                         | 420               |
|                                                                 |        | 200             | ~10           | ~15                                    | 640                         | 260               | 200             | ~10           | ~15                                    | 640                         | 320               | 200             | ~10           | ~20                                    | 510                         | 260               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8118 | ~100            | ~15           | ~40                                    | 1,150                       | 1,150             | ~100            | ~15           | ~40                                    | 1,150                       | 1,440             | ~100            | ~15           | ~45                                    | 910                         | 1,370             |
|                                                                 |        | 150             | ~12           | ~25                                    | 1,020                       | 820               | 150             | ~12           | ~25                                    | 1,020                       | 1,020             | 150             | ~12           | ~30                                    | 810                         | 1,010             |
|                                                                 |        | 200             | ~10           | ~15                                    | 890                         | 530               | 200             | ~10           | ~15                                    | 890                         | 670               | 200             | ~10           | ~20                                    | 710                         | 710               |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut ap or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut ap or Spindle speed and

Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.



## Facemill type

| Work materials                                                  | Grades | Tool dia. (mm)  |               |                                        |                             |                   |                 |               |                                        |                             |                   |                 |               |                                        |                             |                   |
|-----------------------------------------------------------------|--------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|
|                                                                 |        | 80              |               |                                        |                             |                   | 100             |               |                                        |                             |                   | 125             |               |                                        |                             |                   |
|                                                                 |        | No. of teeth 7N |               |                                        |                             |                   | No. of teeth 7N |               |                                        |                             |                   | No. of teeth 8N |               |                                        |                             |                   |
|                                                                 |        | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50,C55)<br>Below 250HB                           | JC8050 | ~100            | ~15           | ~45                                    | 800                         | 1,960             | ~100            | ~15           | ~45                                    | 640                         | 1,570             | ~100            | ~15           | ~45                                    | 510                         | 1,430             |
|                                                                 |        | 150             | ~12           | ~30                                    | 720                         | 1,510             | 150             | ~12           | ~30                                    | 570                         | 1,200             | 150             | ~12           | ~30                                    | 460                         | 1,100             |
|                                                                 |        | 200             | ~10           | ~20                                    | 640                         | 1,120             | 200             | ~10           | ~20                                    | 510                         | 890               | 200             | ~10           | ~20                                    | 410                         | 820               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050 | ~100            | ~15           | ~45                                    | 720                         | 1,760             | ~100            | ~15           | ~45                                    | 570                         | 1,400             | ~100            | ~15           | ~45                                    | 460                         | 1,290             |
|                                                                 |        | 150             | ~12           | ~30                                    | 640                         | 1,340             | 150             | ~12           | ~30                                    | 510                         | 1,070             | 150             | ~12           | ~30                                    | 410                         | 980               |
|                                                                 |        | 200             | ~10           | ~20                                    | 560                         | 980               | 200             | ~10           | ~20                                    | 450                         | 790               | 200             | ~10           | ~20                                    | 360                         | 720               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050 | ~100            | ~15           | ~45                                    | 800                         | 1,960             | ~100            | ~15           | ~45                                    | 640                         | 1,570             | ~100            | ~15           | ~45                                    | 510                         | 1,430             |
|                                                                 |        | 150             | ~12           | ~30                                    | 720                         | 1,510             | 150             | ~12           | ~30                                    | 570                         | 1,200             | 150             | ~12           | ~30                                    | 460                         | 1,100             |
|                                                                 |        | 200             | ~10           | ~20                                    | 640                         | 1,120             | 200             | ~10           | ~20                                    | 510                         | 890               | 200             | ~10           | ~20                                    | 410                         | 820               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118 | ~100            | ~15           | ~45                                    | 600                         | 1,470             | ~100            | ~15           | ~45                                    | 480                         | 1,180             | ~100            | ~15           | ~45                                    | 380                         | 1,060             |
|                                                                 |        | 150             | ~12           | ~30                                    | 540                         | 1,130             | 150             | ~12           | ~30                                    | 430                         | 900               | 150             | ~12           | ~30                                    | 340                         | 820               |
|                                                                 |        | 200             | ~10           | ~20                                    | 480                         | 840               | 200             | ~10           | ~20                                    | 380                         | 670               | 200             | ~10           | ~20                                    | 310                         | 620               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118 | ~100            | ~15           | ~30                                    | 480                         | 840               | ~100            | ~15           | ~30                                    | 380                         | 670               | ~100            | ~15           | ~30                                    | 310                         | 620               |
|                                                                 |        | 150             | ~12           | ~25                                    | 420                         | 590               | 150             | ~12           | ~25                                    | 330                         | 460               | 150             | ~12           | ~25                                    | 270                         | 430               |
|                                                                 |        | 200             | ~10           | ~15                                    | 360                         | 380               | 200             | ~10           | ~15                                    | 290                         | 300               | 200             | ~10           | ~15                                    | 230                         | 280               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118 | ~100            | ~15           | ~25                                    | 400                         | 560               | ~100            | ~15           | ~25                                    | 320                         | 450               | ~100            | ~15           | ~25                                    | 250                         | 400               |
|                                                                 |        | 150             | ~12           | ~15                                    | 360                         | 380               | 150             | ~12           | ~15                                    | 290                         | 300               | 150             | ~12           | ~15                                    | 230                         | 280               |
|                                                                 |        | 200             | ~10           | ~8                                     | 320                         | 220               | 200             | ~10           | ~8                                     | 250                         | 180               | 200             | ~10           | ~8                                     | 200                         | 160               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118 | ~100            | ~15           | ~45                                    | 990                         | 2,430             | ~100            | ~15           | ~45                                    | 800                         | 1,960             | ~100            | ~15           | ~45                                    | 640                         | 1,790             |
|                                                                 |        | 150             | ~12           | ~30                                    | 920                         | 1,930             | 150             | ~12           | ~30                                    | 730                         | 1,530             | 150             | ~12           | ~30                                    | 590                         | 1,420             |
|                                                                 |        | 200             | ~10           | ~20                                    | 840                         | 1,470             | 200             | ~10           | ~20                                    | 670                         | 1,170             | 200             | ~10           | ~20                                    | 530                         | 1,060             |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118 | ~100            | ~15           | ~45                                    | 600                         | 1,260             | ~100            | ~15           | ~45                                    | 480                         | 1,010             | ~100            | ~15           | ~45                                    | 380                         | 910               |
|                                                                 |        | 150             | ~12           | ~30                                    | 520                         | 910               | 150             | ~12           | ~30                                    | 410                         | 720               | 150             | ~12           | ~30                                    | 330                         | 660               |
|                                                                 |        | 200             | ~10           | ~20                                    | 440                         | 620               | 200             | ~10           | ~20                                    | 350                         | 490               | 200             | ~10           | ~20                                    | 280                         | 450               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050 | ~100            | ~15           | ~45                                    | 480                         | 670               | ~100            | ~15           | ~45                                    | 380                         | 530               | ~100            | ~15           | ~45                                    | 310                         | 500               |
|                                                                 |        | 150             | ~12           | ~30                                    | 440                         | 460               | 150             | ~12           | ~30                                    | 350                         | 370               | 150             | ~12           | ~30                                    | 280                         | 340               |
|                                                                 |        | 200             | ~10           | ~20                                    | 400                         | 280               | 200             | ~10           | ~20                                    | 320                         | 220               | 200             | ~10           | ~20                                    | 250                         | 200               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8118 | ~100            | ~15           | ~45                                    | 720                         | 1,510             | ~100            | ~15           | ~45                                    | 570                         | 1,200             | ~100            | ~15           | ~45                                    | 460                         | 1,100             |
|                                                                 |        | 150             | ~12           | ~30                                    | 640                         | 1,120             | 150             | ~12           | ~30                                    | 510                         | 890               | 150             | ~12           | ~30                                    | 410                         | 820               |
|                                                                 |        | 200             | ~10           | ~20                                    | 560                         | 780               | 200             | ~10           | ~20                                    | 450                         | 630               | 200             | ~10           | ~20                                    | 360                         | 580               |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

