TEHNA PLUS - YU
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privredno društvo za proizvodnju i export - import

# CUTTING TOOLS

## solutions for turbine disks

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# CONTENTS



The company Tehna Plus developed the profile tools for slotting bladed integrated disks in aerospace industries.
Profile mills make it possible to produce complex shapes slots on CNC machines. Milling operation allows to replace broaching one which significantly reduces the tool costs and amount of special equipment for producing slots in bladed integrated disks.
The tolerance is 0,005 mm which makes it possible to achieve high quality and accuracy of machining surfaces.
The tool has a unique feature. It is the patented technology of internal coolant supply which provides high cooling efficiency of cutting edge, longer tool life and productivity increasing. The mills are coated with a special PVD coating for preventing cutting edge from chips and increasing wear resistance.

# GUIDELINE TO ICONS

## Tool material

HM — Solid carbide tool

HSS — The HSS tool material

## Slotting

R — Intended for rough slotting

F — Intended for finish machining

## Coating

AlTiN — The coating is AlTiN

TiSiXN — The coating is TiSiXN (Tmax-11000°)

## Angle

20° — Spiral angle

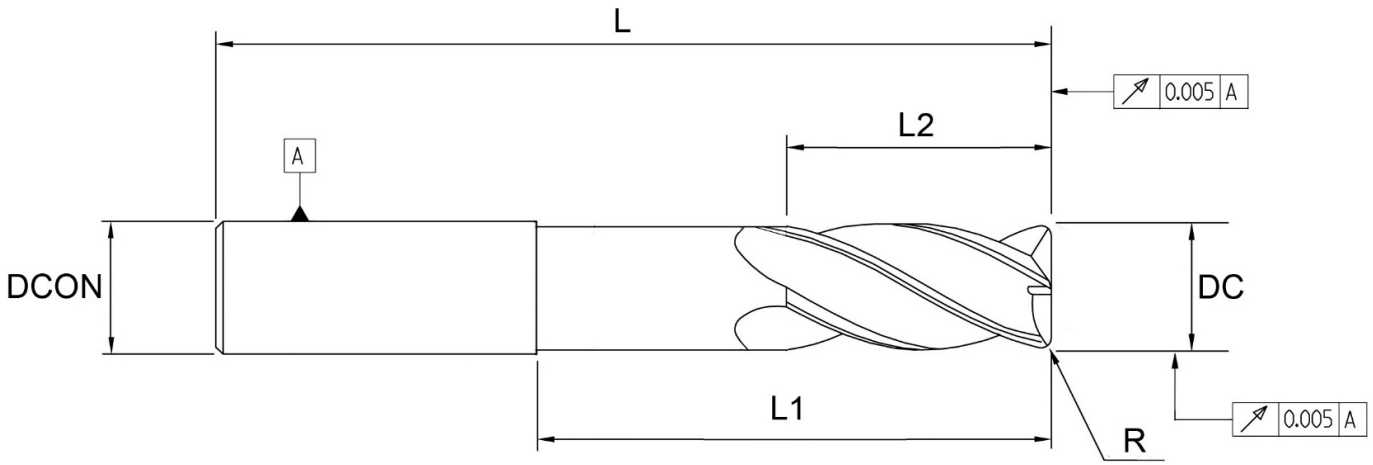
# ENDMILLS

HM | AlTiN | TiSiXN

- The profile deviation is no higher than ±0.005 mm
- The radial runout is no higher than 0,005 mm

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| | ◎ | | | ◎ | ◎ | |




| Article | DC | DCON | L | L1 | L2 | R | ZEFP |
|---|---|---|---|---|---|---|---|
| 20165-04-0458-01500-R004-T | 4,58 | 6 | 50 | 20 | 15 | 0,4 | 4 |
| 20165-04-0517-01500-R005-T | 5,17 | 6 | 50 | 20 | 15 | 0,5 | 4 |
| 20165-04-0527-00800-R008-T | 5,27 | 8 | 60 | 30 | 8 | 0,8 | 4 |
| 20165-04-0617-01000-R008-T | 6,17 | 8 | 60 | 30 | 10 | 0,8 | 4 |
| 20165-04-0627-01500-R004-T | 6,27 | 8 | 65 | 35 | 15 | 0,4 | 4 |
| 20165-04-0658-01500-R006-T | 6,58 | 8 | 65 | 35 | 15 | 0,6 | 4 |
| 20165-04-0717-01700-R006-T | 7,17 | 8 | 65 | 35 | 17 | 0,6 | 4 |
| 20165-04-0758-02000-R008-T | 7,58 | 10 | 70 | 38 | 20 | 0,8 | 4 |
| 20165-04-0828-02200-R010-T | 8,28 | 10 | 70 | 38 | 22 | 1,0 | 4 |
| 20165-04-0878-02500-R008-T | 8,78 | 10 | 70 | 38 | 25 | 0,8 | 4 |
| 20165-04-0928-02500-R006-T | 9,28 | 10 | 70 | 38 | 25 | 0,6 | 4 |
| 20165-04-0958-02700-R004-T | 9,58 | 12 | 75 | 40 | 27 | 0,4 | 4 |
| 20165-04-1018-02700-R006-T | 10,18 | 12 | 75 | 40 | 27 | 0,6 | 4 |
| 20165-04-1057-02700-R008-T | 10,57 | 12 | 75 | 40 | 27 | 0,8 | 4 |
| 20169-04-1200-01300-T | 14,00 | 14 | 110 | - | 10 | 13,0 | 4 |

