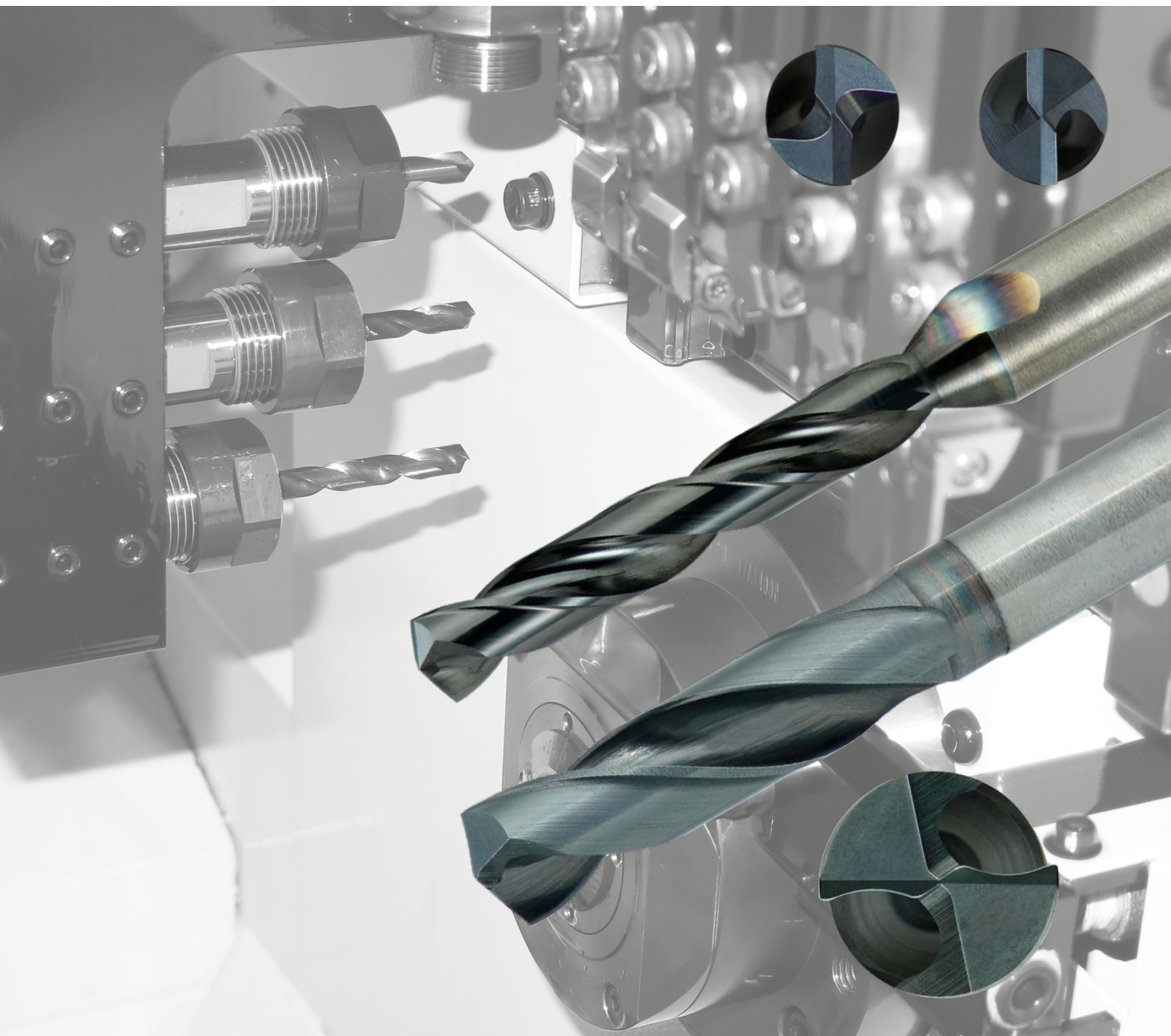


# DWAE

SOLID CARBIDE DRILLS FOR SWISS-TYPE AUTOMATIC  
& SMALL CNC LATHES



# MINI DWAE

## MINI SIZE Ø1.0 MM-Ø2.9 MM

- Solid carbide drills for swiss-type
- Automatic & small CNC lathes

### FEATURING HIGH PRECISION AND LONG TOOL LIFE FOR SMALL DIAMETER DRILLING



#### NEW CUTTING EDGE TREATMENT THAT ACHIEVES BOTH SHARPNESS AND DURABILITY

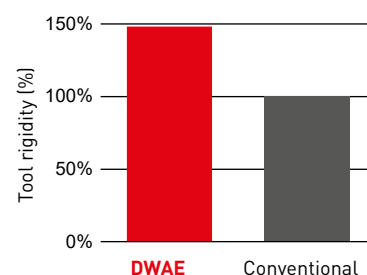
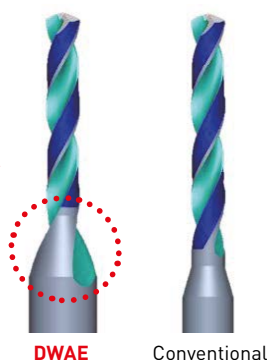
Mitsubishi's new original cutting edge treatment maintains the stability of the cutting edge while exhibiting excellent fracture and wear resistance.

#### COATED GRADE DP102A

DP102A coated grade provides excellent lubricity and long-term durability, achieving excellent wear resistance at low to medium cutting speeds.

#### UNIQUE FLUTE FORM FOR GREATER RIGIDITY

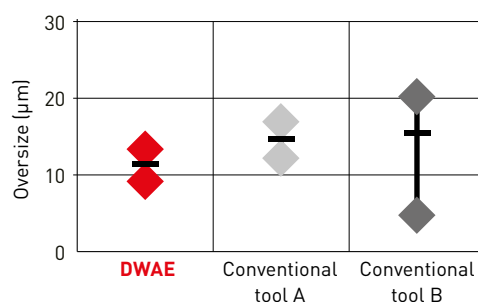
Mini Size is uniquely designed for rigidity and good chip evacuation by minimizing the neck length. A chip discharge area is provided through the taper neck. This increases tool rigidity by 50 % compared to conventional drills and also improves hole positional accuracy.



### ANALYSIS CONDITIONS

DC=Ø2 mm, L/D=4, OAL= 50 mm  
Distributed load of 130N in Z axis direction.

|              |                        |
|--------------|------------------------|
| Material     | DIN CK10               |
| Tool         | DC=Ø2 mm, L/D=4        |
| Vc (m/min)   | 30                     |
| fr (mm/rev)  | 0.04                   |
| Hole depth   | 8                      |
| Cutting mode | Water-soluble coolants |

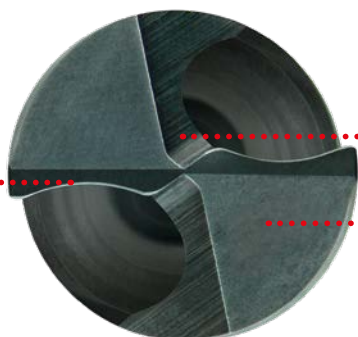


# DWAE

## OPTIMAL LENGTH, LOW CUTTING RESISTANCE DRILLS PROVIDES HIGH STABILITY AND EXCELLENT CHIP CONTROL (Ø3.0 MM-Ø14.0 MM)

### WAVY CUTTING EDGE

The wavy cutting edge, in contrast to conventional cutting edges that are easily damaged, provides both sharpness and cutting edge strength by resisting wear to the outer cutting edge. It also breaks chips efficiently into smaller pieces.

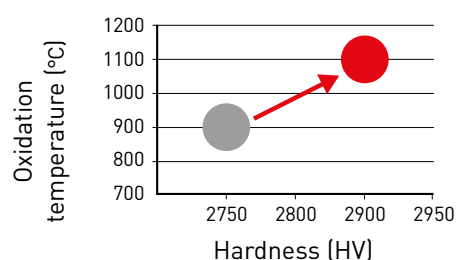


### Z THINNING

The special web thinning geometry ensures sufficient space for chip evacuation and provides low cutting resistance.

### COATED GRADE: DP102A

DP102A coated grade provides excellent lubricity and long-term durability, achieving excellent wear resistance at low to medium cutting speeds.



### FLUTE SHAPE

Specially designed flute shape breaks chips into smaller pieces and prevents clogging during drilling.



### ZERO-μ SURFACE

A smoothing surface treatment is applied to the drill, further reducing cutting resistance whilst also facilitating excellent chip evacuation.

### OPTIMAL FLUTE LENGTH FOR SWISS-TYPE AUTOMATIC AND SMALL CNC LATHES

The flute length has been specifically engineered to meet the compact needs and limited machining space requirements of small CNC lathes. Shank diameters are compatible with standard ER collet sizes.

DCON (Shank diameter) : Ø5 = ER8  
DCON : Ø7 = ER11

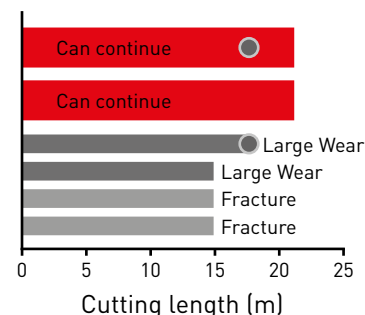
# MINI DWAE

## CUTTING PERFORMANCE

|              |                                                           |
|--------------|-----------------------------------------------------------|
| Material     | DIN X30Cr13                                               |
| Tool         | DWAE0200X04S040                                           |
| Vc (m/min)   | 30                                                        |
| fr (mm/rev)  | 0.045                                                     |
| ap (mm)      | 8                                                         |
| Cutting mode | Wet cutting, external coolant<br>(Water-soluble coolants) |

### Results

By combining DP102A and a new cutting edge treatment, durability and long tool life have been achieved when drilling with an external coolant supply.