## Recommended cutting conditions for shoulder milling

EXSAP-17 type

### Endmill type

| Work materials                                                  | Grades | Tool dia. (mm)  |               |                                        |                             |                   |                 |               |                                        |                             |                   |
|-----------------------------------------------------------------|--------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|
|                                                                 |        | 25              |               |                                        |                             |                   | 32              |               |                                        |                             |                   |
|                                                                 |        | No. of teeth 2N |               |                                        |                             |                   | No. of teeth 2N |               |                                        |                             |                   |
|                                                                 |        | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50, C55)<br>Below 250HB                          | JC8050 | ~60             | ~10           | ~15                                    | 2,550                       | 1,530             | ~70             | ~12           | ~24                                    | 1,990                       | 1,190             |
|                                                                 |        | 90              | ~7            | ~10                                    | 2,290                       | 1,150             | 100             | ~9            | ~18                                    | 1,790                       | 900               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050 | ~60             | ~10           | ~15                                    | 2,290                       | 1,370             | ~70             | ~12           | ~24                                    | 1,790                       | 1,070             |
|                                                                 |        | 90              | ~7            | ~10                                    | 2,040                       | 1,020             | 100             | ~9            | ~18                                    | 1,590                       | 800               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050 | ~60             | ~10           | ~15                                    | 2,550                       | 1,530             | ~70             | ~12           | ~24                                    | 1,990                       | 1,190             |
|                                                                 |        | 90              | ~7            | ~10                                    | 2,290                       | 1,150             | 100             | ~9            | ~18                                    | 1,790                       | 900               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118 | ~60             | ~10           | ~15                                    | 1,910                       | 1,150             | ~70             | ~12           | ~24                                    | 1,490                       | 890               |
|                                                                 |        | 90              | ~7            | ~10                                    | 1,720                       | 860               | 100             | ~9            | ~18                                    | 1,340                       | 670               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118 | ~60             | ~10           | ~12                                    | 1,530                       | 770               | ~70             | ~12           | ~18                                    | 1,190                       | 600               |
|                                                                 |        | 90              | ~7            | ~6                                     | 1,340                       | 540               | 100             | ~9            | ~13                                    | 1,040                       | 420               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118 | ~60             | ~10           | ~8                                     | 1,270                       | 510               | ~70             | ~12           | ~12                                    | 990                         | 400               |
|                                                                 |        | 90              | ~7            | ~4                                     | 1,150                       | 350               | 100             | ~9            | ~8                                     | 900                         | 270               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118 | ~60             | ~10           | ~15                                    | 3,180                       | 1,910             | ~70             | ~12           | ~24                                    | 2,490                       | 1,490             |
|                                                                 |        | 90              | ~7            | ~10                                    | 2,930                       | 1,470             | 100             | ~9            | ~18                                    | 2,290                       | 1,150             |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118 | ~60             | ~10           | ~15                                    | 1,910                       | 960               | ~70             | ~12           | ~24                                    | 1,490                       | 750               |
|                                                                 |        | 90              | ~7            | ~10                                    | 1,660                       | 660               | 100             | ~9            | ~18                                    | 1,290                       | 520               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050 | ~60             | ~10           | ~15                                    | 1,530                       | 610               | ~70             | ~12           | ~24                                    | 1,190                       | 480               |
|                                                                 |        | 90              | ~7            | ~10                                    | 1,400                       | 420               | 100             | ~9            | ~18                                    | 1,090                       | 330               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8118 | ~60             | ~10.0         | ~15                                    | 2,290                       | 1,150             | ~70             | ~12           | ~24                                    | 1,790                       | 900               |
|                                                                 |        | 90              | ~7.0          | ~10                                    | 2,040                       | 820               | 100             | ~9            | ~18                                    | 1,590                       | 640               |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

## Endmill type

| Work materials                                                  | Grades | Tool dia. (mm)  |               |                                        |                             |                   |
|-----------------------------------------------------------------|--------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|
|                                                                 |        | 32              |               |                                        |                             |                   |
|                                                                 |        | No. of teeth 3N |               |                                        |                             |                   |
|                                                                 |        | $l$<br>(mm)     | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50, C55)<br>Below 250HB                          | JC8050 | ~70             | ~12           | ~24                                    | 1,990                       | 1,790             |
|                                                                 |        | 100             | ~9            | ~18                                    | 1,790                       | 1,340             |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050 | ~70             | ~12           | ~24                                    | 1,790                       | 1,610             |
|                                                                 |        | 100             | ~9            | ~18                                    | 1,590                       | 1,190             |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050 | ~70             | ~12           | ~24                                    | 1,990                       | 1,790             |
|                                                                 |        | 100             | ~9            | ~18                                    | 1,790                       | 1,340             |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118 | ~70             | ~12           | ~24                                    | 1,490                       | 1,340             |
|                                                                 |        | 100             | ~9            | ~18                                    | 1,340                       | 1,010             |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118 | ~70             | ~12           | ~18                                    | 1,190                       | 890               |
|                                                                 |        | 100             | ~9            | ~13                                    | 1,040                       | 620               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118 | ~70             | ~12           | ~12                                    | 990                         | 590               |
|                                                                 |        | 100             | ~9            | ~8                                     | 900                         | 410               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118 | ~70             | ~12           | ~24                                    | 2,490                       | 2,240             |
|                                                                 |        | 100             | ~9            | ~18                                    | 2,290                       | 1,720             |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118 | ~70             | ~12           | ~24                                    | 1,490                       | 1,120             |
|                                                                 |        | 100             | ~9            | ~18                                    | 1,290                       | 770               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050 | ~70             | ~12           | ~24                                    | 1,190                       | 710               |
|                                                                 |        | 100             | ~9            | ~18                                    | 1,090                       | 490               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8118 | ~70             | ~12           | ~24                                    | 1,790                       | 1,340             |
|                                                                 |        | 100             | ~9            | ~18                                    | 1,590                       | 950               |