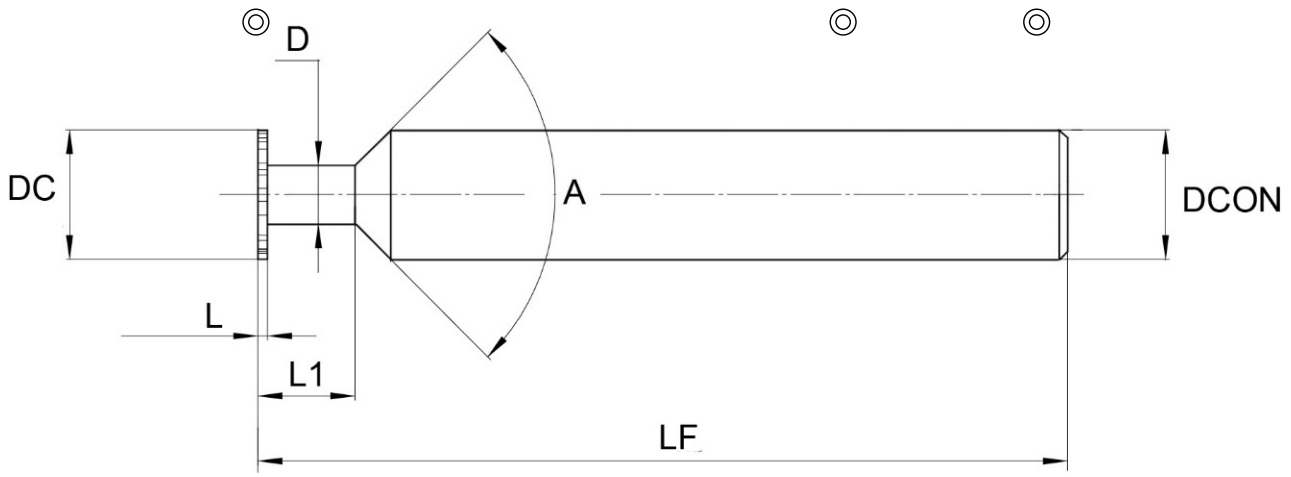
# T-SLOTTING ENDMILLS

HM | AlTiN | TiSiXN

- The profile deviation is no higher than ±0.01 mm
- The radial runout is no higher than 0,01 mm

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums




| Article | DC | D | DCON | LF | L | L1 | A | ZEFP |
|---|---|---|---|---|---|---|---|---|
| 21010-12-0800-00060 | 8 | 3,6 | 8 | 50 | 0,6 | 6 | 90 | 12 |
| 21010-12-0800-00120 | 8 | 3,6 | 8 | 50 | 1,2 | 7 | 90 | 12 |
| 21010-12-0800-00180 | 8 | 3,6 | 8 | 50 | 1,8 | 8 | 90 | 12 |
| 21010-12-0800-00240 | 8 | 3,6 | 8 | 50 | 2,4 | 8 | 90 | 12 |
| 21010-12-0800-00300 | 8 | 3,6 | 8 | 50 | 3,0 | 10 | 90 | 12 |
| 21010-14-1000-00250 | 10 | 5,1 | 10 | 60 | 2,5 | 7 | 90 | 14 |
| 21010-14-1000-00310 | 10 | 5,1 | 10 | 60 | 3,1 | 7 | 90 | 14 |
| 21010-14-1000-00370 | 10 | 5,1 | 10 | 60 | 3,7 | 9 | 90 | 14 |
| 21010-14-1000-00430 | 10 | 5,1 | 10 | 60 | 4,3 | 9 | 90 | 14 |
| 21010-16-1200-00330 | 12 | 6,3 | 12 | 70 | 3,3 | 9 | 80 | 16 |
| 21010-16-1200-00390 | 12 | 6,3 | 12 | 70 | 3,9 | 10 | 80 | 16 |
| 21010-16-1200-00440 | 12 | 6,3 | 12 | 70 | 4,4 | 10 | 80 | 16 |
| 21010-16-1200-00480 | 12 | 6,3 | 12 | 70 | 4,8 | 12 | 80 | 16 |
| 21010-16-1200-00530 | 12 | 6,3 | 12 | 70 | 5,3 | 12 | 80 | 16 |
| 21010-16-1200-00580 | 12 | 6,3 | 12 | 70 | 5,8 | 14 | 80 | 16 |

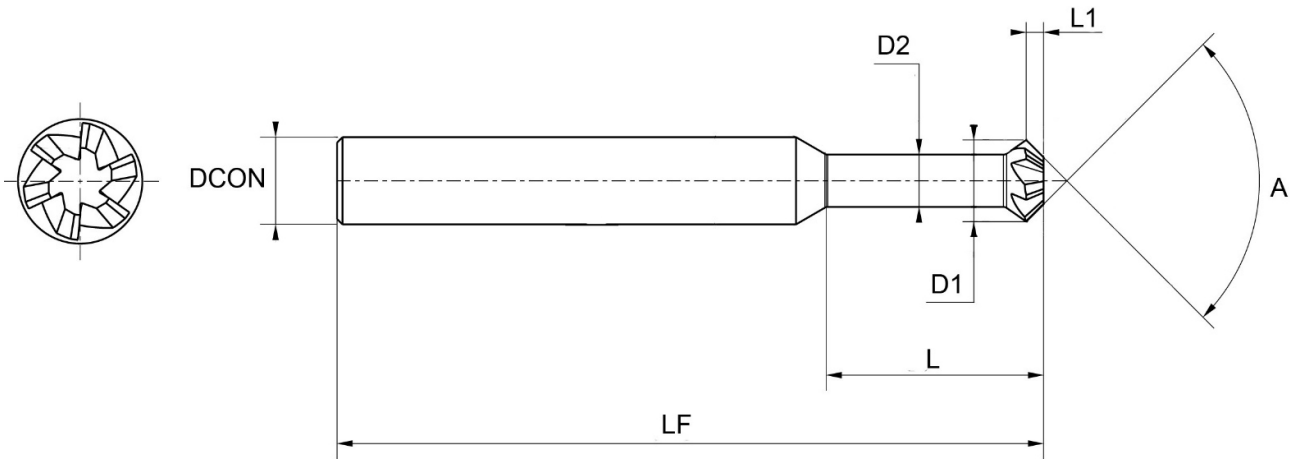
# COUNTERSINKS

HM | AlTiN | TiSiXN

- The profile deviation is no higher than ±0.01 mm
- The radial runout is no higher than 0,01 mm

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| | ◎ | | | ◎ | ◎ | |




| Article | D1 | D2 | DCON | LF | L | L1 | A | ZEFP |
|---|---|---|---|---|---|---|---|---|
| 20413-04-0450-00095-T | 4,5 | 3,0 | 6 | 65 | 12 | 0,90 | 90 | 4 |
| 20413-05-0550-00095-T | 5,5 | 3,0 | 6 | 65 | 15 | 0,95 | 90 | 5 |
| 20413-06-0600-00095-T | 6,0 | 3,6 | 6 | 65 | 15 | 0,95 | 90 | 6 |
| 20413-06-0750-00160-T | 7,5 | 4,8 | 8 | 65 | 20 | 1,60 | 90 | 6 |
| 20413-06-0800-00170-T | 8,0 | 5,8 | 8 | 65 | 20 | 1,70 | 90 | 6 |
| 20413-06-0850-00200-T | 8,5 | 5,8 | 10 | 65 | 23 | 2,00 | 60 | 6 |
| 20413-08-0900-00200-T | 9,0 | 6,8 | 10 | 65 | 23 | 2,00 | 60 | 8 |
| 20413-08-0950-00250-T | 9,5 | 6,8 | 10 | 65 | 24 | 2,50 | 60 | 8 |
| 20413-08-1000-00300-T | 10,0 | 7,8 | 10 | 65 | 24 | 3,00 | 60 | 8 |
| 20413-08-1050-00350-T | 10,5 | 7,8 | 12 | 65 | 25 | 3,50 | 60 | 8 |
| 20413-08-1100-00450-T | 11,0 | 7,8 | 12 | 65 | 25 | 4,50 | 60 | 8 |
| 20413-08-1150-00450-T | 11,5 | 7,8 | 12 | 65 | 25 | 4,50 | 60 | 8 |
| 20413-12-1200-00450-T | 12,0 | 8,8 | 12 | 75 | 25 | 4,50 | 60 | 12 |
| 20413-12-1250-00490-T | 12,5 | 8,8 | 14 | 75 | 27 | 4,90 | 60 | 12 |
| 20413-12-1300-00550-T | 13,0 | 8,8 | 14 | 75 | 27 | 5,50 | 60 | 12 |