### After 18.0 m cutting length



DWAE

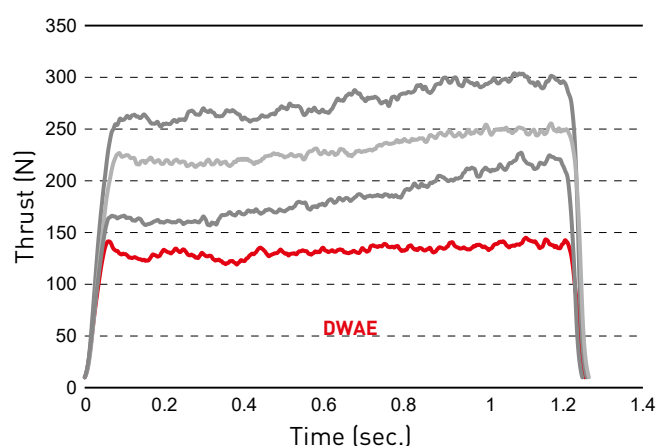


Conventional

|              |                                                           |
|--------------|-----------------------------------------------------------|
| Material     | DIN X30Cr13                                               |
| Tool         | DWAE0200X04S040                                           |
| Vc (m/min)   | 40                                                        |
| fr (mm/rev)  | 0.06                                                      |
| ap (mm)      | 8                                                         |
| Cutting mode | Wet cutting, external coolant<br>(Water-soluble coolants) |

### Results

DWAE attains low thrust resistance compared to conventional products.



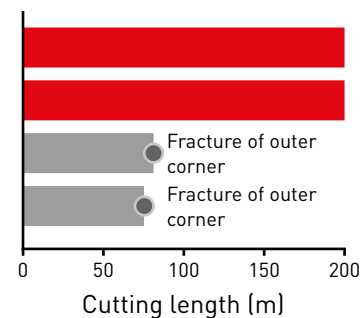
# DWAE

## CUTTING PERFORMANCE

|              |                                                    |
|--------------|----------------------------------------------------|
| Material     | DIN Cf53                                           |
| Tool         | DWAE0600X04S060                                    |
| Vc (m/min)   | 80                                                 |
| fr (mm/rev)  | 0.2                                                |
| ap (mm)      | 24                                                 |
| Cutting mode | Wet cutting, external coolant<br>(Water-insoluble) |

### Results

DP102A offers excellent lubricity and heat resistance, providing more fracture resistance and achieving longer tool life than conventional drills under medium cutting speeds. Stable machining achieved even with external coolant.



### After 75.0 m cutting length



DWAE



Conventional

|              |                                                           |
|--------------|-----------------------------------------------------------|
| Material     | DIN Ck10                                                  |
| Tool         | DWAE0600X04S060                                           |
| Vc (m/min)   | 60                                                        |
| fr (mm/rev)  | 0.3                                                       |
| ap (mm)      | 24                                                        |
| Cutting mode | Wet cutting, external coolant<br>(Water-soluble coolants) |

### Results

DWAE, specially designed to break up chips into smaller pieces and prevent flutes from clogging during machining.



DWAE



Conventional A

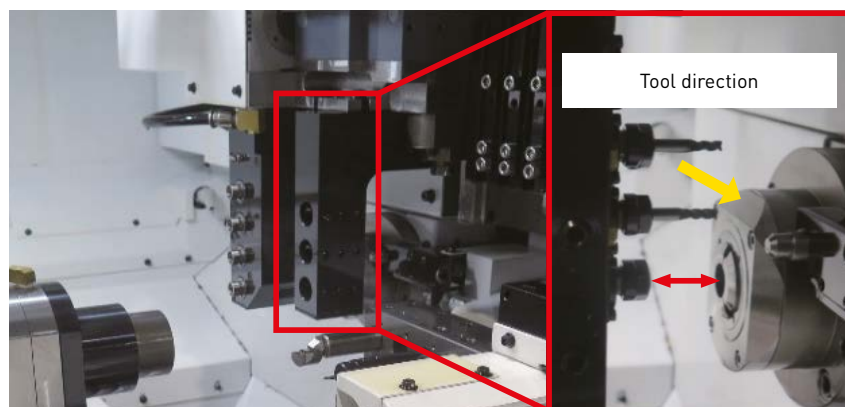


Conventional B

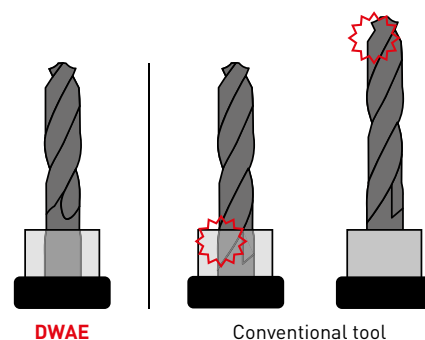
# DWAE

## OPTIMAL CUTTING LENGTH

External coolant type carbide drills with ideal tool length for Swiss-type automatic and small CNC lathes.

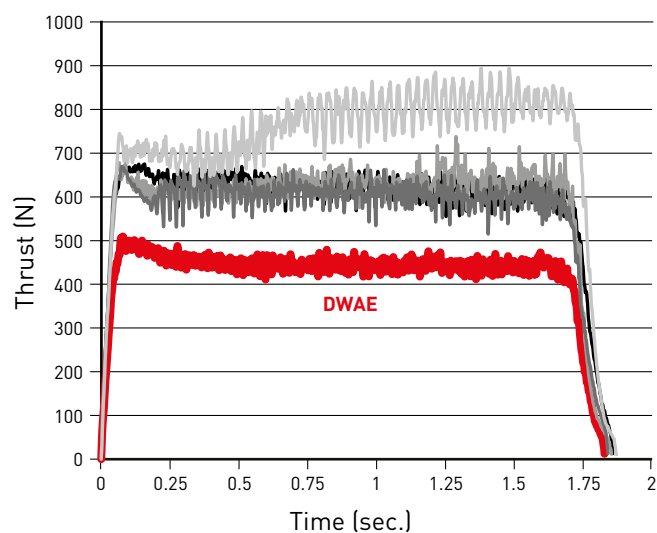


Machine workpiece material



## LOW CUTTING RESISTANCE DESIGN

|              |                                                                                                                                                                   |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Material     | Mild steel DIN C10                                                                                                                                                |
| Tool         | DWAE0600X04S060                                                                                                                                                   |
| Vc (m/min)   | 80                                                                                                                                                                |
| f (mm/rev)   | 0.2                                                                                                                                                               |
| ap (mm)      | 24                                                                                                                                                                |
| Cutting mode | Wet cutting, external coolant<br>(Water-soluble coolants)                                                                                                         |
| Results      | Low cutting resistance design provides highly stable drilling even in situations where the rigidity of the workpiece material or clamping is difficult to secure. |