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

Recommended cutting conditions for shoulder milling

EXSAP-17 type

## MSX and MSN type

| Work materials                                                  | Grades | Tool dia. (mm)  |               |                                        |                             |                   |                 |               |                                        |                             |                   |
|-----------------------------------------------------------------|--------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|
|                                                                 |        | 25/26/28        |               |                                        |                             |                   | 30/32           |               |                                        |                             |                   |
|                                                                 |        | No. of teeth 2N |               |                                        |                             |                   | No. of teeth 2N |               |                                        |                             |                   |
|                                                                 |        | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50, C55)<br>Below 250HB                          | JC8050 | ~90             | ~10           | ~15                                    | 2,450                       | 1,470             | ~100            | ~12           | ~24                                    | 2,050                       | 1,230             |
|                                                                 |        | 140             | ~7            | ~10                                    | 2,200                       | 1,100             | 150             | ~9            | ~18                                    | 1,850                       | 930               |
|                                                                 |        | 210             | ~4            | ~5                                     | 1,960                       | 780               | 210             | ~6            | ~9                                     | 1,640                       | 660               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050 | ~90             | ~10           | ~15                                    | 2,200                       | 1,320             | ~100            | ~12           | ~24                                    | 1,850                       | 1,110             |
|                                                                 |        | 140             | ~7            | ~10                                    | 1,960                       | 980               | 150             | ~9            | ~18                                    | 1,640                       | 820               |
|                                                                 |        | 210             | ~4            | ~5                                     | 1,710                       | 680               | 210             | ~6            | ~9                                     | 1,440                       | 580               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050 | ~90             | ~10           | ~15                                    | 2,450                       | 1,470             | ~100            | ~12           | ~24                                    | 2,050                       | 1,230             |
|                                                                 |        | 140             | ~7            | ~10                                    | 2,200                       | 1,100             | 150             | ~9            | ~18                                    | 1,850                       | 930               |
|                                                                 |        | 210             | ~4            | ~5                                     | 1,960                       | 780               | 210             | ~6            | ~9                                     | 1,640                       | 660               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118 | ~90             | ~10           | ~15                                    | 1,840                       | 1,100             | ~100            | ~12           | ~24                                    | 1,540                       | 920               |
|                                                                 |        | 140             | ~7            | ~10                                    | 1,650                       | 830               | 150             | ~9            | ~18                                    | 1,390                       | 700               |
|                                                                 |        | 210             | ~4            | ~5                                     | 1,470                       | 590               | 210             | ~6            | ~9                                     | 1,230                       | 490               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118 | ~90             | ~10           | ~12                                    | 1,470                       | 740               | ~100            | ~12           | ~18                                    | 1,230                       | 620               |
|                                                                 |        | 140             | ~7            | ~6                                     | 1,290                       | 520               | 150             | ~9            | ~13                                    | 1,080                       | 430               |
|                                                                 |        | 210             | ~4            | ~2                                     | 1,100                       | 330               | 210             | ~6            | ~7                                     | 920                         | 280               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118 | ~90             | ~10           | ~8                                     | 1,220                       | 490               | ~100            | ~12           | ~12                                    | 1,030                       | 410               |
|                                                                 |        | 140             | ~7            | ~4                                     | 1,100                       | 330               | 150             | ~9            | ~8                                     | 920                         | 280               |
|                                                                 |        | 210             | ~4            | ~2                                     | 980                         | 200               | 210             | ~6            | ~3                                     | 820                         | 160               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118 | ~90             | ~10           | ~15                                    | 3,060                       | 1,840             | ~100            | ~12           | ~24                                    | 2,570                       | 1,540             |
|                                                                 |        | 140             | ~7            | ~10                                    | 2,820                       | 1,410             | 150             | ~9            | ~18                                    | 2,360                       | 1,180             |
|                                                                 |        | 210             | ~4            | ~5                                     | 2,570                       | 1,030             | 210             | ~6            | ~12                                    | 2,160                       | 860               |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118 | ~90             | ~10           | ~15                                    | 1,840                       | 920               | ~100            | ~12           | ~24                                    | 1,540                       | 770               |
|                                                                 |        | 140             | ~7            | ~10                                    | 1,590                       | 640               | 150             | ~9            | ~18                                    | 1,330                       | 530               |
|                                                                 |        | 210             | ~4            | ~5                                     | 1,350                       | 410               | 210             | ~6            | ~9                                     | 1,130                       | 340               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050 | ~90             | ~10           | ~15                                    | 1,470                       | 590               | ~100            | ~12           | ~24                                    | 1,230                       | 490               |
|                                                                 |        | 140             | ~7            | ~10                                    | 1,350                       | 410               | 150             | ~9            | ~18                                    | 1,130                       | 340               |
|                                                                 |        | 210             | ~4            | ~5                                     | 1,220                       | 240               | 210             | ~6            | ~9                                     | 1,030                       | 210               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8118 | ~90             | ~10           | ~15                                    | 2,200                       | 1,100             | ~100            | ~12           | ~24                                    | 1,850                       | 930               |
|                                                                 |        | 140             | ~7            | ~10                                    | 1,960                       | 780               | 150             | ~9            | ~18                                    | 1,640                       | 660               |
|                                                                 |        | 210             | ~4            | ~5                                     | 1,710                       | 510               | 210             | ~6            | ~9                                     | 1,440                       | 430               |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.