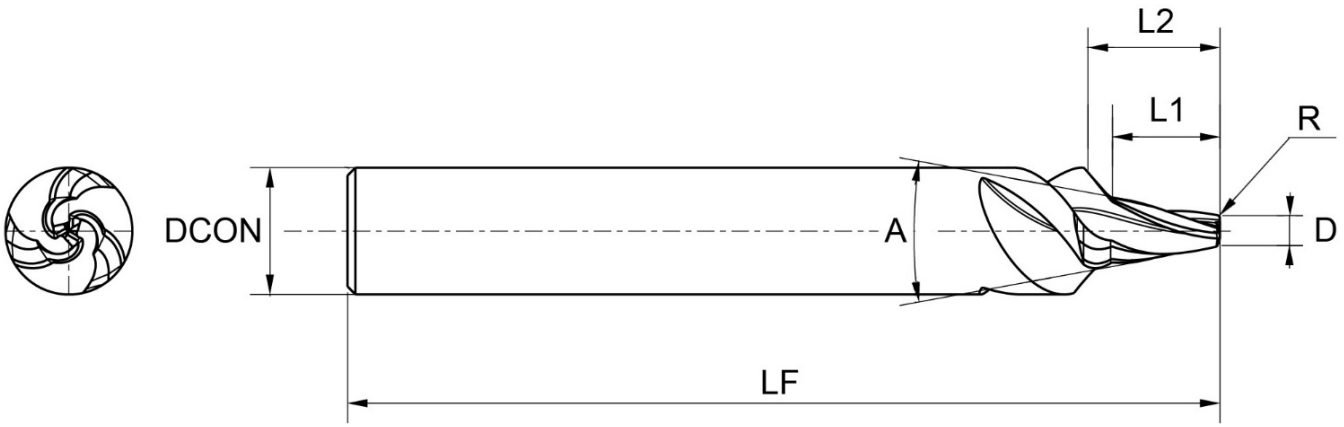
# PROFILE ENDMILLS FOR ROUGH SLOTTING

HM | AlTiN | TiSiXN | R | 20°-35°

- The profile deviation is no higher than ±0.01 mm
- The radial runout is no higher than 0,01 mm

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| | ◎ | | | ◎ | ◎ | |




| Article | D | DCON | LF | L1 | L2 | R | A |
|---|---|---|---|---|---|---|---|
| 20169-03-0193-00681-R002-T | 1,93 | 8 | 55 | 6,81 | 8,59 | 0,2 | 20° |
| 20169-03-0195-00900-R003-T | 1,95 | 8 | 55 | 9,00 | 10,00 | 0,3 | 20° |
| 20169-03-0200-00916-R005-T | 2,00 | 8 | 55 | 9,16 | 11,17 | 0,5 | 20° |
| 20169-03-0250-00100-R005-T | 2,50 | 8 | 55 | 10,00 | 12,00 | 0,5 | 23° |
| 20169-03-0360-00113-R006-T | 3,60 | 8 | 55 | 11,30 | 12,50 | 0,6 | 23° |
| 20169-03-0420-00118-R006-T | 4,20 | 8 | 55 | 11,80 | 13,00 | 0,6 | 25° |
| 20169-03-0517-00150-R006-T | 5,17 | 10 | 65 | 15,00 | 13,00 | 0,6 | 25° |
| 20169-03-0600-00160-R007-T | 6,00 | 10 | 65 | 16,00 | 13,65 | 0,7 | 25° |
| 20169-03-0650-00160-R007-T | 6,50 | 12 | 65 | 16,00 | 13,65 | 0,7 | 25° |
| 20169-03-0686-00165-R008-T | 6,86 | 14 | 65 | 16,50 | 14,00 | 0,8 | 27° |
| 20169-03-0776-00165-R009-T | 7,76 | 16 | 65 | 16,50 | 14,54 | 0,9 | 27° |
| 20169-03-0860-00183-R009-T | 8,60 | 16 | 65 | 18,30 | 15,50 | 0,9 | 28° |
| 20169-03-0900-00185-R010-T | 9,00 | 16 | 65 | 18,50 | 15,89 | 1,0 | 28° |
| 20169-03-0977-00185-R010-T | 9,77 | 16 | 65 | 19,50 | 16,00 | 1,0 | 28° |
| 20169-03-1000-00185-R010-T | 9,00 | 18 | 65 | 18,50 | 15,89 | 1,0 | 28° |

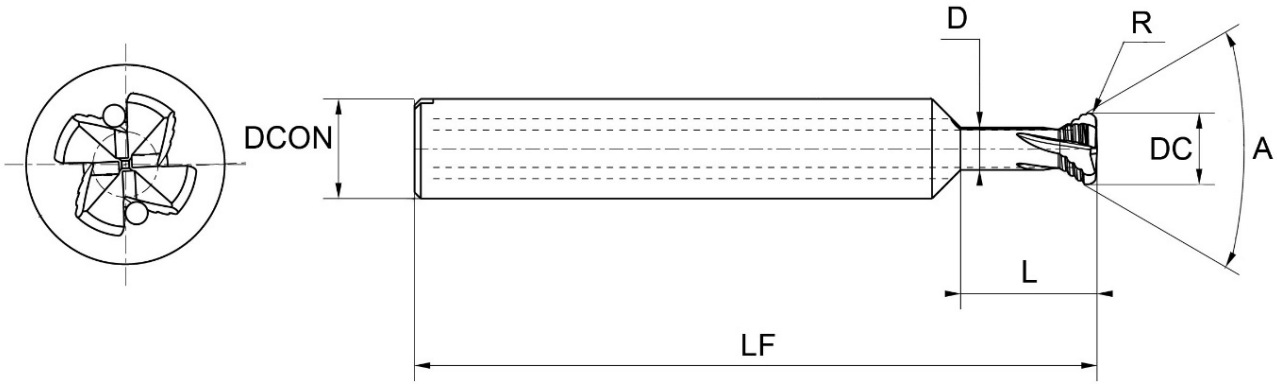
# DOVETAIL SLOT ENDMILLS

HM | AlTiN | TiSiXN | R | 20°-35°

- The profile deviation is no higher than ±0.005 mm
- The radial runout is no higher than 0,01 mm
- Internal coolant

