

UNION TOOL COMPANY

# Tungsten Carbide End Mills UNIMAX Series

For Cemented Carbide and  
Hard Brittle Materials

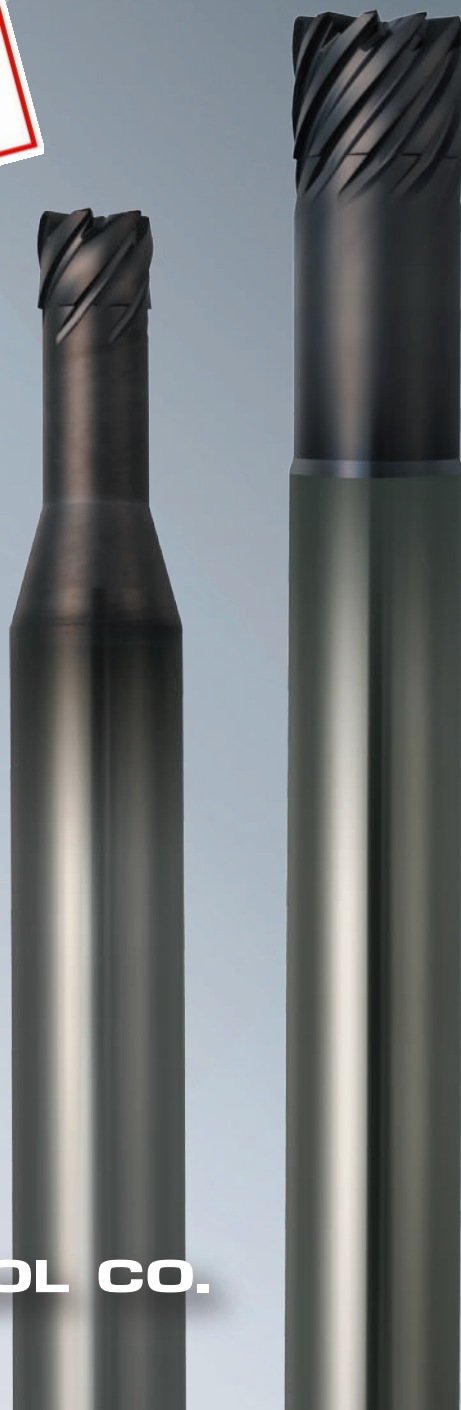


6 Flutes / 10 Flutes Diamond Coated UDC Series

## UDCRRS

Long Neck Radius End Mills for Roughing Process

**Additional parameters  
for  
Trochoidal milling**



UNION TOOL CO.

6 Flute / 10 Flute Long Neck Radius End Mills for Roughing Cemented Carbide and Hard Brittle Materials



Size  $\varnothing 2 \sim \varnothing 6$

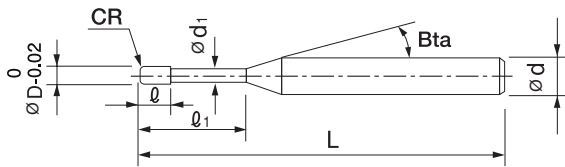
**UDCRRS**



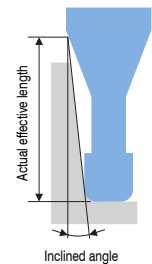
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material                 |                                 |                                  |                 |         |         |           |                 |          |        |          |                       |                 |                       |                  |                                       |
|-------------------------------|---------------------------------|----------------------------------|-----------------|---------|---------|-----------|-----------------|----------|--------|----------|-----------------------|-----------------|-----------------------|------------------|---------------------------------------|
| CARBON STEELS<br>S45C<br>S55C | ALLOY STEELS<br>SK / SCM<br>SUS | PREHARDENED STEELS<br>NAK<br>HPM | HARDENED STEELS |         |         | CAST IRON | ALUMINUM ALLOYS | GRAPHITE | COPPER | PLASTICS | GLASS FILLED PLASTICS | TITANIUM ALLOYS | HEAT RESISTANT ALLOYS | CEMENTED CARBIDE | HARD BRITTLE (NON-METALLIC) MATERIALS |
|                               |                                 |                                  | ~ 55HRC         | ~ 60HRC | ~ 70HRC |           |                 |          |        |          |                       |                 |                       |                  |                                       |
|                               |                                 |                                  |                 |         |         |           |                 |          |        |          | ○                     |                 |                       | ☆                | ◎                                     |

※ Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glass, etc.



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.