## MSX and MSN type

| Work materials                                                  | Grades | Tool dia. (mm)  |               |                                        |                             |                   |                 |               |                                        |                             |                   |
|-----------------------------------------------------------------|--------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|-----------------|---------------|----------------------------------------|-----------------------------|-------------------|
|                                                                 |        | 32/33/35        |               |                                        |                             |                   | 40              |               |                                        |                             |                   |
|                                                                 |        | No. of teeth 3N |               |                                        |                             |                   | No. of teeth 4N |               |                                        |                             |                   |
|                                                                 |        | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_p \times a_e$<br>(mm <sup>2</sup> ) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50, C55)<br>Below 250HB                          | JC8050 | ~100            | ~12           | ~24                                    | 1,930                       | 1,740             | ~100            | ~15           | ~30                                    | 1,590                       | 1,910             |
|                                                                 |        | 150             | ~9            | ~18                                    | 1,740                       | 1,310             | 150             | ~10           | ~20                                    | 1,430                       | 1,430             |
|                                                                 |        | 210             | ~6            | ~9                                     | 1,540                       | 920               | 210             | ~8            | ~12                                    | 1,270                       | 1,020             |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050 | ~100            | ~12           | ~24                                    | 1,740                       | 1,570             | ~100            | ~15           | ~30                                    | 1,430                       | 1,720             |
|                                                                 |        | 150             | ~9            | ~18                                    | 1,540                       | 1,160             | 150             | ~10           | ~20                                    | 1,270                       | 1,270             |
|                                                                 |        | 210             | ~6            | ~9                                     | 1,350                       | 810               | 210             | ~8            | ~12                                    | 1,110                       | 890               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050 | ~100            | ~12           | ~24                                    | 1,930                       | 1,740             | ~100            | ~15           | ~30                                    | 1,590                       | 1,910             |
|                                                                 |        | 150             | ~9            | ~18                                    | 1,740                       | 1,310             | 150             | ~10           | ~20                                    | 1,430                       | 1,430             |
|                                                                 |        | 210             | ~6            | ~9                                     | 1,540                       | 920               | 210             | ~8            | ~12                                    | 1,270                       | 1,020             |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118 | ~100            | ~12           | ~24                                    | 1,450                       | 1,310             | ~100            | ~15           | ~30                                    | 1,190                       | 1,430             |
|                                                                 |        | 150             | ~9            | ~18                                    | 1,300                       | 980               | 150             | ~10           | ~20                                    | 1,070                       | 1,070             |
|                                                                 |        | 210             | ~6            | ~9                                     | 1,160                       | 700               | 210             | ~8            | ~12                                    | 950                         | 760               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118 | ~100            | ~12           | ~18                                    | 1,160                       | 870               | ~100            | ~15           | ~20                                    | 950                         | 950               |
|                                                                 |        | 150             | ~9            | ~13                                    | 1,010                       | 610               | 150             | ~10           | ~15                                    | 840                         | 670               |
|                                                                 |        | 210             | ~6            | ~7                                     | 870                         | 390               | 210             | ~8            | ~8                                     | 720                         | 430               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118 | ~100            | ~12           | ~12                                    | 960                         | 580               | ~100            | ~12           | ~12                                    | 800                         | 640               |
|                                                                 |        | 150             | ~9            | ~8                                     | 870                         | 390               | 150             | ~10           | ~8                                     | 720                         | 430               |
|                                                                 |        | 210             | ~6            | ~3                                     | 770                         | 230               | 210             | ~8            | ~3                                     | 640                         | 260               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118 | ~100            | ~12           | ~24                                    | 2,410                       | 2,170             | ~100            | ~15           | ~30                                    | 1,990                       | 2,390             |
|                                                                 |        | 150             | ~9            | ~18                                    | 2,220                       | 1,670             | 150             | ~10           | ~20                                    | 1,830                       | 1,830             |
|                                                                 |        | 210             | ~6            | ~12                                    | 2,030                       | 1,220             | 210             | ~8            | ~16                                    | 1,670                       | 1,340             |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118 | ~100            | ~12           | ~24                                    | 1,450                       | 1,090             | ~100            | ~15           | ~30                                    | 1,190                       | 1,190             |
|                                                                 |        | 150             | ~9            | ~18                                    | 1,250                       | 750               | 150             | ~10           | ~20                                    | 1,030                       | 820               |
|                                                                 |        | 210             | ~6            | ~9                                     | 1,060                       | 480               | 210             | ~8            | ~12                                    | 880                         | 530               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050 | ~100            | ~12           | ~24                                    | 1,160                       | 700               | ~100            | ~15           | ~30                                    | 950                         | 760               |
|                                                                 |        | 150             | ~9            | ~18                                    | 1,060                       | 480               | 150             | ~10           | ~20                                    | 880                         | 530               |
|                                                                 |        | 210             | ~6            | ~9                                     | 960                         | 290               | 210             | ~8            | ~12                                    | 800                         | 320               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8118 | ~100            | ~12           | ~24                                    | 1,740                       | 1,310             | ~100            | ~15           | ~30                                    | 1,430                       | 1,430             |
|                                                                 |        | 150             | ~9            | ~18                                    | 1,540                       | 920               | 150             | ~10           | ~20                                    | 1,270                       | 1,020             |
|                                                                 |        | 210             | ~6            | ~9                                     | 1,350                       | 610               | 210             | ~8            | ~12                                    | 1,110                       | 670               |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut ap or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut ap or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