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| | ◎ | | | ◎ | ◎ | |




| Article | DC | D | DCON | LF | L | R | A |
|---|---|---|---|---|---|---|---|
| 20169-04-0450-00374-R010-T | 4,50 | 3,2 | 8 | 55 | 7,00 | 1,00 | 55° |
| 20169-04-0510-00374-R010-T | 5,10 | 3,40 | 8 | 55 | 9,00 | 1,00 | 55° |
| 20169-04-0524-00374-R010-T | 5,24 | 3,40 | 8 | 55 | 9,00 | 1,00 | 60° |
| 20169-04-0535-00374-R010-T | 5,35 | 3,40 | 8 | 55 | 10,00 | 1,00 | 60° |
| 20169-04-0549-00374-R010-T | 5,49 | 3,40 | 8 | 55 | 10,00 | 1,00 | 60° |
| 20169-04-0560-00374-R010-T | 5,60 | 3,40 | 8 | 55 | 11,00 | 1,00 | 60° |
| 20169-04-0574-00312-R008-T | 5,74 | 3,40 | 8 | 55 | 11,00 | 0,80 | 60° |
| 20169-04-0586-00312-R008-T | 5,86 | 5,20 | 10 | 55 | 12,50 | 0,80 | 70° |
| 20169-04-0859-00374-R010-T | 8,59 | 5,20 | 10 | 55 | 17,50 | 1,00 | 70° |
| 20169-03-1462-02000-R016-A | 14,62 | 8,70 | 16 | 80 | 20,00 | 1,60 | 80° |
| 20169-03-1848-02500-R021-A | 18,48 | 11,00 | 16 | 80 | 25,00 | 2,10 | 80° |
| 20169-03-2349-03000-R027-A | 23,49 | 14,20 | 20 | 90 | 30,00 | 2,75 | 80° |
| 20169-03-3390-03800-R041-A | 33,90 | 20,40 | 25 | 100 | 38,00 | 4,10 | 80° |
| 20169-03-3390-04500-R041-A | 33,90 | 18,00 | 32 | 130 | 45,00 | 4,10 | 80° |
| 20169-03-3775-04200-R046-A | 37,75 | 22,8 | 32 | 125 | 42,00 | 4,60 | 80° |
| 20169-03-3875-04200-R048-A | 38,75 | 23,00 | 32 | 125 | 43,00 | 4,80 | 80° |

# DOVETAIL SLOT ENDMILLS

HM | AlTiN | TiSiXN | F | 20°-35°

- The profile deviation is no higher than ±0.005 mm
- The radial runout is no higher than 0,01 mm
- Internal coolant

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When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

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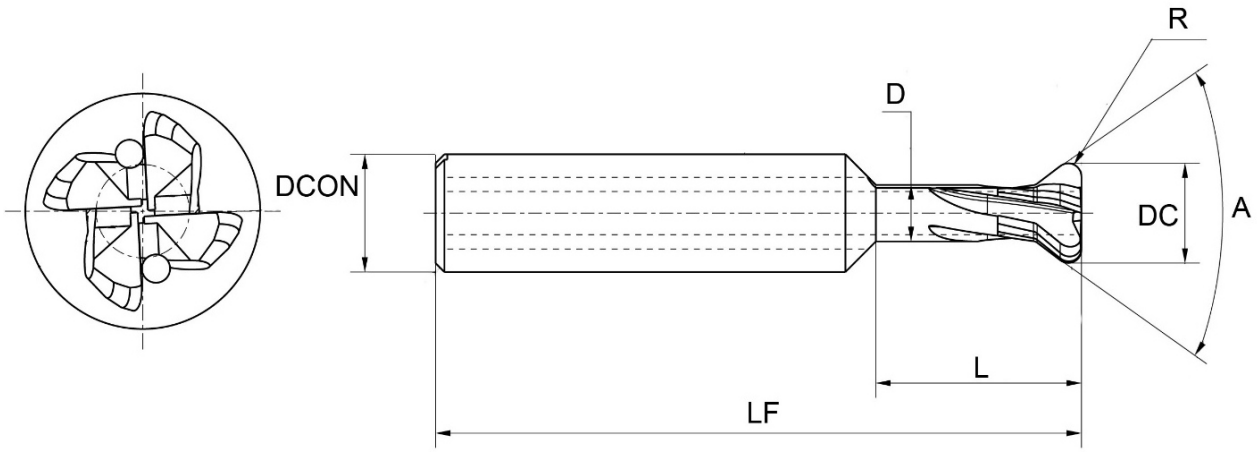
|---|---|---|---|---|---|---|
| ◎ | | | | ◎ | ◎ | |




| Article | DC | D | DCON | LF | L | R | A |
|---|---|---|---|---|---|---|---|
| 20169-04-0400-00560-R010-T | 4,00 | 3,00 | 8 | 55 | 7 | 1,00 | 60° |
| 20169-04-0410-00560-R010-T | 4,10 | 3,00 | 8 | 55 | 7 | 1,00 | 60° |
| 20169-04-0450-00560-R010-T | 4,50 | 3,00 | 8 | 55 | 9 | 1,00 | 60° |
| 20169-04-0500-00560-R010-T | 5,00 | 3,00 | 8 | 55 | 9 | 1,00 | 60° |
| 20169-04-0515-00560-R010-T | 5,15 | 3,20 | 8 | 55 | 9 | 1,00 | 60° |
| 20169-04-0557-00560-R010-T | 5,57 | 3,20 | 8 | 55 | 10 | 1,00 | 60° |
| 20169-04-0568-00560-R010-T | 5,68 | 3,20 | 8 | 55 | 11 | 1,00 | 60° |
| 20169-04-0628-00560-R010-T | 6,28 | 3,20 | 8 | 55 | 11 | 1,00 | 70° |
| 20169-04-0715-00713-R012-T | 7,15 | 4,50 | 10 | 55 | 15,5 | 1,20 | 70° |
| 20169-04-1450-02000-R012-A | 14,50 | 8,53 | 16 | 80 | 20,0 | 1,20 | 80° |
| 20169-04-1836-02500-R025-A | 18,36 | 10,84 | 16 | 80 | 25,0 | 2,50 | 80° |
| 20169-04-2337-03000-R031-A | 23,37 | 14,04 | 20 | 90 | 30,0 | 3,15 | 80° |
| 20169-04-3378-03800-R045-A | 33,78 | 20,25 | 25 | 100 | 38,0 | 4,50 | 80° |
| 20169-04-3378-07036-R045-A | 33,78 | 20,25 | 32 | 160 | 70,3 | 4,50 | 80° |
| 20169-04-3762-05500-R050-A | 37,62 | 22,65 | 32 | 125 | 55,00 | 5,00 | 80° |
| 20169-04-3862-05600-R050-A | 38,62 | 23,50 | 32 | 125 | 56,00 | 5,00 | 80° |