# MINI DWAE



DC&lt;2.0

DC≥2.0

P M K



DC&lt;2.0



DC≥2.0



DC≤3

0

-0.014



DCON=3

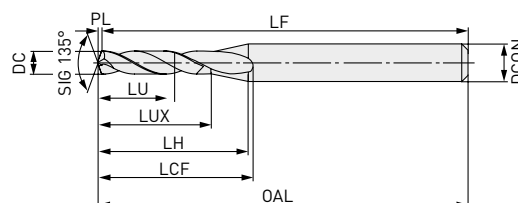
3&lt;DCON≤4

0

-0.006

0

-0.008



| Order number    | DC  | L/D | DP102A | LU   | LUX  | LCF  | LH   | OAL  | LF   | PL  | DCON |
|-----------------|-----|-----|--------|------|------|------|------|------|------|-----|------|
| DWAE0100X02S030 | 1.0 | 2   | ●      | 2.2  | 5.0  | 7.7  | 8.7  | 45.0 | 44.8 | 0.2 | 3    |
| DWAE0100X04S030 |     | 4   | ●      | 4.2  | 7.0  | 9.9  | 10.7 | 45.0 | 44.8 | 0.2 | 3    |
| DWAE0110X02S030 | 1.1 | 2   | ★      | 2.4  | 5.4  | 8.1  | 8.9  | 45.0 | 44.8 | 0.2 | 3    |
| DWAE0110X04S030 |     | 4   | ★      | 4.6  | 7.6  | 10.5 | 11.1 | 45.0 | 44.8 | 0.2 | 3    |
| DWAE0120X02S030 | 1.2 | 2   | ★      | 2.6  | 5.8  | 8.5  | 9.2  | 45.0 | 44.8 | 0.2 | 3    |
| DWAE0120X04S030 |     | 4   | ★      | 5.0  | 8.2  | 11.1 | 11.6 | 45.0 | 44.8 | 0.2 | 3    |
| DWAE0130X02S030 | 1.3 | 2   | ★      | 2.9  | 6.3  | 9.0  | 9.5  | 45.0 | 44.7 | 0.3 | 3    |
| DWAE0130X04S030 |     | 4   | ★      | 5.5  | 8.9  | 11.9 | 12.1 | 45.0 | 44.7 | 0.3 | 3    |
| DWAE0140X02S030 | 1.4 | 2   | ★      | 3.1  | 6.7  | 9.4  | 9.7  | 45.0 | 44.7 | 0.3 | 3    |
| DWAE0140X04S030 |     | 4   | ★      | 5.9  | 9.5  | 12.5 | 12.5 | 45.0 | 44.7 | 0.3 | 3    |
| DWAE0150X02S030 | 1.5 | 2   | ●      | 3.3  | 7.1  | 9.8  | 9.9  | 45.0 | 44.7 | 0.3 | 3    |
| DWAE0150X04S030 |     | 4   | ●      | 6.3  | 10.1 | 13.1 | 12.9 | 45.0 | 44.7 | 0.3 | 3    |
| DWAE0160X02S030 | 1.6 | 2   | ★      | 3.5  | 7.5  | 10.2 | 10.1 | 45.0 | 44.7 | 0.3 | 3    |
| DWAE0160X04S030 |     | 4   | ★      | 6.7  | 10.7 | 13.7 | 13.3 | 45.0 | 44.7 | 0.3 | 3    |
| DWAE0170X02S030 | 1.7 | 2   | ★      | 3.8  | 8.0  | 10.7 | 10.4 | 45.0 | 44.6 | 0.4 | 3    |
| DWAE0170X04S030 |     | 4   | ★      | 7.2  | 11.4 | 14.4 | 13.8 | 45.0 | 44.6 | 0.4 | 3    |
| DWAE0180X02S030 | 1.8 | 2   | ★      | 4.0  | 8.4  | 11.1 | 10.6 | 45.0 | 44.6 | 0.4 | 3    |
| DWAE0180X04S030 |     | 4   | ★      | 7.6  | 12.0 | 15.1 | 14.2 | 45.0 | 44.6 | 0.4 | 3    |
| DWAE0190X02S030 | 1.9 | 2   | ★      | 4.2  | 8.8  | 11.5 | 10.9 | 45.0 | 44.6 | 0.4 | 3    |
| DWAE0190X04S030 |     | 4   | ★      | 8.0  | 12.6 | 15.7 | 14.7 | 45.0 | 44.6 | 0.4 | 3    |
| DWAE0200X02S040 | 2.0 | 2   | ●      | 4.4  | 9.2  | 12.8 | 12.9 | 50.0 | 49.6 | 0.4 | 4    |
| DWAE0200X04S040 |     | 4   | ●      | 8.4  | 13.2 | 17.2 | 16.9 | 50.0 | 49.6 | 0.4 | 4    |
| DWAE0210X02S040 | 2.1 | 2   | ★      | 4.6  | 9.6  | 13.2 | 13.1 | 50.0 | 49.6 | 0.4 | 4    |
| DWAE0210X04S040 |     | 4   | ★      | 8.8  | 13.8 | 17.8 | 17.3 | 50.0 | 49.6 | 0.4 | 4    |
| DWAE0220X02S040 | 2.2 | 2   | ★      | 4.9  | 10.1 | 13.7 | 13.5 | 50.0 | 49.5 | 0.5 | 4    |
| DWAE0220X04S040 |     | 4   | ★      | 9.3  | 14.5 | 18.5 | 17.9 | 50.0 | 49.5 | 0.5 | 4    |
| DWAE0230X02S040 | 2.3 | 2   | ★      | 5.1  | 10.5 | 14.1 | 13.7 | 50.0 | 49.5 | 0.5 | 4    |
| DWAE0230X04S040 |     | 4   | ★      | 9.7  | 15.1 | 19.2 | 18.3 | 50.0 | 49.5 | 0.5 | 4    |
| DWAE0240X02S040 | 2.4 | 2   | ★      | 5.3  | 10.9 | 14.5 | 13.9 | 50.0 | 49.5 | 0.5 | 4    |
| DWAE0240X04S040 |     | 4   | ★      | 10.1 | 15.7 | 19.8 | 18.7 | 50.0 | 49.5 | 0.5 | 4    |
| DWAE0250X02S040 | 2.5 | 2   | ●      | 5.5  | 11.3 | 14.9 | 14.1 | 50.0 | 49.5 | 0.5 | 4    |
| DWAE0250X04S040 |     | 4   | ●      | 10.5 | 16.3 | 20.4 | 19.1 | 50.0 | 49.5 | 0.5 | 4    |
| DWAE0260X02S040 | 2.6 | 2   | ★      | 5.7  | 11.7 | 15.3 | 14.3 | 50.0 | 49.5 | 0.5 | 4    |
| DWAE0260X04S040 |     | 4   | ★      | 10.9 | 16.9 | 21.0 | 19.5 | 50.0 | 49.5 | 0.5 | 4    |
| DWAE0270X02S040 | 2.7 | 2   | ★      | 6.0  | 12.2 | 15.8 | 14.6 | 50.0 | 49.4 | 0.6 | 4    |
| DWAE0270X04S040 |     | 4   | ★      | 11.4 | 17.6 | 21.7 | 20.0 | 50.0 | 49.4 | 0.6 | 4    |
| DWAE0280X02S040 | 2.8 | 2   | ★      | 6.2  | 12.6 | 16.2 | 14.8 | 50.0 | 49.4 | 0.6 | 4    |
| DWAE0280X04S040 |     | 4   | ★      | 11.8 | 18.2 | 22.4 | 20.4 | 50.0 | 49.4 | 0.6 | 4    |
| DWAE0290X02S040 | 2.9 | 2   | ★      | 6.4  | 13.0 | 16.6 | 15.1 | 50.0 | 49.4 | 0.6 | 4    |
| DWAE0290X04S040 |     | 4   | ★      | 12.2 | 18.8 | 23.0 | 20.9 | 50.0 | 49.4 | 0.6 | 4    |

DWAE



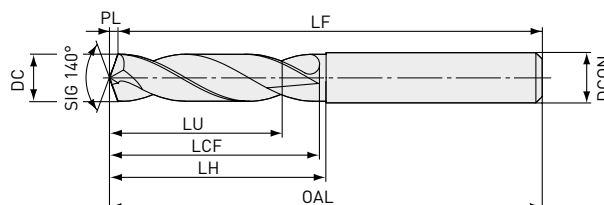
P M K



| DC=3   | 3<DC≤6 | 6<DC≤10 | 10<DC≤14 |
|--------|--------|---------|----------|
| 0      | 0      | 0       | 0        |
| -0.014 | -0.018 | -0.022  | -0.027   |



| DCON=3 | 3<DCON≤6 | 6<DCON≤10 | 10<DCON≤14 |
|--------|----------|-----------|------------|
| 0      | 0        | 0         | 0          |
| -0.006 | -0.008   | -0.009    | -0.011     |



| Order number    | DC  | L/D | DP102A | LU   | LCF  | LH   | OAL  | LF | PL  | DCON |
|-----------------|-----|-----|--------|------|------|------|------|----|-----|------|
| DWAE0300X02S030 | 3.0 | 2   | ●      | 6.5  | 12.5 | 14.5 | 45.5 | 45 | 0.5 | 3    |
| DWAE0300X04S030 |     | 4   | ●      | 12.5 | 21.5 | 23.5 | 55.5 | 55 | 0.5 | 3    |
| DWAE0310X02S040 | 3.1 | 2   | ●      | 6.8  | 12.6 | 14.6 | 55.6 | 55 | 0.6 | 4    |
| DWAE0310X04S040 |     | 4   | ●      | 13.0 | 21.6 | 23.6 | 60.6 | 60 | 0.6 | 4    |
| DWAE0320X02S040 | 3.2 | 2   | ●      | 7.0  | 13.6 | 15.6 | 55.6 | 55 | 0.6 | 4    |
| DWAE0320X04S040 |     | 4   | ●      | 13.4 | 22.6 | 24.6 | 60.6 | 60 | 0.6 | 4    |
| DWAE0330X02S040 | 3.3 | 2   | ●      | 7.2  | 13.6 | 15.6 | 55.6 | 55 | 0.6 | 4    |
| DWAE0330X04S040 |     | 4   | ●      | 13.8 | 23.6 | 25.6 | 60.6 | 60 | 0.6 | 4    |
| DWAE0340X02S040 | 3.4 | 2   | ●      | 7.4  | 13.6 | 15.6 | 55.6 | 55 | 0.6 | 4    |
| DWAE0340X04S040 |     | 4   | ●      | 14.2 | 23.6 | 25.6 | 60.6 | 60 | 0.6 | 4    |
| DWAE0350X02S040 | 3.5 | 2   | ●      | 7.6  | 14.6 | 16.6 | 55.6 | 55 | 0.6 | 4    |
| DWAE0350X04S040 |     | 4   | ●      | 14.6 | 24.6 | 26.6 | 60.6 | 60 | 0.6 | 4    |
| DWAE0360X02S040 | 3.6 | 2   | ●      | 7.9  | 14.7 | 16.7 | 55.7 | 55 | 0.7 | 4    |
| DWAE0360X04S040 |     | 4   | ●      | 15.1 | 25.7 | 27.7 | 60.7 | 60 | 0.7 | 4    |
| DWAE0370X02S040 | 3.7 | 2   | ●      | 8.1  | 14.7 | 16.7 | 55.7 | 55 | 0.7 | 4    |
| DWAE0370X04S040 |     | 4   | ●      | 15.5 | 25.7 | 27.7 | 60.7 | 60 | 0.7 | 4    |
| DWAE0380X02S040 | 3.8 | 2   | ●      | 8.3  | 15.7 | 17.7 | 55.7 | 55 | 0.7 | 4    |
| DWAE0380X04S040 |     | 4   | ●      | 15.9 | 26.7 | 28.7 | 60.7 | 60 | 0.7 | 4    |
| DWAE0390X02S040 | 3.9 | 2   | ●      | 8.5  | 15.7 | 17.7 | 55.7 | 55 | 0.7 | 4    |
| DWAE0390X04S040 |     | 4   | ●      | 16.3 | 27.7 | 29.7 | 60.7 | 60 | 0.7 | 4    |
| DWAE0400X02S040 | 4.0 | 2   | ●      | 8.7  | 15.7 | 17.7 | 55.7 | 55 | 0.7 | 4    |
| DWAE0400X04S040 |     | 4   | ●      | 16.7 | 27.7 | 29.7 | 60.7 | 60 | 0.7 | 4    |
| DWAE0410X02S050 | 4.1 | 2   | ●      | 8.9  | 16.7 | 18.7 | 62.7 | 62 | 0.7 | 5    |
| DWAE0410X04S050 |     | 4   | ●      | 17.1 | 28.7 | 30.7 | 80.7 | 80 | 0.7 | 5    |
| DWAE0420X02S050 | 4.2 | 2   | ●      | 9.2  | 16.8 | 18.8 | 62.8 | 62 | 0.8 | 5    |
| DWAE0420X04S050 |     | 4   | ●      | 17.6 | 29.8 | 31.8 | 80.8 | 80 | 0.8 | 5    |
| DWAE0430X02S050 | 4.3 | 2   | ●      | 9.4  | 17.8 | 19.8 | 62.8 | 62 | 0.8 | 5    |
| DWAE0430X04S050 |     | 4   | ●      | 18.0 | 30.8 | 32.8 | 80.8 | 80 | 0.8 | 5    |
| DWAE0440X02S050 | 4.4 | 2   | ●      | 9.6  | 17.8 | 19.8 | 62.8 | 62 | 0.8 | 5    |
| DWAE0440X04S050 |     | 4   | ●      | 18.4 | 30.8 | 32.8 | 80.8 | 80 | 0.8 | 5    |
| DWAE0450X02S050 | 4.5 | 2   | ●      | 9.8  | 17.8 | 19.8 | 62.8 | 62 | 0.8 | 5    |
| DWAE0450X04S050 |     | 4   | ●      | 18.8 | 31.8 | 33.8 | 80.8 | 80 | 0.8 | 5    |
| DWAE0460X02S050 | 4.6 | 2   | ●      | 10.0 | 18.8 | 20.8 | 62.8 | 62 | 0.8 | 5    |
| DWAE0460X04S050 |     | 4   | ●      | 19.2 | 32.8 | 34.8 | 80.8 | 80 | 0.8 | 5    |