## Recommended cutting conditions for facemilling

EXSAP-17 type

### Facemill type

| Work materials                                                  | Grades | Tool dia. (mm)  |               |               |                             |                   |                 |               |               |                             |                   |                 |               |               |                             |                   |
|-----------------------------------------------------------------|--------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|
|                                                                 |        | 50              |               |               |                             |                   | 50/52           |               |               |                             |                   | 63              |               |               |                             |                   |
|                                                                 |        | No. of teeth 4N |               |               |                             |                   | No. of teeth 5N |               |               |                             |                   | No. of teeth 5N |               |               |                             |                   |
|                                                                 |        | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50,C55)<br>Below 250HB                           | JC8050 | ~150            | ~4            | ~50           | 950                         | 1,140             | ~150            | ~4            | ~1Dc          | 950                         | 1,430             | ~150            | ~4            | ~63           | 760                         | 1,330             |
|                                                                 |        | 200             | ~3            | ~40           | 830                         | 830               | 200             | ~3            | ~40           | 830                         | 1,040             | 200             | ~3            | ~55           | 660                         | 990               |
|                                                                 |        | 300             | ~2            | ~30           | 700                         | 560               | 300             | ~2            | ~30           | 700                         | 700               | 300             | ~2            | ~40           | 560                         | 700               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050 | ~150            | ~4            | ~50           | 950                         | 1,140             | ~150            | ~4            | ~1Dc          | 950                         | 1,430             | ~150            | ~4            | ~63           | 760                         | 1,330             |
|                                                                 |        | 200             | ~3            | ~40           | 830                         | 830               | 200             | ~3            | ~40           | 830                         | 1,040             | 200             | ~3            | ~55           | 660                         | 990               |
|                                                                 |        | 300             | ~2            | ~30           | 700                         | 560               | 300             | ~2            | ~30           | 700                         | 700               | 300             | ~2            | ~40           | 560                         | 700               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050 | ~150            | ~4            | ~50           | 950                         | 950               | ~150            | ~4            | ~1Dc          | 950                         | 1,190             | ~150            | ~4            | ~63           | 760                         | 1,140             |
|                                                                 |        | 200             | ~3            | ~40           | 830                         | 660               | 200             | ~3            | ~40           | 830                         | 830               | 200             | ~3            | ~55           | 660                         | 830               |
|                                                                 |        | 300             | ~2            | ~30           | 700                         | 420               | 300             | ~2            | ~30           | 700                         | 530               | 300             | ~2            | ~40           | 560                         | 560               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118 | ~150            | ~4            | ~50           | 830                         | 830               | ~150            | ~4            | ~1Dc          | 830                         | 1,040             | ~150            | ~4            | ~63           | 660                         | 990               |
|                                                                 |        | 200             | ~3            | ~40           | 760                         | 610               | 200             | ~3            | ~40           | 760                         | 760               | 200             | ~3            | ~55           | 610                         | 760               |
|                                                                 |        | 300             | ~2            | ~30           | 700                         | 420               | 300             | ~2            | ~30           | 700                         | 530               | 300             | ~2            | ~40           | 560                         | 560               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118 | ~150            | ~3            | ~50           | 700                         | 700               | ~150            | ~3            | ~1Dc          | 700                         | 880               | ~150            | ~3            | ~63           | 560                         | 700               |
|                                                                 |        | 200             | ~2.5          | ~40           | 640                         | 510               | 200             | ~2.5          | ~40           | 640                         | 640               | 200             | ~2.5          | ~55           | 510                         | 510               |
|                                                                 |        | 300             | ~1.5          | ~30           | 570                         | 340               | 300             | ~1.5          | ~30           | 570                         | 430               | 300             | ~1.5          | ~40           | 450                         | 340               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118 | ~150            | ~2.5          | ~40           | 570                         | 460               | ~150            | ~2.5          | ~40           | 570                         | 570               | ~150            | ~2.5          | ~55           | 450                         | 450               |
|                                                                 |        | 200             | ~2            | ~30           | 510                         | 310               | 200             | ~2            | ~30           | 510                         | 380               | 200             | ~2            | ~40           | 400                         | 300               |
|                                                                 |        | 300             | ~1.5          | ~20           | 450                         | 180               | 300             | ~1.5          | ~20           | 450                         | 230               | 300             | ~1.5          | ~32           | 350                         | 180               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118 | ~150            | ~6            | ~50           | 1,150                       | 1,380             | ~150            | ~6            | ~1Dc          | 1,150                       | 1,730             | ~150            | ~6            | ~63           | 910                         | 1,590             |
|                                                                 |        | 200             | ~4            | ~40           | 950                         | 950               | 200             | ~4            | ~40           | 950                         | 1,190             | 200             | ~4            | ~55           | 760                         | 1,140             |
|                                                                 |        | 300             | ~2            | ~30           | 830                         | 660               | 300             | ~2            | ~30           | 830                         | 830               | 300             | ~2            | ~40           | 660                         | 830               |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118 | ~150            | ~4            | ~50           | 830                         | 830               | ~150            | ~4            | ~1Dc          | 830                         | 1,040             | ~150            | ~4            | ~63           | 660                         | 990               |
|                                                                 |        | 200             | ~3            | ~40           | 760                         | 610               | 200             | ~3            | ~40           | 760                         | 760               | 200             | ~3            | ~55           | 610                         | 760               |
|                                                                 |        | 300             | ~2            | ~30           | 700                         | 420               | 300             | ~2            | ~30           | 700                         | 530               | 300             | ~2            | ~40           | 560                         | 560               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050 | ~150            | ~4            | ~40           | 700                         | 560               | ~150            | ~4            | ~40           | 700                         | 700               | ~150            | ~4            | ~55           | 560                         | 560               |
|                                                                 |        | 200             | ~3            | ~30           | 640                         | 380               | 200             | ~3            | ~30           | 640                         | 480               | 200             | ~3            | ~40           | 510                         | 380               |
|                                                                 |        | 300             | ~2            | ~20           | 570                         | 230               | 300             | ~2            | ~20           | 570                         | 290               | 300             | ~2            | ~32           | 450                         | 230               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8118 | ~150            | ~4            | ~50           | 950                         | 950               | ~150            | ~4            | ~1Dc          | 950                         | 1,190             | ~150            | ~4            | ~63           | 760                         | 1,140             |
|                                                                 |        | 200             | ~3            | ~40           | 830                         | 660               | 200             | ~3            | ~40           | 830                         | 830               | 200             | ~3            | ~55           | 660                         | 830               |
|                                                                 |        | 300             | ~2            | ~30           | 700                         | 420               | 300             | ~2            | ~30           | 700                         | 530               | 300             | ~2            | ~40           | 560                         | 560               |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.