Total 4 models

Unit(mm)

| Model Number        | Outside Diameter $\varnothing D$ | Corner Radius CR | Effective Length $\ell_1$ | Length of Cut $\ell$ | Neck Diameter $\varnothing d_1$ | Shank Taper Angle Bta | Overall Length L | Shank Diameter $\varnothing d$ | Number of Flutes | Suggested Retail Price | Effective Length by Inclined Angles |                 |                 |                 |                 |
|---------------------|----------------------------------|------------------|---------------------------|----------------------|---------------------------------|-----------------------|------------------|--------------------------------|------------------|------------------------|-------------------------------------|-----------------|-----------------|-----------------|-----------------|
|                     |                                  |                  |                           |                      |                                 |                       |                  |                                |                  |                        | 30°                                 | 1°              | 1° 30'          | 2°              | 3°              |
| UDCRRS 6020-020-050 | 2                                | R0.2             | 5                         | 1.6                  | 1.77                            | 16                    | 50               | 4                              | 6                | 42,800                 | 5.52                                | 5.70            | 5.88            | 6.08            | 6.52            |
| UDCRRS 6030-020-075 | 3                                | R0.2             | 7.5                       | 2.4                  | 2.77                            | 16                    | 60               | 6                              | 6                | 45,960                 | 8.10                                | 8.36            | 8.63            | 8.92            | 9.58            |
| UDCRRS 6040-020-100 | 4                                | R0.2             | 10                        | 3.2                  | 3.77                            | 16                    | 60               | 6                              | 6                | 45,960                 | 10.68                               | 11.02           | 11.38           | 11.77           | 12.64           |
| UDCRRS 10060-020150 | 6                                | R0.2             | 15                        | 4.8                  | 5.77                            | 16                    | 60               | 6                              | 10               | 48,370                 | No Interference                     | No Interference | No Interference | No Interference | No Interference |

High Efficiency

$\varnothing 2 \sim \varnothing 4$   
6 Flutes

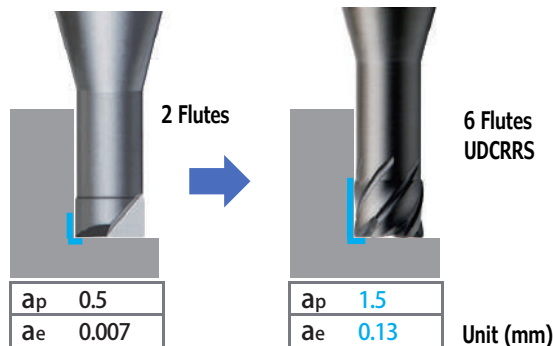


$\varnothing 6$   
10 Flutes



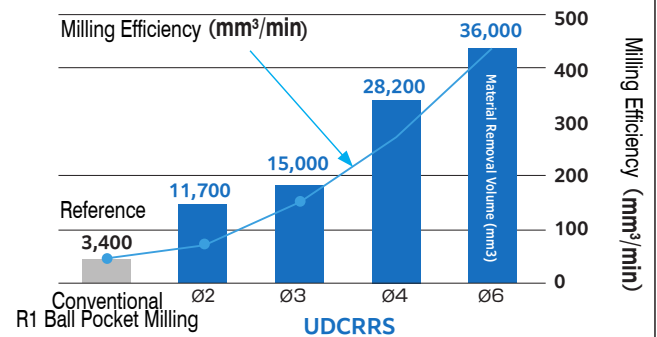
6 Flutes, 10 Flutes with a 40° helix angle help to reduce cutting load allowing for deep milling on axial depth.

Milling amount compared with 2 Flutes ( $\varnothing 2 \times EL 6$ )



Compared to a tool with 2 flutes, the  $a_p$  is 3 times and the  $a_e$  18 times higher in comparison. This shows a significant efficiency improvement.

Cutting material removal volume for each size



Milling efficiency and material removal volume exceeds the conventional tool.

## Roughing conditions for UDCRRS - Based on Union Tool Europe experiences

| WORK MATERIAL |                       | CEMENTED CARBIDE ( $\geq 87\text{HRA}$ ) |                    |                     |                      |                                   |                    |                     |                      |
|---------------|-----------------------|--|--------------------|---------------------|----------------------|-----------------------------------|--------------------|---------------------|----------------------|
| Model Number  | Outside Diameter (mm) | Flat milling                             |                    |                     |                      | Trochoidal milling (side milling) |                    |                     |                      |
|               |                       | Spindle Speed (min-1)                    | Feed Rate (mm/min) | ap Axial Depth (mm) | ae Radial Depth (mm) | Spindle Speed (min-1)             | Feed Rate (mm/min) | ap Axial Depth (mm) | ae Radial Depth (mm) |
| 6020-020-050  | 2                     | 20 000                                   | 375                | 0.1                 | 0.8                  | 24 000                            | 2700               | 1.6                 | 0.02                 |
| 6030-020-075  | 3                     | 17 500                                   | 375                | 0.1                 | 1.2                  | 17 500                            | 2300               | 2.4                 | 0.02                 |
| 6040-020-100  | 4                     | 15 000                                   | 375                | 0.1                 | 1.6                  | 15 000                            | 1780               | 3                   | 0.06                 |
| 10060-020150  | 6                     | 10 000                                   | 375                | 0.2                 | 1                    | 10 000                            | 1950               | 3                   | 0.08                 |