# PROFILE ENDMILLS FOR FINISH SLOTTING

HM | AlTiN | TiSiXN

F | R | 20°-35°

- The profile deviation is no higher than ±0.005 mm
- The radial runout is no higher than 0,01 mm
- Internal coolant

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

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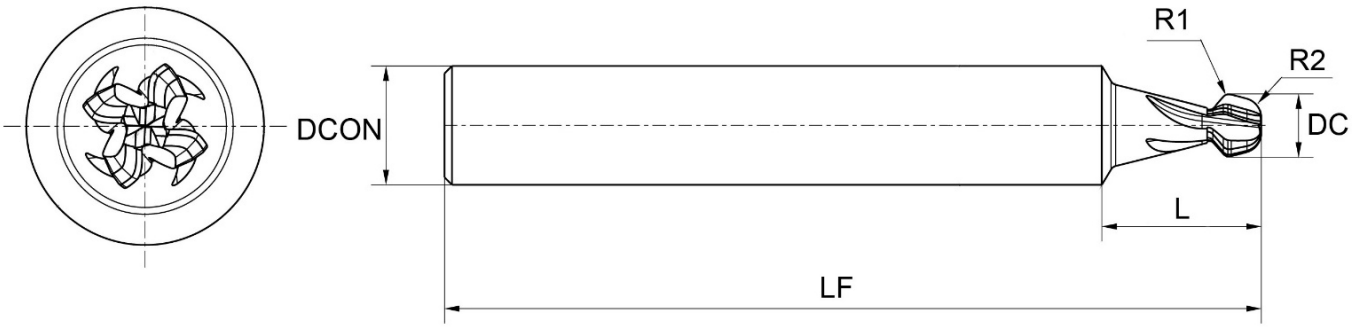
|---|---|---|---|---|---|---|
| ◎ | | | | ◎ | ◎ | |




| Article | DC | DCON | LF | L | R1 | R2 | ZEFP |
|---|---|---|---|---|---|---|---|
| 20169-04-0417-00287-R006-T | 4,17 | 8 | 55 | 12,59 | 0,60 | 0,70 | 4 |
| 20169-04-0375-00229-R004-T | 3,75 | 8 | 55 | 12,90 | 0,40 | 1,40 | 4 |
| 20169-04-0426-00212-R007-T | 4,26 | 8 | 55 | 11,77 | 0,70 | 0,30 | 4 |
| 20169-04-0398-00161-R004-T | 3,98 | 8 | 55 | 11,48 | 0,90 | 0.45 | 4 |
| 20169-04-0430-00305-R008-T | 4,30 | 8 | 55 | 12,77 | 0,77 | 0,77 | 4 |
| 20169-04-0399-00303-R004-T | 3,99 | 8 | 55 | 12,90 | 0,88 | 1,38 | 4 |
| 20169-04-0440-00304-R004-T | 4,40 | 8 | 55 | 10,74 | 0,40 | 1,40 | 4 |
| 20169-03-0440-00350-R004-T | 4,40 | 8 | 55 | 10,80 | 0,40 | 1,40 | 3 |
| 20169-04-0440-00433-R008-T | 4,40 | 8 | 55 | 10,99 | 0,80 | 1,40 | 4 |
| 20169-03-0443-00430-R008-T | 4,43 | 8 | 55 | 10,00 | 0,80 | 1,40 | 3 |
| 20169-04-0445-00295-R008-T | 4,45 | 8 | 55 | 9,62 | 0,80 | 0,40 | 4 |
| 20169-03-0450-00295-R008-T | 4,50 | 8 | 55 | 9,62 | 0,80 | 0,40 | 3 |
| 20169-04-0468-00500-R013-T | 4,68 | 8 | 55 | 12,80 | 1,30 | 1,30 | 4 |
| 20169-03-0480-00500-R013-T | 4,80 | 8 | 55 | 14,80 | 1,30 | 1,30 | 3 |
| 20169-04-0506-00253-R007-T | 5,06 | 8 | 55 | 12,08 | 0,72 | 0,60 | 4 |
| 20169-03-0510-00253-R007-T | 5,10 | 8 | 55 | 12,60 | 0,72 | 0,60 | 3 |
| 20169-04-0516-00500-R007-T | 5,16 | 8 | 55 | 13,60 | 0,72 | 1,36 | 4 |
| 20169-03-0520-00500-R007-T | 5,20 | 8 | 55 | 15,60 | 0,72 | 1,36 | 3 |

# PROFILE ENDMILLS FOR FINISH SLOTTING

HM | AlTiN | TiSiXN

F | R | 20°-35°

- The profile deviation is no higher than ±0.005 mm
- The radial runout is no higher than 0,01 mm
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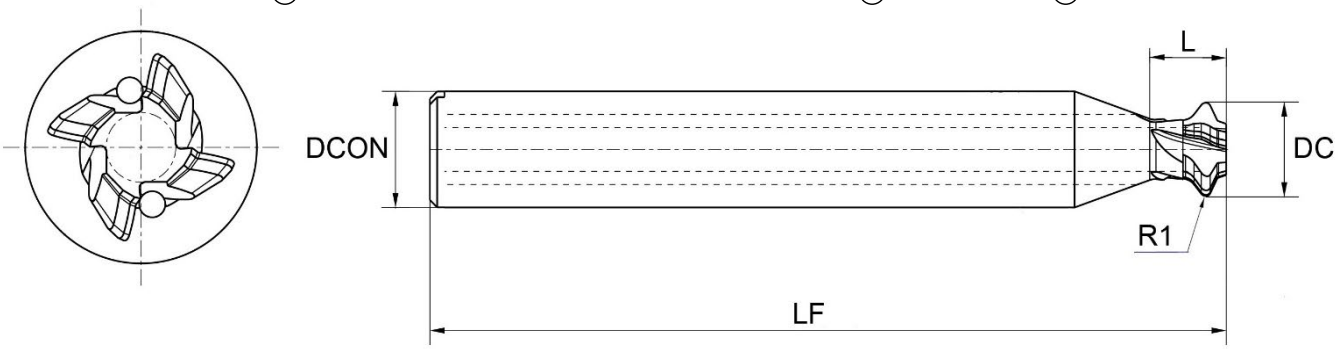
|---|---|---|---|---|---|---|
| ◎ | | | | ◎ | ◎ | |