## Facemill type

| Work materials                                                  | Grades | Tool dia. (mm)  |               |               |                             |                   |                 |               |               |                             |                   |                 |               |               |                             |                   |
|-----------------------------------------------------------------|--------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|
|                                                                 |        | 80              |               |               |                             |                   | 100             |               |               |                             |                   | 125             |               |               |                             |                   |
|                                                                 |        | No. of teeth 7N |               |               |                             |                   | No. of teeth 7N |               |               |                             |                   | No. of teeth 8N |               |               |                             |                   |
|                                                                 |        | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50,C55)<br>Below 250HB                           | JC8050 | ~150            | ~4            | ~80           | 600                         | 1,470             | ~150            | ~4            | ~100          | 480                         | 1,010             | ~150            | ~4            | ~125          | 380                         | 910               |
|                                                                 |        | 200             | ~3            | ~65           | 520                         | 1,090             | 200             | ~3            | ~80           | 410                         | 720               | 200             | ~3            | ~100          | 330                         | 660               |
|                                                                 |        | 300             | ~2            | ~50           | 440                         | 770               | 300             | ~2            | ~60           | 350                         | 490               | 300             | ~2            | ~75           | 280                         | 450               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050 | ~150            | ~4            | ~80           | 600                         | 1,470             | ~150            | ~4            | ~100          | 480                         | 1,010             | ~150            | ~4            | ~125          | 380                         | 910               |
|                                                                 |        | 200             | ~3            | ~65           | 520                         | 1,090             | 200             | ~3            | ~80           | 410                         | 720               | 200             | ~3            | ~100          | 330                         | 660               |
|                                                                 |        | 300             | ~2            | ~50           | 440                         | 770               | 300             | ~2            | ~60           | 350                         | 490               | 300             | ~2            | ~75           | 280                         | 450               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050 | ~150            | ~4            | ~80           | 600                         | 1,260             | ~150            | ~4            | ~100          | 480                         | 840               | ~150            | ~4            | ~125          | 380                         | 760               |
|                                                                 |        | 200             | ~3            | ~65           | 520                         | 910               | 200             | ~3            | ~80           | 410                         | 570               | 200             | ~3            | ~100          | 330                         | 530               |
|                                                                 |        | 300             | ~2            | ~50           | 440                         | 620               | 300             | ~2            | ~60           | 350                         | 370               | 300             | ~2            | ~75           | 280                         | 340               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118 | ~150            | ~4            | ~80           | 520                         | 1,090             | ~150            | ~4            | ~100          | 410                         | 720               | ~150            | ~4            | ~125          | 330                         | 660               |
|                                                                 |        | 200             | ~3            | ~65           | 480                         | 840               | 200             | ~3            | ~80           | 380                         | 530               | 200             | ~3            | ~100          | 310                         | 500               |
|                                                                 |        | 300             | ~2            | ~50           | 440                         | 620               | 300             | ~2            | ~60           | 350                         | 370               | 300             | ~2            | ~75           | 280                         | 340               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118 | ~150            | ~3            | ~80           | 440                         | 770               | ~150            | ~4            | ~100          | 350                         | 490               | ~150            | ~4            | ~125          | 280                         | 450               |
|                                                                 |        | 200             | ~2.5          | ~65           | 400                         | 560               | 200             | ~3            | ~80           | 320                         | 340               | 200             | ~3            | ~100          | 250                         | 300               |
|                                                                 |        | 300             | ~1.5          | ~50           | 360                         | 380               | 300             | ~2            | ~60           | 290                         | 200               | 300             | ~2            | ~75           | 230                         | 180               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118 | ~150            | ~2.5          | ~65           | 360                         | 500               | ~150            | ~4            | ~80           | 290                         | 300               | ~150            | ~4            | ~100          | 230                         | 280               |
|                                                                 |        | 200             | ~2.0          | ~50           | 320                         | 340               | 200             | ~3            | ~60           | 250                         | 180               | 200             | ~3            | ~75           | 200                         | 160               |
|                                                                 |        | 300             | ~1.5          | ~35           | 280                         | 200               | 300             | ~2            | ~40           | 220                         | 150               | 300             | ~2            | ~50           | 180                         | 140               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118 | ~150            | ~6            | ~80           | 720                         | 1,760             | ~150            | ~4            | ~100          | 570                         | 1,200             | ~150            | ~4            | ~125          | 460                         | 1,100             |
|                                                                 |        | 200             | ~4            | ~65           | 600                         | 1,260             | 200             | ~3            | ~80           | 480                         | 840               | 200             | ~3            | ~100          | 380                         | 760               |
|                                                                 |        | 300             | ~2            | ~50           | 520                         | 910               | 300             | ~2            | ~60           | 410                         | 570               | 300             | ~2            | ~75           | 330                         | 530               |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118 | ~150            | ~4            | ~80           | 520                         | 1,090             | ~150            | ~4            | ~100          | 410                         | 720               | ~150            | ~4            | ~125          | 330                         | 660               |
|                                                                 |        | 200             | ~3            | ~65           | 480                         | 840               | 200             | ~3            | ~80           | 380                         | 530               | 200             | ~3            | ~100          | 310                         | 500               |
|                                                                 |        | 300             | ~2            | ~50           | 440                         | 620               | 300             | ~2            | ~60           | 350                         | 370               | 300             | ~2            | ~75           | 280                         | 340               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050 | ~150            | ~4            | ~65           | 440                         | 620               | ~150            | ~4            | ~80           | 350                         | 370               | ~150            | ~4            | ~100          | 280                         | 340               |
|                                                                 |        | 200             | ~3            | ~50           | 400                         | 420               | 200             | ~3            | ~60           | 320                         | 220               | 200             | ~3            | ~75           | 250                         | 200               |
|                                                                 |        | 300             | ~2            | ~35           | 360                         | 250               | 300             | ~2            | ~40           | 290                         | 200               | 300             | ~2            | ~50           | 230                         | 180               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8118 | ~150            | ~4            | ~80           | 600                         | 1,260             | ~150            | ~4            | ~100          | 480                         | 840               | ~150            | ~4            | ~125          | 380                         | 760               |
|                                                                 |        | 200             | ~3            | ~65           | 520                         | 910               | 200             | ~3            | ~80           | 410                         | 570               | 200             | ~3            | ~100          | 330                         | 530               |
|                                                                 |        | 300             | ~2            | ~50           | 440                         | 620               | 300             | ~2            | ~60           | 350                         | 370               | 300             | ~2            | ~75           | 280                         | 340               |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.

## Recommended cutting conditions for facemilling

EXSAP-17 type

### Endmill type

| Work materials                                                  | Grades | Tool dia. (mm)  |               |               |                             |                   |                 |               |               |                             |                   |
|-----------------------------------------------------------------|--------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|
|                                                                 |        | 25              |               |               |                             |                   | 32              |               |               |                             |                   |
|                                                                 |        | No. of teeth 2N |               |               |                             |                   | No. of teeth 2N |               |               |                             |                   |
|                                                                 |        | $l$<br>(mm)     | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $l$<br>(mm)     | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50, C55)<br>Below 250HB                          | JC8050 | ~60             | ~3            | ~1Dc          | 1,910                       | 1,150             | ~70             | ~3.5          | ~1Dc          | 1,490                       | 890               |
|                                                                 |        | 90              | ~2            | ~20           | 1,660                       | 830               | 100             | ~2.5          | ~25           | 1,290                       | 650               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050 | ~60             | ~3            | ~1Dc          | 1,910                       | 1,150             | ~70             | ~3.5          | ~1Dc          | 1,490                       | 890               |
|                                                                 |        | 90              | ~2            | ~20           | 1,660                       | 830               | 100             | ~2.5          | ~25           | 1,290                       | 650               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050 | ~60             | ~3            | ~1Dc          | 1,910                       | 960               | ~70             | ~3.5          | ~1Dc          | 1,490                       | 750               |
|                                                                 |        | 90              | ~2            | ~20           | 1,660                       | 660               | 100             | ~2.5          | ~25           | 1,290                       | 520               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118 | ~60             | ~3            | ~1Dc          | 1,660                       | 830               | ~70             | ~3.5          | ~1Dc          | 1,290                       | 650               |
|                                                                 |        | 90              | ~2            | ~20           | 1,530                       | 610               | 100             | ~2.5          | ~25           | 1,190                       | 480               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118 | ~60             | ~2            | ~1Dc          | 1,400                       | 700               | ~70             | ~2.5          | ~1Dc          | 1,090                       | 550               |
|                                                                 |        | 90              | ~1            | ~20           | 1,270                       | 510               | 100             | ~2            | ~25           | 990                         | 400               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118 | ~60             | ~1            | ~20           | 1,150                       | 460               | ~70             | ~2            | ~25           | 900                         | 360               |
|                                                                 |        | 90              | ~1            | ~15           | 1,020                       | 310               | 100             | ~1.5          | ~20           | 800                         | 240               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118 | ~60             | ~5            | ~1Dc          | 2,550                       | 1,530             | ~70             | ~5.5          | ~1Dc          | 1,990                       | 1,190             |
|                                                                 |        | 90              | ~3            | ~20           | 2,290                       | 1,150             | 100             | ~3.5          | ~25           | 1,790                       | 900               |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118 | ~60             | ~3            | ~1Dc          | 1,660                       | 830               | ~70             | ~3.5          | ~1Dc          | 1,290                       | 650               |
|                                                                 |        | 90              | ~2            | ~20           | 1,530                       | 610               | 100             | ~2.5          | ~25           | 1,190                       | 480               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050 | ~60             | ~3            | ~20           | 1,400                       | 560               | ~70             | ~3.5          | ~25           | 1,090                       | 440               |
|                                                                 |        | 90              | ~2            | ~15           | 1,270                       | 380               | 100             | ~2.5          | ~20           | 990                         | 300               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8118 | ~60             | ~3            | ~1Dc          | 1,910                       | 960               | ~70             | ~3.5          | ~1Dc          | 1,490                       | 750               |
|                                                                 |        | 90              | ~2            | ~20           | 1,660                       | 660               | 100             | ~2.5          | ~25           | 1,290                       | 520               |

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.