# DWAE

| Order number    | DC  | L/D | DP102A | LU   | LCF  | LH   | OAL  | LF | PL  | DCON |
|-----------------|-----|-----|--------|------|------|------|------|----|-----|------|
| DWAE0470X02S050 | 4.7 | 2   | ●      | 10.3 | 18.9 | 20.9 | 62.9 | 62 | 0.9 | 5    |
| DWAE0470X04S050 |     | 4   | ●      | 19.7 | 32.9 | 34.9 | 80.9 | 80 | 0.9 | 5    |
| DWAE0480X02S050 | 4.8 | 2   | ●      | 10.5 | 18.9 | 20.9 | 62.9 | 62 | 0.9 | 5    |
| DWAE0480X04S050 |     | 4   | ●      | 20.1 | 33.9 | 35.9 | 80.9 | 80 | 0.9 | 5    |
| DWAE0490X02S050 | 4.9 | 2   | ●      | 10.7 | 19.9 | 21.9 | 62.9 | 62 | 0.9 | 5    |
| DWAE0490X04S050 |     | 4   | ●      | 20.5 | 34.9 | 36.9 | 80.9 | 80 | 0.9 | 5    |
| DWAE0500X02S050 | 5.0 | 2   | ●      | 10.9 | 19.9 | 21.9 | 62.9 | 62 | 0.9 | 5    |
| DWAE0500X04S050 |     | 4   | ●      | 20.9 | 34.9 | 36.9 | 80.9 | 80 | 0.9 | 5    |
| DWAE0510X02S060 | 5.1 | 2   | ★      | 11.1 | 21.9 | 23.9 | 66.9 | 66 | 0.9 | 6    |
| DWAE0510X04S060 |     | 4   | ★      | 21.3 | 35.9 | 37.9 | 80.9 | 80 | 0.9 | 6    |
| DWAE0520X02S060 | 5.2 | 2   | ●      | 11.3 | 21.9 | 23.9 | 66.9 | 66 | 0.9 | 6    |
| DWAE0520X04S060 |     | 4   | ●      | 21.7 | 36.9 | 38.9 | 80.9 | 80 | 0.9 | 6    |
| DWAE0530X02S060 | 5.3 | 2   | ★      | 11.6 | 22.0 | 24.0 | 67.0 | 66 | 1.0 | 6    |
| DWAE0530X04S060 |     | 4   | ★      | 22.2 | 37.0 | 39.0 | 81.0 | 80 | 1.0 | 6    |
| DWAE0540X02S060 | 5.4 | 2   | ●      | 11.8 | 22.0 | 24.0 | 67.0 | 66 | 1.0 | 6    |
| DWAE0540X04S060 |     | 4   | ●      | 22.6 | 38.0 | 40.0 | 81.0 | 80 | 1.0 | 6    |
| DWAE0550X02S060 | 5.5 | 2   | ★      | 12.0 | 22.0 | 24.0 | 67.0 | 66 | 1.0 | 6    |
| DWAE0550X04S060 |     | 4   | ★      | 23.0 | 39.0 | 41.0 | 81.0 | 80 | 1.0 | 6    |
| DWAE0560X02S060 | 5.6 | 2   | ●      | 12.2 | 24.0 | 26.0 | 67.0 | 66 | 1.0 | 6    |
| DWAE0560X04S060 |     | 4   | ●      | 23.4 | 39.0 | 41.0 | 81.0 | 80 | 1.0 | 6    |
| DWAE0570X02S060 | 5.7 | 2   | ★      | 12.4 | 24.0 | 26.0 | 67.0 | 66 | 1.0 | 6    |
| DWAE0570X04S060 |     | 4   | ★      | 23.8 | 39.0 | 41.0 | 81.0 | 80 | 1.0 | 6    |
| DWAE0580X02S060 | 5.8 | 2   | ●      | 12.7 | 24.1 | 26.1 | 67.1 | 66 | 1.1 | 6    |
| DWAE0580X04S060 |     | 4   | ●      | 24.3 | 41.1 | 43.1 | 81.1 | 80 | 1.1 | 6    |
| DWAE0590X02S060 | 5.9 | 2   | ★      | 12.9 | 24.1 | 26.1 | 67.1 | 66 | 1.1 | 6    |
| DWAE0590X04S060 |     | 4   | ★      | 24.7 | 41.1 | 43.1 | 81.1 | 80 | 1.1 | 6    |
| DWAE0600X02S060 | 6.0 | 2   | ●      | 13.1 | 24.1 | 26.1 | 67.1 | 66 | 1.1 | 6    |
| DWAE0600X04S060 |     | 4   | ●      | 25.1 | 42.1 | 44.1 | 81.1 | 80 | 1.1 | 6    |
| DWAE0610X02S070 | 6.1 | 2   | ★      | 13.3 | 26.1 | 28.1 | 75.1 | 74 | 1.1 | 7    |
| DWAE0610X04S070 |     | 4   | ★      | 25.5 | 44.1 | 46.1 | 84.1 | 83 | 1.1 | 7    |
| DWAE0620X02S070 | 6.2 | 2   | ●      | 13.5 | 26.1 | 28.1 | 75.1 | 74 | 1.1 | 7    |
| DWAE0620X04S070 |     | 4   | ●      | 25.9 | 44.1 | 46.1 | 84.1 | 83 | 1.1 | 7    |
| DWAE0630X02S070 | 6.3 | 2   | ★      | 13.7 | 26.1 | 28.1 | 75.1 | 74 | 1.1 | 7    |
| DWAE0630X04S070 |     | 4   | ★      | 26.3 | 44.1 | 46.1 | 84.1 | 83 | 1.1 | 7    |
| DWAE0640X02S070 | 6.4 | 2   | ●      | 14.0 | 26.2 | 28.2 | 75.2 | 74 | 1.2 | 7    |
| DWAE0640X04S070 |     | 4   | ●      | 26.8 | 44.2 | 46.2 | 84.2 | 83 | 1.2 | 7    |
| DWAE0650X02S070 | 6.5 | 2   | ★      | 14.2 | 26.2 | 28.2 | 75.2 | 74 | 1.2 | 7    |
| DWAE0650X04S070 |     | 4   | ★      | 27.2 | 44.2 | 46.2 | 84.2 | 83 | 1.2 | 7    |
| DWAE0660X02S070 | 6.6 | 2   | ●      | 14.4 | 28.2 | 30.2 | 75.2 | 74 | 1.2 | 7    |
| DWAE0660X04S070 |     | 4   | ●      | 27.6 | 46.2 | 48.2 | 84.2 | 83 | 1.2 | 7    |
| DWAE0670X02S070 | 6.7 | 2   | ★      | 14.6 | 28.2 | 30.2 | 75.2 | 74 | 1.2 | 7    |
| DWAE0670X04S070 |     | 4   | ★      | 28.0 | 46.2 | 48.2 | 84.2 | 83 | 1.2 | 7    |
| DWAE0680X02S070 | 6.8 | 2   | ●      | 14.8 | 28.2 | 30.2 | 75.2 | 74 | 1.2 | 7    |
| DWAE0680X04S070 |     | 4   | ●      | 28.4 | 46.2 | 48.2 | 84.2 | 83 | 1.2 | 7    |
| DWAE0690X02S070 | 6.9 | 2   | ★      | 15.1 | 28.3 | 30.3 | 75.3 | 74 | 1.3 | 7    |
| DWAE0690X04S070 |     | 4   | ★      | 28.9 | 46.3 | 48.3 | 84.3 | 83 | 1.3 | 7    |
| DWAE0700X02S070 | 7.0 | 2   | ●      | 15.3 | 28.3 | 30.3 | 75.3 | 74 | 1.3 | 7    |
| DWAE0700X04S070 |     | 4   | ●      | 29.3 | 46.3 | 48.3 | 84.3 | 83 | 1.3 | 7    |
| DWAE0710X02S080 | 7.1 | 2   | ★      | 15.5 | 29.3 | 31.3 | 80.3 | 79 | 1.3 | 8    |
| DWAE0710X04S080 |     | 4   | ★      | 29.7 | 51.3 | 53.3 | 91.3 | 90 | 1.3 | 8    |