| Article | DC | DCON | LF | L | R1 | ZEFP |
|---|---|---|---|---|---|---|
| 20169-04-0350-00200-R005-T | 3,50 | 8 | 55 | 6,00 | 0,57 | 4 |
| 20169-03-0380-00200-R006-T | 3,80 | 8 | 55 | 7,00 | 0,60 | 3 |
| 20169-04-0400-00200-R006-T | 4,00 | 8 | 55 | 7,00 | 0,60 | 4 |
| 20169-03-0420-00200-R007-T | 4,20 | 8 | 60 | 6,00 | 0,70 | 3 |
| 20169-04-0434-00200-R005-T | 4,34 | 8 | 60 | 9,00 | 0,57 | 4 |
| 20169-03-0450-00200-R005-T | 4,50 | 8 | 60 | 9,00 | 0,57 | 3 |
| 20169-04-0490-00200-R006-T | 4,90 | 8 | 60 | 10,00 | 0,60 | 4 |
| 20169-03-0500-00200-R006-T | 5,00 | 8 | 60 | 9,00 | 0,60 | 3 |
| 20169-04-0544-00400-R003-T | 5,44 | 8 | 60 | 7,50 | 0,37 | 4 |
| 20169-03-0600-00400-R003-T | 6,00 | 8 | 60 | 7,50 | 0,37 | 3 |
| 20169-04-0635-00300-R003-T | 6,35 | 8 | 55 | 10,47 | 0,37 | 4 |
| 20169-03-0640-00400-R003-T | 6,40 | 8 | 60 | 10,50 | 0,37 | 3 |
| 20169-04-0669-00419-R003-T | 6,69 | 8 | 60 | 5,00 | 0,37 | 4 |
| 20169-03-0700-00400-R003-T | 7,00 | 8 | 60 | 12,50 | 0,37 | 3 |
| 20169-04-0764-00347-R004-T | 7,64 | 8 | 55 | 8,98 | 0,41 | 4 |
| 20169-03-0795-00347-R006-T | 7,95 | 8 | 55 | 16,98 | 0,60 | 3 |
| 20169-04-0800-00347-R006-T | 8,00 | 8 | 55 | 17,90 | 0,60 | 4 |
| 20169-04-0800-00347-R008-T | 8,00 | 8 | 55 | 17,90 | 0,80 | 4 |

# PROFILE ENDMILLS FOR FINISH SLOTTING

HM | AlTiN | TiSiXN

F | R | 20°-35°

- The profile deviation is no higher than ±0.005 mm
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There are 2 options of tools manufacturing: with or without internal coolant supply
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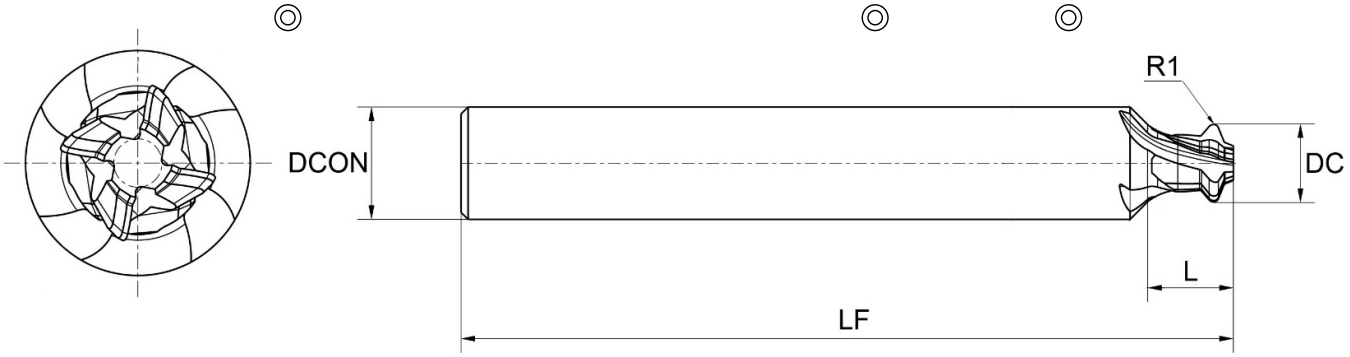
|---|---|---|---|---|---|---|
| ◎ | | | | ◎ | ◎ | |




| Article | DC | DCON | LF | L | R1 | ZEFP |
|---|---|---|---|---|---|---|
| 20169-04-0486-00399-R004-T | 4,86 | 8 | 55 | 8,70 | 0,45 | 4 |
| 20169-03-0300-00260-R002-T | 3,00 | 6 | 55 | 3,00 | 0,28 | 3 |
| 20169-03-0325-00260-R002-T | 3,25 | 6 | 55 | 4,00 | 0,28 | 3 |
| 20169-03-0315-00260-R002-T | 3,15 | 6 | 55 | 4,00 | 0,28 | 3 |
| 20169-03-0486-00289-R004-T | 4,86 | 6 | 60 | 14 | 0,36 | 3 |
| 20169-03-0490-00289-R004-T | 4,90 | 6 | 60 | 14 | 0,40 | 3 |
| 20169-04-0506-00380-R004-T | 5,06 | 8 | 55 | 7,50 | 0,42 | 4 |
| 20169-04-0510-00380-R004-T | 5,10 | 8 | 55 | 8,50 | 0,42 | 4 |
| 20169-04-0529-00277-R004-T | 5,29 | 8 | 55 | 11,3 | 0,37 | 4 |
| 20169-04-0565-00277-R005-T | 5,65 | 8 | 55 | 12,3 | 0,50 | 4 |
| 20169-04-0596-00300-R004-T | 5,96 | 8 | 55 | 8,70 | 0,42 | 4 |
| 20169-04-0610-00300-R005-T | 6,10 | 8 | 55 | 10,70 | 0,50 | 4 |
| 20169-04-0629-00365-R004-T | 6,29 | 8 | 55 | 10,18 | 0,41 | 4 |
| 20169-04-0640-00365-R005-T | 6,40 | 8 | 55 | 10,18 | 0,50 | 4 |
| 20169-04-0687-00300-R004-T | 6,87 | 8 | 55 | 6,00 | 0,42 | 4 |
| 20169-04-0561-00396-R004-T | 5,61 | 8 | 55 | 7,36 | 0,40 | 4 |