## Endmill type

| Work materials                                                  | Grades | Tool dia. (mm)  |               |               |                             |                   |
|-----------------------------------------------------------------|--------|-----------------|---------------|---------------|-----------------------------|-------------------|
|                                                                 |        | 32              |               |               |                             |                   |
|                                                                 |        | No. of teeth 3N |               |               |                             |                   |
|                                                                 |        | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50, C55)<br>Below 250HB                          | JC8050 | ~70             | ~3.5          | ~1Dc          | 1,490                       | 1,340             |
|                                                                 |        | 100             | ~2.5          | ~25           | 1,290                       | 970               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050 | ~70             | ~3.5          | ~1Dc          | 1,490                       | 1,340             |
|                                                                 |        | 100             | ~2.5          | ~25           | 1,290                       | 970               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050 | ~70             | ~3.5          | ~1Dc          | 1,490                       | 1,120             |
|                                                                 |        | 100             | ~2.5          | ~25           | 1,290                       | 770               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118 | ~70             | ~3.5          | ~1Dc          | 1,290                       | 970               |
|                                                                 |        | 100             | ~2.5          | ~25           | 1,190                       | 710               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118 | ~70             | ~2.5          | ~1Dc          | 1,090                       | 820               |
|                                                                 |        | 100             | ~2            | ~25           | 990                         | 590               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118 | ~70             | ~2            | ~25           | 900                         | 540               |
|                                                                 |        | 100             | ~1.5          | ~20           | 800                         | 360               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118 | ~70             | ~5.5          | ~1Dc          | 1,990                       | 1,790             |
|                                                                 |        | 100             | ~3.5          | ~25           | 1,790                       | 1,340             |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118 | ~70             | ~3.5          | ~1Dc          | 1,290                       | 970               |
|                                                                 |        | 100             | ~2.5          | ~25           | 1,190                       | 710               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050 | ~70             | ~3.5          | ~25           | 1,090                       | 650               |
|                                                                 |        | 100             | ~2.5          | ~20           | 990                         | 450               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8118 | ~70             | ~3.5          | ~1Dc          | 1,490                       | 1,120             |
|                                                                 |        | 100             | ~2.5          | ~25           | 1,290                       | 770               |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.

Recommended cutting conditions for facemilling

EXSAP-17 type

## MSX and MSN type

| Work materials                                                  | Grades | Tool dia. (mm)  |               |               |                             |                   |                 |               |               |                             |                   |
|-----------------------------------------------------------------|--------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|
|                                                                 |        | 25/26/28        |               |               |                             |                   | 30/32           |               |               |                             |                   |
|                                                                 |        | No. of teeth 2N |               |               |                             |                   | No. of teeth 2N |               |               |                             |                   |
|                                                                 |        | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50, C55)<br>Below 250HB                          | JC8050 | ~90             | ~3            | ~1Dc          | 1,840                       | 1,100             | ~100            | ~3.5          | ~1Dc          | 1,540                       | 920               |
|                                                                 |        | 140             | ~2            | ~20           | 1,590                       | 800               | 150             | ~2.5          | ~25           | 1,330                       | 670               |
|                                                                 |        | 210             | ~1            | ~15           | 1,350                       | 540               | 210             | ~1.5          | ~20           | 1,130                       | 450               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050 | ~90             | ~3            | ~1Dc          | 1,840                       | 1,100             | ~100            | ~3.5          | ~1Dc          | 1,540                       | 920               |
|                                                                 |        | 140             | ~2            | ~20           | 1,590                       | 800               | 150             | ~2.5          | ~25           | 1,330                       | 670               |
|                                                                 |        | 210             | ~1            | ~15           | 1,350                       | 540               | 210             | ~1.5          | ~20           | 1,130                       | 450               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050 | ~90             | ~3            | ~1Dc          | 1,840                       | 920               | ~100            | ~3.5          | ~1Dc          | 1,540                       | 770               |
|                                                                 |        | 140             | ~2            | ~20           | 1,590                       | 640               | 150             | ~2.5          | ~25           | 1,330                       | 530               |
|                                                                 |        | 210             | ~1            | ~15           | 1,350                       | 410               | 210             | ~1.5          | ~20           | 1,130                       | 340               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118 | ~90             | ~3            | ~1Dc          | 1,590                       | 800               | ~100            | ~3.5          | ~1Dc          | 1,330                       | 670               |
|                                                                 |        | 140             | ~2            | ~20           | 1,470                       | 590               | 150             | ~2.5          | ~25           | 1,230                       | 490               |
|                                                                 |        | 210             | ~1            | ~15           | 1,350                       | 410               | 210             | ~1.5          | ~20           | 1,130                       | 340               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118 | ~90             | ~2            | ~1Dc          | 1,350                       | 680               | ~100            | ~2.5          | ~1Dc          | 1,130                       | 570               |
|                                                                 |        | 140             | ~1.5          | ~20           | 1,220                       | 490               | 150             | ~2            | ~25           | 1,030                       | 410               |
|                                                                 |        | 210             | ~1            | ~15           | 1,100                       | 330               | 210             | ~1.5          | ~20           | 920                         | 280               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118 | ~90             | ~1.5          | ~20           | 1,100                       | 440               | ~100            | ~2            | ~25           | 920                         | 370               |
|                                                                 |        | 140             | ~1            | ~15           | 980                         | 290               | 150             | ~1.5          | ~20           | 820                         | 250               |
|                                                                 |        | 210             | ~0.5          | ~10           | 860                         | 170               | 210             | ~1            | ~15           | 720                         | 140               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118 | ~90             | ~5            | ~1Dc          | 2,450                       | 1,470             | ~100            | ~5.5          | ~1Dc          | 2,050                       | 1,230             |
|                                                                 |        | 140             | ~3            | ~20           | 2,200                       | 1,100             | 150             | ~3.5          | ~25           | 1,850                       | 930               |
|                                                                 |        | 210             | ~1            | ~15           | 1,960                       | 780               | 210             | ~1.5          | ~20           | 1,640                       | 660               |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118 | ~90             | ~3            | ~1Dc          | 1,590                       | 800               | ~100            | ~3.5          | ~1Dc          | 1,330                       | 670               |
|                                                                 |        | 140             | ~2            | ~20           | 1,470                       | 590               | 150             | ~2.5          | ~25           | 1,230                       | 490               |
|                                                                 |        | 210             | ~1            | ~15           | 1,350                       | 410               | 210             | ~1.5          | ~20           | 1,130                       | 340               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050 | ~90             | ~3            | ~20           | 1,350                       | 540               | ~100            | ~3.5          | ~25           | 1,130                       | 450               |
|                                                                 |        | 140             | ~2            | ~15           | 1,220                       | 370               | 150             | ~2.5          | ~20           | 1,030                       | 310               |
|                                                                 |        | 210             | ~1            | ~10           | 1,100                       | 220               | 210             | ~1.5          | ~15           | 920                         | 180               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8118 | ~90             | ~3            | ~1Dc          | 1,840                       | 920               | ~100            | ~3.5          | ~1Dc          | 1,540                       | 770               |
|                                                                 |        | 140             | ~2            | ~20           | 1,590                       | 640               | 150             | ~2.5          | ~25           | 1,330                       | 530               |
|                                                                 |        | 210             | ~1            | ~15           | 1,350                       | 410               | 210             | ~1.5          | ~20           | 1,130                       | 340               |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.