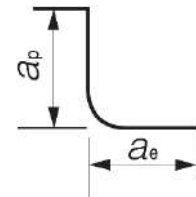
| WORK MATERIAL |                       | HARD BRITTLE MATERIALS |                    |                     |                      |                       |                    |                     |                      |
|---------------|-----------------------|------------------------|--------------------|---------------------|----------------------|-----------------------|--------------------|---------------------|----------------------|
| Model Number  | Outside Diameter (mm) | Flat milling           |                    |                     |                      | Side milling          |                    |                     |                      |
|               |                       | Spindle Speed (min-1)  | Feed Rate (mm/min) | ap Axial Depth (mm) | ae Radial Depth (mm) | Spindle Speed (min-1) | Feed Rate (mm/min) | ap Axial Depth (mm) | ae Radial Depth (mm) |
| 6020-020-050  | 2                     | 20 000                 | 375                | 0.1                 | 0.8                  | 20 000                | 375                | 1.5                 | 0.13                 |
| 6030-020-075  | 3                     | 17 500                 | 375                | 0.1                 | 1.2                  | 17 500                | 375                | 2.2                 | 0.19                 |
| 6040-020-100  | 4                     | 15 000                 | 375                | 0.1                 | 1.6                  | 15 000                | 375                | 3                   | 0.25                 |
| 10060-020150  | 6                     | 10 000                 | 375                | 0.2                 | 1                    | 10 000                | 375                | 4                   | 0.3                  |

| WORK MATERIAL |                       | CEMENTED CARBIDE ( $< 87\text{HRA}$ ) |                    |                     |                      |                       |                    |                     |                      |
|---------------|-----------------------|---------------------------------------|--------------------|---------------------|----------------------|-----------------------|--------------------|---------------------|----------------------|
| Model Number  | Outside Diameter (mm) | Flat milling                          |                    |                     |                      | Side milling          |                    |                     |                      |
|               |                       | Spindle Speed (min-1)                 | Feed Rate (mm/min) | ap Axial Depth (mm) | ae Radial Depth (mm) | Spindle Speed (min-1) | Feed Rate (mm/min) | ap Axial Depth (mm) | ae Radial Depth (mm) |
| 6020-020-050  | 2                     | 10 000                                | 375                | 0.1                 | 0.8                  | 10 000                | 1440               | 1.5                 | 0.02                 |
| 6030-020-075  | 3                     | 6 700                                 | 375                | 0.1                 | 1.2                  | 6 700                 | 1610               | 2.2                 | 0.02                 |
| 6040-020-100  | 4                     | 5 000                                 | 375                | 0.1                 | 1.6                  | 5 000                 | 1780               | 3                   | 0.02                 |
| 10060-020150  | 6                     | 3 300                                 | 375                | 0.2                 | 1                    | 3 300                 | 2000               | 4                   | 0.02                 |

Roughing with UDCRRS



Finishing with UDC 2 Flutes



UDCRRS is designed for roughing, use other UDC 2 flutes when finishing.

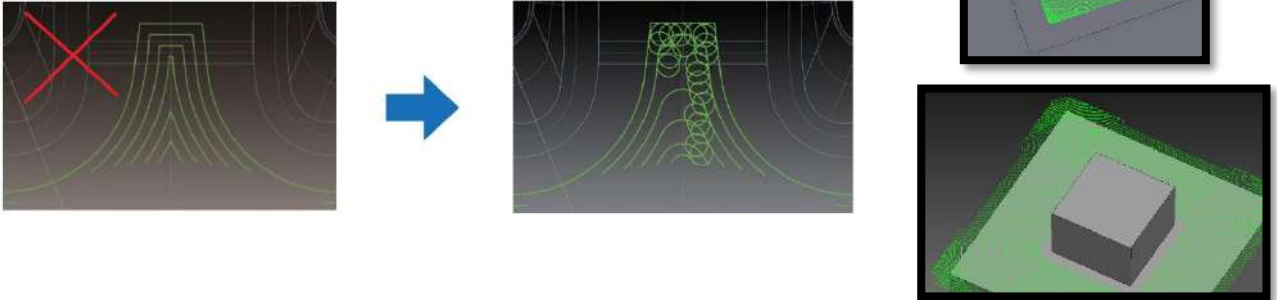
These milling parameters are based on VF-20, VM-40, VC-70, VU-70 (TAS standard) for Cemented Carbide, and Alumina for Hard Brittle Materials. These are for reference only.

Tool life may differ depending on the type of Cemented Carbide / Hard Brittle Materials.