# PROFILE ENDMILLS FOR FINISH SLOTTING

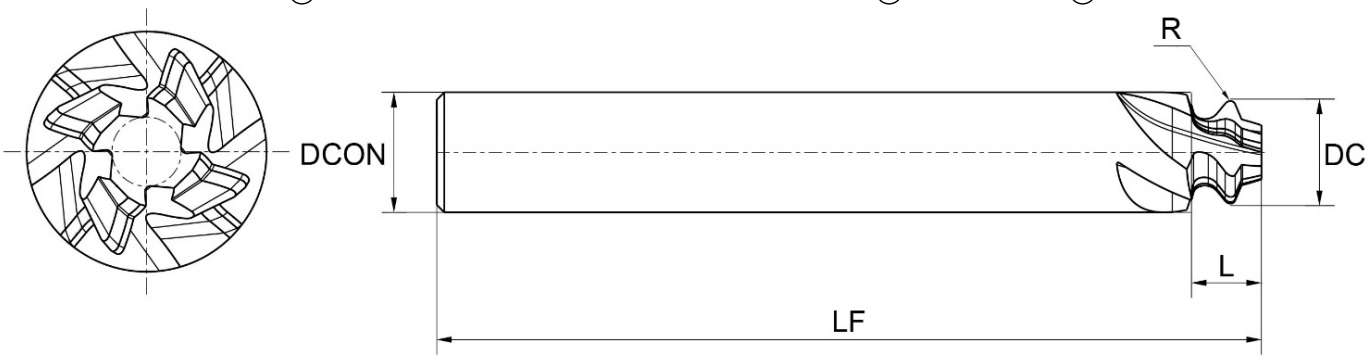
HM | AlTiN | TiSiXN

F | R | 20°-35°

- The profile deviation is no higher than ±0.005 mm
- The radial runout is no higher than 0,01 mm
- Internal coolant

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| ◎ | | | | ◎ | ◎ | |




| Article | DC | DCON | LF | L | R | ZEFP |
|---|---|---|---|---|---|---|
| 20169-03-0310-00286-R002-T | 3,10 | 8 | 60 | 2,51 | 0,28 | 3 |
| 20169-03-0350-00286-R003-T | 3,50 | 8 | 60 | 2,65 | 0,30 | 3 |
| 20169-03-0387-00286-R002-T | 3,87 | 8 | 60 | 2,51 | 0,28 | 3 |
| 20169-03-0400-00286-R003-T | 4,00 | 8 | 60 | 3,00 | 0,30 | 3 |
| 20169-03-0414-00180-R003-T | 4,14 | 6 | 60 | 1,80 | 0,31 | 3 |
| 20169-03-0445-00280-R003-T | 4,45 | 6 | 60 | 2,80 | 0,31 | 3 |
| 20169-03-0510-00380-R003-T | 5,10 | 6 | 60 | 3,80 | 0,31 | 3 |
| 20169-04-0652-00486-R004-T | 6,52 | 8 | 55 | 4,86 | 0,44 | 4 |
| 20169-04-0710-00467-R003-T | 7,10 | 8 | 55 | 4,07 | 0,40 | 4 |
| 20169-04-0775-00396-R004-T | 7,75 | 8 | 55 | 4,50 | 0,40 | 4 |
| 20169-04-0795-00396-R004-T | 7,95 | 8 | 55 | 5,00 | 0,40 | 4 |
| 20169-04-0800-00396-R004-T | 8,00 | 8 | 55 | 6,50 | 0,40 | 4 |
| 20169-04-0800-00396-R005-T | 8,50 | 10 | 65 | 7,50 | 0,50 | 4 |
| 20169-04-0800-00396-R006-T | 8,50 | 10 | 65 | 7,50 | 0,60 | 4 |
| 20169-04-0930-00396-R006-T | 9,30 | 10 | 65 | 9,50 | 0,60 | 4 |
| 20169-04-0930-00396-R006-T | 9,30 | 10 | 65 | 9,50 | 0,80 | 4 |

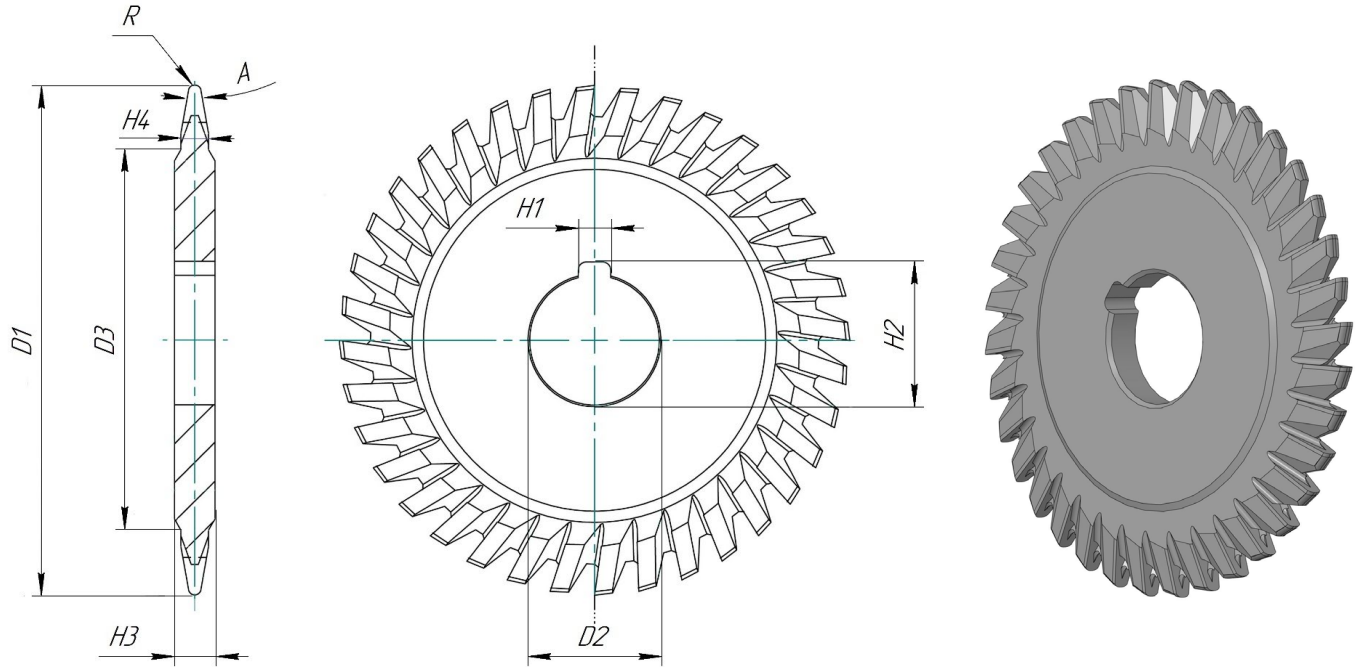
# PROFILE SIDE MILLS

HM | AlTiN | TiSiXN | F | R

- The profile deviation is no higher than ±0.005 mm
- The radial runout is no higher than 0,01 mm