## MSX and MSN type

| Work materials                                                  | Grades | Tool dia. (mm)  |               |               |                             |                   |                 |               |               |                             |                   |
|-----------------------------------------------------------------|--------|-----------------|---------------|---------------|-----------------------------|-------------------|-----------------|---------------|---------------|-----------------------------|-------------------|
|                                                                 |        | 32/33/35        |               |               |                             |                   | 40              |               |               |                             |                   |
|                                                                 |        | No. of teeth 3N |               |               |                             |                   | No. of teeth 4N |               |               |                             |                   |
|                                                                 |        | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) | $\ell$<br>(mm)  | $a_p$<br>(mm) | $a_e$<br>(mm) | $n$<br>(min <sup>-1</sup> ) | $V_f$<br>(mm/min) |
| Carbon steel (C50, C55)<br>Below 250HB                          | JC8050 | ~100            | ~3.5          | ~1Dc          | 1,450                       | 1,310             | ~100            | ~3.5          | ~40           | 1,190                       | 1,430             |
|                                                                 |        | 150             | ~2.5          | ~25           | 1,250                       | 940               | 150             | ~2.5          | ~32           | 1,030                       | 1,030             |
|                                                                 |        | 210             | ~1.5          | ~20           | 1,060                       | 640               | 210             | ~1.5          | ~24           | 880                         | 700               |
| Cast steel (1.7225)<br>Below 285HB                              | JC8050 | ~100            | ~3.5          | ~1Dc          | 1,450                       | 1,310             | ~100            | ~3.5          | ~40           | 1,190                       | 1,430             |
|                                                                 |        | 150             | ~2.5          | ~25           | 1,250                       | 940               | 150             | ~2.5          | ~32           | 1,030                       | 1,030             |
|                                                                 |        | 210             | ~1.5          | ~20           | 1,060                       | 640               | 210             | ~1.5          | ~24           | 880                         | 700               |
| Die steel (1.2344, 1.2379)<br>Below 255HB                       | JC8050 | ~100            | ~3.5          | ~1Dc          | 1,450                       | 1,090             | ~100            | ~3.5          | ~40           | 1,190                       | 1,190             |
|                                                                 |        | 150             | ~2.5          | ~25           | 1,250                       | 750               | 150             | ~2.5          | ~32           | 1,030                       | 820               |
|                                                                 |        | 210             | ~1.5          | ~20           | 1,060                       | 480               | 210             | ~1.5          | ~24           | 880                         | 530               |
| Mold steel (1.2311, P20)<br>30~36HRC                            | JC8118 | ~100            | ~3.5          | ~1Dc          | 1,250                       | 940               | ~100            | ~3.5          | ~40           | 1,030                       | 1,030             |
|                                                                 |        | 150             | ~2.5          | ~25           | 1,160                       | 700               | 150             | ~2.5          | ~32           | 950                         | 760               |
|                                                                 |        | 210             | ~1.5          | ~20           | 1,060                       | 480               | 210             | ~1.5          | ~24           | 880                         | 530               |
| Mold steel (1.2311, P21)<br>38~43HRC                            | JC8118 | ~100            | ~2.5          | ~1Dc          | 1,060                       | 800               | ~100            | ~2.5          | ~40           | 880                         | 880               |
|                                                                 |        | 150             | ~2            | ~25           | 960                         | 580               | 150             | ~2            | ~32           | 800                         | 640               |
|                                                                 |        | 210             | ~1.5          | ~20           | 870                         | 390               | 210             | ~1.5          | ~24           | 720                         | 430               |
| Hardened die steel (1.2344, 1.2379)<br>42~52HRC                 | JC8118 | ~100            | ~2            | ~25           | 870                         | 520               | ~100            | ~2            | ~32           | 720                         | 580               |
|                                                                 |        | 150             | ~1.5          | ~20           | 770                         | 350               | 150             | ~1.5          | ~24           | 640                         | 380               |
|                                                                 |        | 210             | ~1            | ~15           | 680                         | 200               | 210             | ~1            | ~18           | 560                         | 220               |
| Cast iron (GG25)<br>160~260HB                                   | JC8118 | ~100            | ~5.5          | ~1Dc          | 1,930                       | 1,740             | ~100            | ~5.5          | ~40           | 1,590                       | 1,910             |
|                                                                 |        | 150             | ~3.5          | ~25           | 1,740                       | 1,310             | 150             | ~3.5          | ~32           | 1,430                       | 1,430             |
|                                                                 |        | 210             | ~1.5          | ~20           | 1,540                       | 920               | 210             | ~1.5          | ~24           | 1,270                       | 1,020             |
| Nodular cast iron (GGG70)<br>170~300HB                          | JC8118 | ~100            | ~3.5          | ~1Dc          | 1,250                       | 940               | ~100            | ~3.5          | ~40           | 1,030                       | 1,030             |
|                                                                 |        | 150             | ~2.5          | ~25           | 1,160                       | 700               | 150             | ~2.5          | ~32           | 950                         | 760               |
|                                                                 |        | 210             | ~1.5          | ~20           | 1,060                       | 480               | 210             | ~1.5          | ~24           | 880                         | 530               |
| Stainless steel Austenitic<br>(AISI 304, 316, 317)              | JC8050 | ~100            | ~3.5          | ~25           | 1,060                       | 640               | ~100            | ~3.5          | ~32           | 880                         | 700               |
|                                                                 |        | 150             | ~2.5          | ~20           | 960                         | 430               | 150             | ~2.5          | ~24           | 800                         | 480               |
|                                                                 |        | 210             | ~1.5          | ~15           | 870                         | 260               | 210             | ~1.5          | ~18           | 720                         | 290               |
| Stainless steel Ferritics/Martensitic<br>(AISI 403, 420J2, 430) | JC8118 | ~100            | ~3.5          | ~1Dc          | 1,450                       | 1,090             | ~100            | ~3.5          | ~40           | 1,190                       | 1,190             |
|                                                                 |        | 150             | ~2.5          | ~25           | 1,250                       | 750               | 150             | ~2.5          | ~32           | 1,030                       | 820               |
|                                                                 |        | 210             | ~1.5          | ~20           | 1,060                       | 480               | 210             | ~1.5          | ~24           | 880                         | 530               |

$\ell$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

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\*3. If machine does not have enough power, recommend to reduce the depth of cut or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.



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