# DWAE

| Order number    | DC  | L/D | DP102A | LU   | LCF  | LH   | OAL   | LF  | PL  | DCON |
|-----------------|-----|-----|--------|------|------|------|-------|-----|-----|------|
| DWAE0720X02S080 | 7.2 | 2   | ●      | 15.7 | 29.3 | 31.3 | 80.3  | 79  | 1.3 | 8    |
| DWAE0720X04S080 |     | 4   | ●      | 30.1 | 51.3 | 53.3 | 91.3  | 90  | 1.3 | 8    |
| DWAE0730X02S080 | 7.3 | 2   | ★      | 15.9 | 29.3 | 31.3 | 80.3  | 79  | 1.3 | 8    |
| DWAE0730X04S080 |     | 4   | ★      | 30.5 | 51.3 | 53.3 | 91.3  | 90  | 1.3 | 8    |
| DWAE0740X02S080 | 7.4 | 2   | ●      | 16.1 | 29.3 | 31.3 | 80.3  | 79  | 1.3 | 8    |
| DWAE0740X04S080 |     | 4   | ●      | 30.9 | 51.3 | 53.3 | 91.3  | 90  | 1.3 | 8    |
| DWAE0750X02S080 | 7.5 | 2   | ★      | 16.4 | 29.4 | 31.4 | 80.4  | 79  | 1.4 | 8    |
| DWAE0750X04S080 |     | 4   | ★      | 31.4 | 51.4 | 53.4 | 91.4  | 90  | 1.4 | 8    |
| DWAE0760X02S080 | 7.6 | 2   | ●      | 16.6 | 31.4 | 33.4 | 80.4  | 79  | 1.4 | 8    |
| DWAE0760X04S080 |     | 4   | ●      | 31.8 | 53.4 | 55.4 | 91.4  | 90  | 1.4 | 8    |
| DWAE0770X02S080 | 7.7 | 2   | ★      | 16.8 | 31.4 | 33.4 | 80.4  | 79  | 1.4 | 8    |
| DWAE0770X04S080 |     | 4   | ★      | 32.2 | 53.4 | 55.4 | 91.4  | 90  | 1.4 | 8    |
| DWAE0780X02S080 | 7.8 | 2   | ●      | 17.0 | 31.4 | 33.4 | 80.4  | 79  | 1.4 | 8    |
| DWAE0780X04S080 |     | 4   | ●      | 32.6 | 53.4 | 55.4 | 91.4  | 90  | 1.4 | 8    |
| DWAE0790X02S080 | 7.9 | 2   | ★      | 17.2 | 31.4 | 33.4 | 80.4  | 79  | 1.4 | 8    |
| DWAE0790X04S080 |     | 4   | ★      | 33.0 | 53.4 | 55.4 | 91.4  | 90  | 1.4 | 8    |
| DWAE0800X02S080 | 8.0 | 2   | ●      | 17.5 | 31.5 | 33.5 | 80.5  | 79  | 1.5 | 8    |
| DWAE0800X04S080 |     | 4   | ●      | 33.5 | 53.5 | 55.5 | 91.5  | 90  | 1.5 | 8    |
| DWAE0810X02S090 | 8.1 | 2   | ★      | 17.7 | 33.5 | 35.5 | 85.5  | 84  | 1.5 | 9    |
| DWAE0810X04S090 |     | 4   | ★      | 33.9 | 57.5 | 59.5 | 99.5  | 98  | 1.5 | 9    |
| DWAE0820X02S090 | 8.2 | 2   | ●      | 17.9 | 33.5 | 35.5 | 85.5  | 84  | 1.5 | 9    |
| DWAE0820X04S090 |     | 4   | ●      | 34.3 | 57.5 | 59.5 | 99.5  | 98  | 1.5 | 9    |
| DWAE0830X02S090 | 8.3 | 2   | ★      | 18.1 | 33.5 | 35.5 | 85.5  | 84  | 1.5 | 9    |
| DWAE0830X04S090 |     | 4   | ★      | 34.7 | 57.5 | 59.5 | 99.5  | 98  | 1.5 | 9    |
| DWAE0840X02S090 | 8.4 | 2   | ●      | 18.3 | 33.5 | 35.5 | 85.5  | 84  | 1.5 | 9    |
| DWAE0840X04S090 |     | 4   | ●      | 35.1 | 57.5 | 59.5 | 99.5  | 98  | 1.5 | 9    |
| DWAE0850X02S090 | 8.5 | 2   | ★      | 18.5 | 33.5 | 35.5 | 85.5  | 84  | 1.5 | 9    |
| DWAE0850X04S090 |     | 4   | ★      | 35.5 | 57.5 | 59.5 | 99.5  | 98  | 1.5 | 9    |
| DWAE0860X02S090 | 8.6 | 2   | ●      | 18.8 | 34.6 | 36.6 | 85.6  | 84  | 1.6 | 9    |
| DWAE0860X04S090 |     | 4   | ●      | 36.0 | 61.6 | 63.6 | 99.6  | 98  | 1.6 | 9    |
| DWAE0870X02S090 | 8.7 | 2   | ★      | 19.0 | 34.6 | 36.6 | 85.6  | 84  | 1.6 | 9    |
| DWAE0870X04S090 |     | 4   | ★      | 36.4 | 61.6 | 63.6 | 99.6  | 98  | 1.6 | 9    |
| DWAE0880X02S090 | 8.8 | 2   | ●      | 19.2 | 34.6 | 36.6 | 85.6  | 84  | 1.6 | 9    |
| DWAE0880X04S090 |     | 4   | ●      | 36.8 | 61.6 | 63.6 | 99.6  | 98  | 1.6 | 9    |
| DWAE0890X02S090 | 8.9 | 2   | ★      | 19.4 | 34.6 | 36.6 | 85.6  | 84  | 1.6 | 9    |
| DWAE0890X04S090 |     | 4   | ★      | 37.2 | 61.6 | 63.6 | 99.6  | 98  | 1.6 | 9    |
| DWAE0900X02S090 | 9.0 | 2   | ●      | 19.6 | 34.6 | 36.6 | 85.6  | 84  | 1.6 | 9    |
| DWAE0900X04S090 |     | 4   | ●      | 37.6 | 61.6 | 63.6 | 99.6  | 98  | 1.6 | 9    |
| DWAE0910X02S100 | 9.1 | 2   | ★      | 19.9 | 36.7 | 38.7 | 90.7  | 89  | 1.7 | 10   |
| DWAE0910X04S100 |     | 4   | ★      | 38.1 | 63.7 | 65.7 | 106.7 | 105 | 1.7 | 10   |
| DWAE0920X02S100 | 9.2 | 2   | ●      | 20.1 | 36.7 | 38.7 | 90.7  | 89  | 1.7 | 10   |
| DWAE0920X04S100 |     | 4   | ●      | 38.5 | 63.7 | 65.7 | 106.7 | 105 | 1.7 | 10   |
| DWAE0930X02S100 | 9.3 | 2   | ★      | 20.3 | 36.7 | 38.7 | 90.7  | 89  | 1.7 | 10   |
| DWAE0930X04S100 |     | 4   | ★      | 38.9 | 63.7 | 65.7 | 106.7 | 105 | 1.7 | 10   |
| DWAE0940X02S100 | 9.4 | 2   | ●      | 20.5 | 36.7 | 38.7 | 90.7  | 89  | 1.7 | 10   |
| DWAE0940X04S100 |     | 4   | ●      | 39.3 | 63.7 | 65.7 | 106.7 | 105 | 1.7 | 10   |
| DWAE0950X02S100 | 9.5 | 2   | ★      | 20.7 | 36.7 | 38.7 | 90.7  | 89  | 1.7 | 10   |
| DWAE0950X04S100 |     | 4   | ★      | 39.7 | 63.7 | 65.7 | 106.7 | 105 | 1.7 | 10   |
| DWAE0960X02S100 | 9.6 | 2   | ●      | 20.9 | 37.7 | 39.7 | 90.7  | 89  | 1.7 | 10   |
| DWAE0960X04S100 |     | 4   | ●      | 40.1 | 66.7 | 68.7 | 106.7 | 105 | 1.7 | 10   |