For best result, fine parameter adjustments may be required, depending on the materials of Cemented Carbide / Hard Brittle Materials; milling Shape and strategy; machine rigidity and spindle capability.

**1. For Cemented carbide side milling, please use circular arc with the right trochoid arc R. Avoid “spiral milling” roughing strategies.**

- Trochoid R0.2mm minimum for UDCRRS Ø2, Ø3 and Ø4mm
- Trochoid R0.8mm minimum for UDCRRS Ø6mm



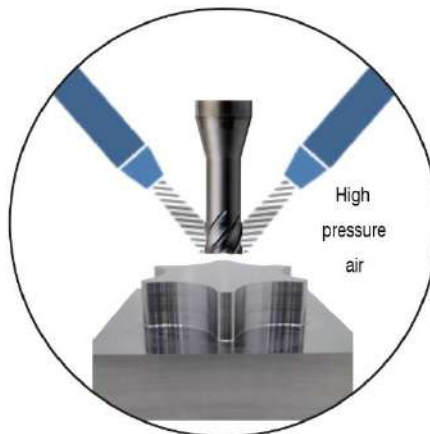
**2. Avoid Z movement for noncutting toolpath during Trochoidal milling.**

**3. Avoid acceleration for noncutting toolpath during Trochoidal milling.**

**4. Be careful with the spindle expansion:**

- Allow few minutes (recommended 10 minutes) spindle warm up when changing a tool and check the Z level of your UDCRRS.
- The spindle, the tool holder and the cutting tool should have the same temperature to avoid expansion during cutting moves.

**5. For a good chip evacuation, please use high pressure air blow from multiple direction**

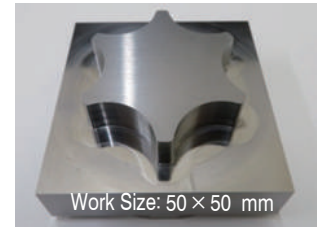
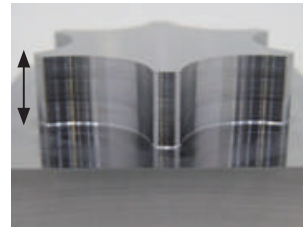


## Cemented Carbide Milling example of punching die UDCRRS Ø4 x CR0.2 x EL10

VM-40 (90HRA)

|                       |                          |
|-----------------------|--------------------------|
| Spindle Speed         | 15,000 min <sup>-1</sup> |
| Feed Rate             | 375 mm/min               |
| $a_p$<br>Axial Depth  | 3 mm                     |
| $a_e$<br>Radial Depth | 0.25 mm                  |
| Coolant               | Air Blow                 |
| Cycle Time            | 93 min                   |

Depth 9mm  
 $a_p$  3mm × 3 times



Tool after milling



Milling volume 15,953 mm<sup>3</sup> with a single tool in 93 min.  
Tool damage is limited and continuous cutting is possible !

### Note

Note:

- This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
- Allow sufficient machine and spindle warm-up time for stability and to remove any expansion of the main spindle before running the program.
- Tool setting length should achieve the least possible overhang.
- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
- Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
- Decrease both spindle speed and feed rate proportionally.
- Air blow is highly recommended for longer tool life. Both oil mist and oil coolant are alternatives.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.
- Remove chips to prevent heat generation and ignition during milling process.
- Protective gear, such as safety glasses and face guards are required when milling.
- Chips / dust generated while milling can have adverse affects on the machine parts if they are not properly evacuated. Take steps to assure proper evacuation.
- The tool life may shorten due to a large difference between the commanded feed speed and the actual machining speed caused by factors as machining model and machining machine.
- Tool damage may progress rapidly near the end of the tool life.



### Advisory for Safe Use of UNIMAX Tungsten Carbide End Mills

Correct application and operation is strongly advised to avoid clogging, abrasion, etc., that could cause serious accidents or injuries. Ignition or sparks generated during milling could lead to fire or extreme damage to the work piece. End Mills are made with very sharp cutting edges and must be handled with extra care.

- Never touch the cutting edge with your bare hands, as this could cause serious injury. Special caution is required when opening the package.
- Dropping the tool could cause breakage or flying debris, leading to serious injury.
- During milling, unexpected impact or shock on the tool could cause breakage or flying debris. Ensure to use protective items such as safety glasses and a face guard.
- For best results, fine parameter adjustment may be required, depending on the materials; milling shape and strategy; machine rigidity and spindle capability.
- Use a machine that has high rigidity and generates a low level of vibration.
- Do not use flammable cutting oils.

#### Advisory for regrinding UNIMAX Tungsten Carbide End Mills

- Never regrind the tool without wearing safety glasses and a face guard.

 0120-60-2620

<https://www.uniontool.co.jp>

Price & Specifications are subject to change without notice.