# DWAE

| Order number    | DC   | L/D | DP102A | LU   | LCF  | LH   | OAL   | LF  | PL  | DCON |
|-----------------|------|-----|--------|------|------|------|-------|-----|-----|------|
| DWAE0970X02S100 | 9.7  | 2   | ★      | 21.2 | 37.8 | 39.8 | 90.8  | 89  | 1.8 | 10   |
| DWAE0970X04S100 |      | 4   | ★      | 40.6 | 66.8 | 68.8 | 106.8 | 105 | 1.8 | 10   |
| DWAE0980X02S100 | 9.8  | 2   | ●      | 21.4 | 37.8 | 39.8 | 90.8  | 89  | 1.8 | 10   |
| DWAE0980X04S100 |      | 4   | ●      | 41.0 | 66.8 | 68.8 | 106.8 | 105 | 1.8 | 10   |
| DWAE0990X02S100 | 9.9  | 2   | ★      | 21.6 | 37.8 | 39.8 | 90.8  | 89  | 1.8 | 10   |
| DWAE0990X04S100 |      | 4   | ★      | 41.4 | 66.8 | 68.8 | 106.8 | 105 | 1.8 | 10   |
| DWAE1000X02S100 | 10.0 | 2   | ●      | 21.8 | 37.8 | 39.8 | 90.8  | 89  | 1.8 | 10   |
| DWAE1000X04S100 |      | 4   | ●      | 41.8 | 66.8 | 68.8 | 106.8 | 105 | 1.8 | 10   |
| DWAE1010X02S110 | 10.1 | 2   | ●      | 22.0 | 40.8 | 42.8 | 101.8 | 100 | 1.8 | 11   |
| DWAE1010X04S110 |      | 4   | ●      | 42.2 | 71.8 | 73.8 | 115.8 | 114 | 1.8 | 11   |
| DWAE1020X02S110 | 10.2 | 2   | ●      | 22.3 | 40.9 | 42.9 | 101.9 | 100 | 1.9 | 11   |
| DWAE1020X04S110 |      | 4   | ●      | 42.7 | 71.9 | 73.9 | 115.9 | 114 | 1.9 | 11   |
| DWAE1030X02S110 | 10.3 | 2   | ●      | 22.5 | 40.9 | 42.9 | 101.9 | 100 | 1.9 | 11   |
| DWAE1030X04S110 |      | 4   | ●      | 43.1 | 71.9 | 73.9 | 115.9 | 114 | 1.9 | 11   |
| DWAE1040X02S110 | 10.4 | 2   | ●      | 22.7 | 40.9 | 42.9 | 101.9 | 100 | 1.9 | 11   |
| DWAE1040X04S110 |      | 4   | ●      | 43.5 | 71.9 | 73.9 | 115.9 | 114 | 1.9 | 11   |
| DWAE1050X02S110 | 10.5 | 2   | ●      | 22.9 | 40.9 | 42.9 | 101.9 | 100 | 1.9 | 11   |
| DWAE1050X04S110 |      | 4   | ●      | 43.9 | 71.9 | 73.9 | 115.9 | 114 | 1.9 | 11   |
| DWAE1060X02S110 | 10.6 | 2   | ●      | 23.1 | 41.9 | 43.9 | 101.9 | 100 | 1.9 | 11   |
| DWAE1060X04S110 |      | 4   | ●      | 44.3 | 72.9 | 74.9 | 115.9 | 114 | 1.9 | 11   |
| DWAE1070X02S110 | 10.7 | 2   | ●      | 23.3 | 41.9 | 43.9 | 101.9 | 100 | 1.9 | 11   |
| DWAE1070X04S110 |      | 4   | ●      | 44.7 | 72.9 | 74.9 | 115.9 | 114 | 1.9 | 11   |
| DWAE1080X02S110 | 10.8 | 2   | ●      | 23.6 | 42.0 | 44.0 | 102.0 | 100 | 2.0 | 11   |
| DWAE1080X04S110 |      | 4   | ●      | 45.2 | 73.0 | 75.0 | 116.0 | 114 | 2.0 | 11   |
| DWAE1090X02S110 | 10.9 | 2   | ●      | 23.8 | 42.0 | 44.0 | 102.0 | 100 | 2.0 | 11   |
| DWAE1090X04S110 |      | 4   | ●      | 45.6 | 73.0 | 75.0 | 116.0 | 114 | 2.0 | 11   |
| DWAE1100X02S110 | 11.0 | 2   | ●      | 24.0 | 42.0 | 44.0 | 102.0 | 100 | 2.0 | 11   |
| DWAE1100X04S110 |      | 4   | ●      | 46.0 | 73.0 | 75.0 | 116.0 | 114 | 2.0 | 11   |
| DWAE1110X02S120 | 11.1 | 2   | ●      | 24.2 | 45.0 | 47.0 | 102.0 | 100 | 2.0 | 12   |
| DWAE1110X04S120 |      | 4   | ●      | 46.4 | 77.0 | 79.0 | 123.0 | 121 | 2.0 | 12   |
| DWAE1120X02S120 | 11.2 | 2   | ●      | 24.4 | 45.0 | 47.0 | 102.0 | 100 | 2.0 | 12   |
| DWAE1120X04S120 |      | 4   | ●      | 46.8 | 77.0 | 79.0 | 123.0 | 121 | 2.0 | 12   |
| DWAE1130X02S120 | 11.3 | 2   | ●      | 24.7 | 45.1 | 47.1 | 102.1 | 100 | 2.1 | 12   |
| DWAE1130X04S120 |      | 4   | ●      | 47.3 | 77.1 | 79.1 | 123.1 | 121 | 2.1 | 12   |
| DWAE1140X02S120 | 11.4 | 2   | ●      | 24.9 | 45.1 | 47.1 | 102.1 | 100 | 2.1 | 12   |
| DWAE1140X04S120 |      | 4   | ●      | 47.7 | 77.1 | 79.1 | 123.1 | 121 | 2.1 | 12   |
| DWAE1150X02S120 | 11.5 | 2   | ●      | 25.1 | 45.1 | 47.1 | 102.1 | 100 | 2.1 | 12   |
| DWAE1150X04S120 |      | 4   | ●      | 48.1 | 77.1 | 79.1 | 123.1 | 121 | 2.1 | 12   |
| DWAE1160X02S120 | 11.6 | 2   | ●      | 25.3 | 47.1 | 49.1 | 102.1 | 100 | 2.1 | 12   |
| DWAE1160X04S120 |      | 4   | ●      | 48.5 | 79.1 | 81.1 | 123.1 | 121 | 2.1 | 12   |
| DWAE1170X02S120 | 11.7 | 2   | ●      | 25.5 | 47.1 | 49.1 | 102.1 | 100 | 2.1 | 12   |
| DWAE1170X04S120 |      | 4   | ●      | 48.9 | 79.1 | 81.1 | 123.1 | 121 | 2.1 | 12   |
| DWAE1180X02S120 | 11.8 | 2   | ●      | 25.7 | 47.1 | 49.1 | 102.1 | 100 | 2.1 | 12   |
| DWAE1180X04S120 |      | 4   | ●      | 49.3 | 79.1 | 81.1 | 123.1 | 121 | 2.1 | 12   |
| DWAE1190X02S120 | 11.9 | 2   | ●      | 26.0 | 47.2 | 49.2 | 102.2 | 100 | 2.2 | 12   |
| DWAE1190X04S120 |      | 4   | ●      | 49.8 | 79.2 | 81.2 | 123.2 | 121 | 2.2 | 12   |
| DWAE1200X02S120 | 12.0 | 2   | ●      | 26.2 | 47.2 | 49.2 | 102.2 | 100 | 2.2 | 12   |
| DWAE1200X04S120 |      | 4   | ●      | 50.2 | 79.2 | 81.2 | 123.2 | 121 | 2.2 | 12   |
| DWAE1210X02S130 | 12.1 | 2   | ●      | 26.4 | 49.2 | 51.2 | 102.2 | 100 | 2.2 | 13   |
| DWAE1210X04S130 |      | 4   | ●      | 50.6 | 82.2 | 84.2 | 139.2 | 137 | 2.2 | 13   |

# DWAE

| Order number    | DC   | L/D | DP102A | LU   | LCF  | LH   | OAL   | LF  | PL  | DCON |
|-----------------|------|-----|--------|------|------|------|-------|-----|-----|------|
| DWAE1220X02S130 | 12.2 | 2   | ●      | 26.6 | 49.2 | 51.2 | 102.2 | 100 | 2.2 | 13   |
| DWAE1220X04S130 |      | 4   | ●      | 51.0 | 82.2 | 84.2 | 139.2 | 137 | 2.2 | 13   |
| DWAE1230X02S130 | 12.3 | 2   | ●      | 26.8 | 49.2 | 51.2 | 102.2 | 100 | 2.2 | 13   |
| DWAE1230X04S130 |      | 4   | ●      | 51.4 | 82.2 | 84.2 | 139.2 | 137 | 2.2 | 13   |
| DWAE1240X02S130 | 12.4 | 2   | ●      | 27.1 | 49.3 | 51.3 | 102.3 | 100 | 2.3 | 13   |
| DWAE1240X04S130 |      | 4   | ●      | 51.9 | 82.3 | 84.3 | 139.3 | 137 | 2.3 | 13   |
| DWAE1250X02S130 | 12.5 | 2   | ●      | 27.3 | 49.3 | 51.3 | 102.3 | 100 | 2.3 | 13   |
| DWAE1250X04S130 |      | 4   | ●      | 52.3 | 82.3 | 84.3 | 139.3 | 137 | 2.3 | 13   |
| DWAE1260X02S130 | 12.6 | 2   | ●      | 27.5 | 52.3 | 54.3 | 102.3 | 100 | 2.3 | 13   |
| DWAE1260X04S130 |      | 4   | ●      | 52.7 | 84.3 | 86.3 | 139.3 | 137 | 2.3 | 13   |
| DWAE1270X02S130 | 12.7 | 2   | ●      | 27.7 | 52.3 | 54.3 | 102.3 | 100 | 2.3 | 13   |
| DWAE1270X04S130 |      | 4   | ●      | 53.1 | 84.3 | 86.3 | 139.3 | 137 | 2.3 | 13   |
| DWAE1280X02S130 | 12.8 | 2   | ●      | 27.9 | 52.3 | 54.3 | 102.3 | 100 | 2.3 | 13   |
| DWAE1280X04S130 |      | 4   | ●      | 53.5 | 84.3 | 86.3 | 139.3 | 137 | 2.3 | 13   |
| DWAE1290X02S130 | 12.9 | 2   | ●      | 28.1 | 52.3 | 54.3 | 102.3 | 100 | 2.3 | 13   |
| DWAE1290X04S130 |      | 4   | ●      | 53.9 | 84.3 | 86.3 | 139.3 | 137 | 2.3 | 13   |
| DWAE1300X02S130 | 13.0 | 2   | ●      | 28.4 | 52.4 | 54.4 | 102.4 | 100 | 2.4 | 13   |
| DWAE1300X04S130 |      | 4   | ●      | 54.4 | 84.4 | 86.4 | 139.4 | 137 | 2.4 | 13   |
| DWAE1310X02S140 | 13.1 | 2   | ●      | 28.6 | 55.4 | 57.4 | 102.4 | 100 | 2.4 | 14   |
| DWAE1310X04S140 |      | 4   | ●      | 54.8 | 92.4 | 94.4 | 149.4 | 147 | 2.4 | 14   |
| DWAE1320X02S140 | 13.2 | 2   | ●      | 28.8 | 55.4 | 57.4 | 102.4 | 100 | 2.4 | 14   |
| DWAE1320X04S140 |      | 4   | ●      | 55.2 | 92.4 | 94.4 | 149.4 | 147 | 2.4 | 14   |
| DWAE1330X02S140 | 13.3 | 2   | ●      | 29.0 | 55.4 | 57.4 | 102.4 | 100 | 2.4 | 14   |
| DWAE1330X04S140 |      | 4   | ●      | 55.6 | 92.4 | 94.4 | 149.4 | 147 | 2.4 | 14   |
| DWAE1340X02S140 | 13.4 | 2   | ●      | 29.2 | 55.4 | 57.4 | 102.4 | 100 | 2.4 | 14   |
| DWAE1340X04S140 |      | 4   | ●      | 56.0 | 92.4 | 94.4 | 149.4 | 147 | 2.4 | 14   |
| DWAE1350X02S140 | 13.5 | 2   | ●      | 29.5 | 55.5 | 57.5 | 102.5 | 100 | 2.5 | 14   |
| DWAE1350X04S140 |      | 4   | ●      | 56.5 | 92.5 | 94.5 | 149.5 | 147 | 2.5 | 14   |
| DWAE1360X02S140 | 13.6 | 2   | ●      | 29.7 | 57.5 | 59.5 | 102.5 | 100 | 2.5 | 14   |
| DWAE1360X04S140 |      | 4   | ●      | 56.9 | 97.5 | 99.5 | 149.5 | 147 | 2.5 | 14   |
| DWAE1370X02S140 | 13.7 | 2   | ●      | 29.9 | 57.5 | 59.5 | 102.5 | 100 | 2.5 | 14   |
| DWAE1370X04S140 |      | 4   | ●      | 57.3 | 97.5 | 99.5 | 149.5 | 147 | 2.5 | 14   |
| DWAE1380X02S140 | 13.8 | 2   | ●      | 30.1 | 57.5 | 59.5 | 102.5 | 100 | 2.5 | 14   |
| DWAE1380X04S140 |      | 4   | ●      | 57.7 | 97.5 | 99.5 | 149.5 | 147 | 2.5 | 14   |
| DWAE1390X02S140 | 13.9 | 2   | ●      | 30.3 | 57.5 | 59.5 | 102.5 | 100 | 2.5 | 14   |
| DWAE1390X04S140 |      | 4   | ●      | 58.1 | 97.5 | 99.5 | 149.5 | 147 | 2.5 | 14   |
| DWAE1400X02S140 | 14.0 | 2   | ●      | 30.5 | 57.5 | 59.5 | 102.5 | 100 | 2.5 | 14   |
| DWAE1400X04S140 |      | 4   | ●      | 58.5 | 97.5 | 99.5 | 149.5 | 147 | 2.5 | 14   |

# DWAE / MINI DWAE

## RECOMMENDED CUTTING CONDITIONS

| Material                                                                                                                                                                  | DC   | Vc | n    | f                 | Vf  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----|------|-------------------|-----|
| P<br>Mild steel (<180HB),<br>DIN ST44-2, DIN C10 etc.                                                                                                                     | 1.0  | 30 | 9500 | 0.030 (0.02–0.04) | 285 |
|                                                                                                                                                                           | 1.5  | 30 | 6300 | 0.050 (0.03–0.06) | 315 |
|                                                                                                                                                                           | 2.0  | 55 | 8700 | 0.060 (0.04–0.08) | 520 |
|                                                                                                                                                                           | 2.5  | 55 | 7000 | 0.080 (0.05–0.10) | 560 |
|                                                                                                                                                                           | 3.0  | 65 | 6800 | 0.090 (0.07–0.11) | 610 |
|                                                                                                                                                                           | 4.0  | 70 | 5500 | 0.115 (0.09–0.14) | 630 |
|                                                                                                                                                                           | 5.0  | 70 | 4400 | 0.145 (0.11–0.18) | 635 |
|                                                                                                                                                                           | 6.0  | 80 | 4200 | 0.175 (0.14–0.21) | 735 |
|                                                                                                                                                                           | 7.0  | 80 | 3600 | 0.205 (0.16–0.25) | 735 |
|                                                                                                                                                                           | 8.0  | 85 | 3300 | 0.230 (0.18–0.28) | 755 |
|                                                                                                                                                                           | 10.0 | 90 | 2800 | 0.265 (0.21–0.32) | 740 |
|                                                                                                                                                                           | 12.0 | 95 | 2500 | 0.280 (0.22–0.34) | 700 |
|                                                                                                                                                                           | 14.0 | 95 | 2100 | 0.290 (0.23–0.35) | 605 |
|                                                                                                                                                                           | 1.0  | 30 | 9500 | 0.030 (0.02–0.04) | 285 |
| P<br>Carbon steel, Alloy steel (180–250HB)<br>DIN Ck45, DIN 41CrMo4 etc.                                                                                                  | 1.5  | 30 | 6300 | 0.050 (0.03–0.06) | 315 |
|                                                                                                                                                                           | 2.0  | 55 | 8700 | 0.060 (0.04–0.08) | 520 |
|                                                                                                                                                                           | 2.5  | 55 | 7000 | 0.080 (0.05–0.10) | 560 |
|                                                                                                                                                                           | 3.0  | 60 | 6300 | 0.090 (0.07–0.11) | 565 |
|                                                                                                                                                                           | 4.0  | 65 | 5100 | 0.115 (0.09–0.14) | 585 |
|                                                                                                                                                                           | 5.0  | 65 | 4100 | 0.145 (0.11–0.18) | 590 |
|                                                                                                                                                                           | 6.0  | 75 | 3900 | 0.175 (0.14–0.21) | 680 |
|                                                                                                                                                                           | 7.0  | 75 | 3400 | 0.205 (0.16–0.25) | 695 |
|                                                                                                                                                                           | 8.0  | 80 | 3100 | 0.230 (0.18–0.28) | 710 |
|                                                                                                                                                                           | 10.0 | 85 | 2700 | 0.265 (0.21–0.32) | 715 |
|                                                                                                                                                                           | 12.0 | 90 | 2300 | 0.280 (0.22–0.34) | 640 |
|                                                                                                                                                                           | 14.0 | 90 | 2000 | 0.290 (0.23–0.35) | 580 |
|                                                                                                                                                                           | 1.0  | 25 | 7900 | 0.020 (0.01–0.03) | 160 |
|                                                                                                                                                                           | 1.5  | 25 | 5300 | 0.040 (0.02–0.05) | 210 |
| P<br>Carbon steel, Alloy steel (280–350HB)<br>DIN 41NiCrMo7-3-2 etc.                                                                                                      | 2.0  | 50 | 7900 | 0.050 (0.03–0.07) | 395 |
|                                                                                                                                                                           | 2.5  | 50 | 6300 | 0.070 (0.04–0.09) | 440 |
|                                                                                                                                                                           | 3.0  | 55 | 5800 | 0.075 (0.06–0.09) | 435 |
|                                                                                                                                                                           | 4.0  | 60 | 4700 | 0.105 (0.08–0.13) | 490 |
|                                                                                                                                                                           | 5.0  | 60 | 3800 | 0.130 (0.10–0.16) | 490 |
|                                                                                                                                                                           | 6.0  | 70 | 3700 | 0.155 (0.12–0.19) | 570 |
|                                                                                                                                                                           | 7.0  | 70 | 3100 | 0.180 (0.14–0.22) | 555 |
|                                                                                                                                                                           | 8.0  | 75 | 2900 | 0.205 (0.16–0.25) | 590 |
|                                                                                                                                                                           | 10.0 | 80 | 2500 | 0.240 (0.20–0.28) | 600 |
|                                                                                                                                                                           | 12.0 | 85 | 2200 | 0.250 (0.20–0.30) | 550 |
|                                                                                                                                                                           | 14.0 | 85 | 1900 | 0.250 (0.20–0.30) | 475 |
|                                                                                                                                                                           | 1.0  | 30 | 9500 | 0.020 (0.01–0.03) | 190 |
|                                                                                                                                                                           | 1.5  | 30 | 6300 | 0.040 (0.02–0.05) | 250 |
|                                                                                                                                                                           | 2.0  | 35 | 5500 | 0.040 (0.02–0.06) | 220 |
| M<br>Austenitic stainless steel (<200HB)<br>Ferritic, Precipitation hardening stainless steel (>200HB)<br>with water-insoluble coolant<br>DIN X22CrNi17, DIN X45Cr13 etc. | 2.5  | 35 | 4400 | 0.060 (0.03–0.08) | 265 |
|                                                                                                                                                                           | 3.0  | 40 | 4200 | 0.070 (0.04–0.10) | 290 |
|                                                                                                                                                                           | 4.0  | 40 | 3100 | 0.075 (0.05–0.10) | 230 |
|                                                                                                                                                                           | 5.0  | 40 | 2500 | 0.100 (0.05–0.15) | 250 |
|                                                                                                                                                                           | 6.0  | 40 | 2100 | 0.105 (0.06–0.15) | 220 |
|                                                                                                                                                                           | 7.0  | 40 | 1800 | 0.120 (0.06–0.18) | 215 |
|                                                                                                                                                                           | 8.0  | 40 | 1500 | 0.130 (0.06–0.20) | 195 |
|                                                                                                                                                                           | 10.0 | 40 | 1200 | 0.140 (0.08–0.20) | 165 |
|                                                                                                                                                                           | 12.0 | 40 | 1000 | 0.175 (0.10–0.25) | 175 |
|                                                                                                                                                                           | 14.0 | 40 | 900  | 0.175 (0.10–0.25) | 155 |

# DWAE / MINI DWAE

## RECOMMENDED CUTTING CONDITIONS

| Material                                      | DC   | Vc | n    | f                 | Vf  |
|-----------------------------------------------|------|----|------|-------------------|-----|
| Gray cast iron (<350MPa)<br>DIN GG30 etc.     | 1.0  | 30 | 9500 | 0.030 (0.02–0.04) | 285 |
|                                               | 1.5  | 30 | 6300 | 0.050 (0.03–0.06) | 315 |
|                                               | 2.0  | 55 | 8700 | 0.060 (0.04–0.08) | 520 |
|                                               | 2.5  | 55 | 7000 | 0.080 (0.05–0.10) | 560 |
|                                               | 3.0  | 60 | 6300 | 0.105 (0.06–0.15) | 660 |
|                                               | 4.0  | 65 | 5100 | 0.130 (0.08–0.18) | 660 |
|                                               | 5.0  | 65 | 4100 | 0.150 (0.10–0.20) | 615 |
|                                               | 6.0  | 75 | 3900 | 0.175 (0.12–0.23) | 680 |
|                                               | 7.0  | 75 | 3400 | 0.175 (0.12–0.23) | 595 |
|                                               | 8.0  | 80 | 3100 | 0.210 (0.17–0.25) | 650 |
|                                               | 10.0 | 85 | 2700 | 0.230 (0.18–0.28) | 620 |
|                                               | 12.0 | 90 | 2300 | 0.250 (0.20–0.30) | 575 |
|                                               | 14.0 | 90 | 2000 | 0.250 (0.20–0.30) | 500 |
|                                               | 1.0  | 25 | 7900 | 0.020 (0.01–0.03) | 160 |
|                                               | 1.5  | 25 | 5300 | 0.040 (0.02–0.05) | 210 |
| Ductile cast iron (<450MPa)<br>DIN GGG40 etc. | 2.0  | 50 | 7900 | 0.050 (0.03–0.07) | 395 |
|                                               | 2.5  | 50 | 6300 | 0.070 (0.04–0.09) | 440 |
|                                               | 3.0  | 55 | 5800 | 0.085 (0.05–0.12) | 490 |
|                                               | 4.0  | 60 | 4700 | 0.120 (0.07–0.17) | 560 |
|                                               | 5.0  | 60 | 3800 | 0.140 (0.08–0.20) | 530 |
|                                               | 6.0  | 70 | 3700 | 0.150 (0.10–0.20) | 555 |
|                                               | 7.0  | 70 | 3100 | 0.175 (0.12–0.23) | 540 |
|                                               | 8.0  | 75 | 2900 | 0.200 (0.15–0.25) | 580 |
|                                               | 10.0 | 80 | 2500 | 0.230 (0.18–0.28) | 575 |
|                                               | 12.0 | 85 | 2200 | 0.250 (0.20–0.30) | 550 |
|                                               | 14.0 | 85 | 1900 | 0.250 (0.20–0.30) | 475 |

The above cutting conditions are when water soluble coolant is used. For stainless steel, water-insoluble coolant is recommended.

When using a water-insoluble coolant, reduce the cutting speed by 20 % to ensure adequate lubrication.

Adjust the cutting conditions according to machine tool and workpiece clamping rigidity and machining geometry etc.

Machining depths exceeding flute length (LU) are not recommended.

Clamp the drill so that the runout is within 0.03 mm.

Check the condition of chips and perform step machining if necessary. \* Reference of step length: 0.2 to 1.0 DC

Do not clamp the flute part of the drill.

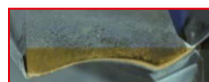
# DWAE

## APPLICATION EXAMPLES

|                      |                                                                                                                                                            |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Material             | KM-62F Electromagnetic stainless steel                                                                                                                     |
| Tool                 | DWAE1080X02S110                                                                                                                                            |
| Vc (m/min)           | 71.3                                                                                                                                                       |
| fr (mm/rev)          | 0.25                                                                                                                                                       |
| Guide hole dia. (mm) | 10.8                                                                                                                                                       |
| ap (mm)              | 14                                                                                                                                                         |
| Cutting mode         | Wet cutting, external coolant (Water-insoluble)                                                                                                            |
| Machine              | CNC Automatic Lathe                                                                                                                                        |
| Results              | When compared with a conventional drill, the cutting resistance of DWAE was lower thereby achieving double tool life with no chipping of the cutting edge. |

**Number of holes:  
8000**

**DWAE**



Rake face



Flank



Margin

**Number of holes:  
4000**

**Conventional**



Rake face



Flank



Margin

|                      |                                                                                                                                                                  |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Material             | Mild Steel DIN C10                                                                                                                                               |
| Tool                 | DWAE0300X04S030                                                                                                                                                  |
| Vc (m/min)           | 51.8                                                                                                                                                             |
| fr (mm/rev)          | 0.08                                                                                                                                                             |
| Guide hole dia. (mm) | 3.0                                                                                                                                                              |
| ap (mm)              | 7                                                                                                                                                                |
| Cutting mode         | Wet cutting, external coolant (Water-insoluble)                                                                                                                  |
| Results              | Compared to a conventional drill, cutting resistance was lower. Cutting conditions were improved by a factor of 1.5, while achieving 2.4 times longer tool life. |

**Number of holes:  
4800**

**DWAE**



Rake face



Flank



Margin

**Number of holes:  
2000**

**Conventional**



Rake face



Flank



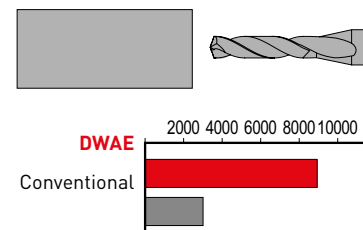
Margin

The above application examples are customer's applications, therefore can differ from the recommended conditions.

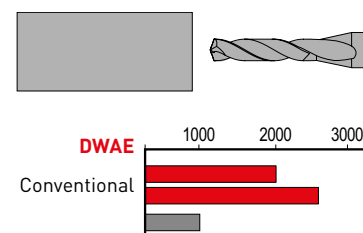
# MINI DWAE

## APPLICATION EXAMPLES

|                         |                                                                                                              |
|-------------------------|--------------------------------------------------------------------------------------------------------------|
| Material                | DIN X30Cr13                                                                                                  |
| Tool                    | DWAE0250X04S040                                                                                              |
| $n$ (mm <sup>-1</sup> ) | 2546                                                                                                         |
| $V_c$ (m/min)           | 20                                                                                                           |
| $f_r$ (mm/rev)          | 0.03                                                                                                         |
| Guide hole dia. (mm)    | 2.5                                                                                                          |
| $a_p$ (mm)              | 2.5                                                                                                          |
| Cutting mode            | Wet cutting<br>(Water-insoluble)                                                                             |
| Machine                 | Automatic Lathe                                                                                              |
| Results                 | Consistent hole dimensions and excellent chip disposal. Tool life tripled compared to conventional products. |



|                         |                                                                                         |
|-------------------------|-----------------------------------------------------------------------------------------|
| Material                | Martensitic Stainless Steel                                                             |
| Tool                    | DWAE0180X04S030                                                                         |
| $n$ (mm <sup>-1</sup> ) | 2000                                                                                    |
| $V_c$ (m/min)           | 11                                                                                      |
| $f_r$ (mm/rev)          | 0.02                                                                                    |
| $a_p$ (mm)              | 1.8                                                                                     |
| Cutting mode            | Step feed: 1 mm<br>Wet cutting<br>(Water-insoluble)                                     |
| Machine                 | CNC-Lathe                                                                               |
| Results                 | Damage to the cutting edge greatly reduced thereby allowing more than double tool life. |



# MEMO



# MEMO

## EUROPEAN SALES COMPANIES

### GERMANY

MITSUBISHI MATERIALS TOOLS EUROPE GMBH  
Comeniusstr. 2 . 40670 Meerbusch  
Phone +49 2159 91890 . Fax +49 2159 918966  
Email admin@mmchg.de

### UK Office

MMC HARDMETAL UK LTD  
1 Centurion Court, Centurion Way  
Tamworth, B77 5PN  
Phone +44 1827 312312  
Email sales@mitsubishicarbide.co.uk

### UK Deliveries / Returns

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MITSUBISHI MATERIALS ESPAÑA, S.A.  
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MMC METAL FRANCE S.A.R.L.  
6, Rue Jacques Monod . 91400 Orsay  
Phone +33 1 69 35 53 53 . Fax +33 1 69 35 53 50  
Email mmfsales@mmc-metal-france.fr

### POLAND

MMC HARDMETAL POLAND SP. Z O.O  
Al. Armii Krajowej 61 . 50-541 Wrocław  
Phone +48 71335 1620 . Fax +48 71335 1621  
Email sales@mitsubishicarbide.com.pl

### ITALY

MMC ITALIA S.R.L.  
Viale Certosa 144 . 20156 Milano  
Phone +39 0293 77031 . Fax +39 0293 589093  
Email info@mmc-italia.it

### TURKEY

MITSUBISHI MATERIALS TOOLS EUROPE GMBH ALMANYA İZMİR MERKEZ ŞUBESİ  
Adalet Mahallesi Anadolu Caddesi No: 41-1 . 15001 35530 Bayraklı / İzmir  
Phone +90 232 5015000 . Fax +90 232 5015007  
Email info@mmchg.com.tr

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