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| | ◎ | | | ◎ | ◎ | |




| Article | D1 | D2 | D3 | H1 | H2 | H3 | H4 | A | R | ZEFP |
|---|---|---|---|---|---|---|---|---|---|---|
| 21160-36-6300-00600-R006-T | 63 | 16 | 45 | 4 | 17,7 | 5,0 | 3,40 | 20⁰ | 0,8 | 36 |
| 21160-36-6300-00610-R006-T | 63 | 16 | 45 | 4 | 17,7 | 5,0 | 3,40 | 25⁰ | 0,8 | 36 |
| 21160-36-6300-00590-R010-T | 63 | 16 | 42 | 4 | 17,7 | 5,0 | 4,00 | 20⁰ | 1,0 | 36 |
| 21160-36-6300-00610-R006-T | 63 | 16 | 45 | 4 | 17,7 | 5,0 | 3,40 | 25⁰ | 1,0 | 36 |
| 21160-18-6300-00870-R010-T | 63 | 16 | - | 4 | 17,7 | 6,2 | 6,20 | 20⁰ | 1,0 | 18 |
| 21160-36-6300-00650-R006-T | 63 | 16 | 50 | 4 | 17,7 | 5,0 | 4,50 | 27⁰ | 1,2 | 36 |
| 21160-36-6300-00605-R006-T | 63 | 16 | 44 | 4 | 17,7 | 6,0 | 4,86 | 30⁰ | 0,6 | 36 |
| 21160-36-6300-00657-R006-T | 63 | 16 | 51 | 4 | 17,7 | 5,7 | 4,60 | 27⁰ | 1,4 | 28 |
| 21160-20-8000-00497-R001-T | 80 | 22 | 52 | 6 | 26,4 | 8,0 | 4,51 | 30⁰ | - | 36 |
| 21160-20-8000-00590-R001-T | 80 | 22 | 52 | 6 | 26,4 | 8,5 | 4,60 | 32⁰ | 2,0 | 36 |
| 21160-22-8000-00590-R010-T | 80 | 22 | 59 | 6 | 26,4 | 7,0 | 4,96 | 40⁰ | 0,6 | 22 |
| 21160-22-8000-00580-R005-T | 80 | 22 | 52 | 6 | 26,4 | 8,0 | 5,20 | 36⁰ | 0,5 | 22 |
| 21160-24-8000-00913-R010-T | 80 | 22 | 61 | 6 | 26,4 | 5,2 | 5,20 | 22⁰ | 1,0 | 24 |

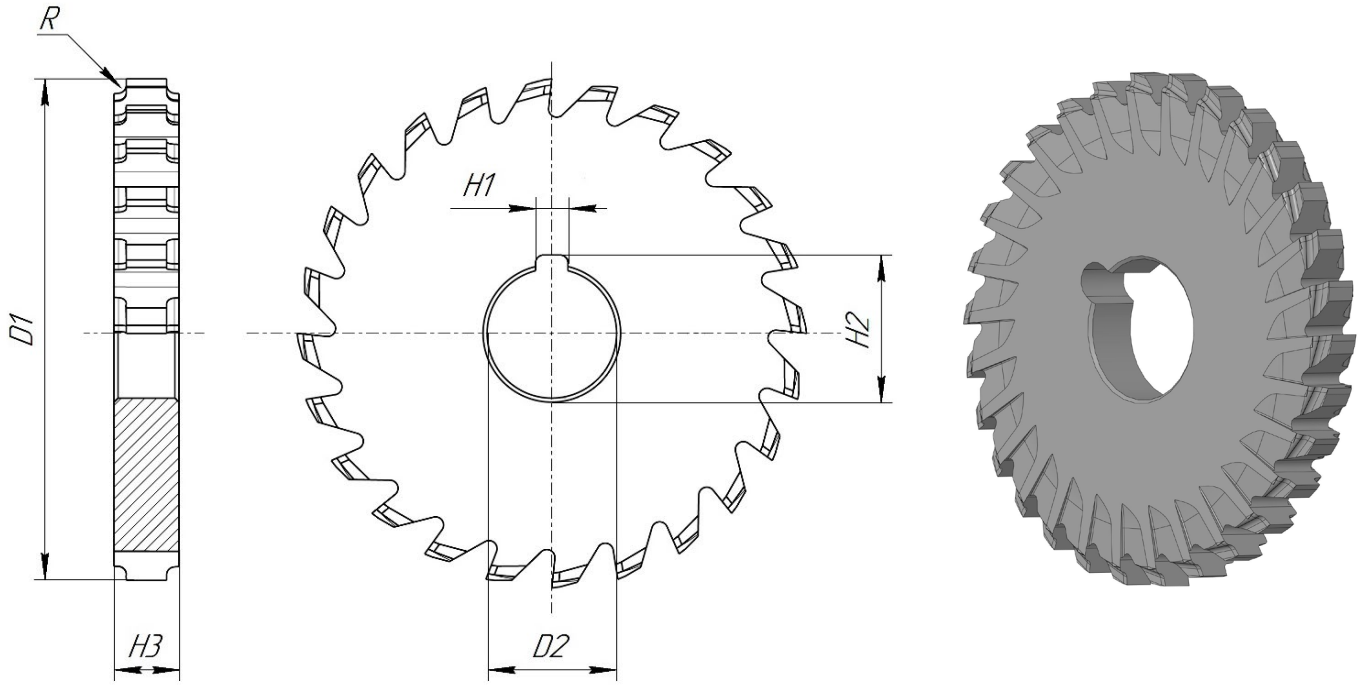
# PROFILE SIDE MILLS

HM | AlTiN | TiSiXN | F | R

- The profile deviation is no higher than ±0.005 mm
- The radial runout is no higher than 0,01 mm

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| | ◎ | | | ◎ | ◎ | |




| Article | D1 | D2 | H1 | H2 | H3 | R1 | ZEFP |
|---|---|---|---|---|---|---|---|
| 20160-24-6300-00184-R004-T | 63 | 16 | 4 | 17,7 | 8,00 | 1,01 | 24 |
| 20160-24-6300-00190-R004-T | 63 | 16 | 4 | 17,7 | 8,50 | 1,50 | 24 |
| 21160-26-8000-00135-R012-T | 80 | 22 | 6 | 26,4 | 9,00 | 1,22 | 30 |
| 21160-30-8000-00170-R012-T | 80 | 22 | 6 | 26,4 | 9,50 | 1,25 | 30 |
| 21160-20-8000-00110-R003-T | 80 | 22 | 6 | 26,4 | 5,64 | 0,30 | 20 |
| 21160-20-8000-00225-R003-T | 80 | 22 | 6 | 26,4 | 7,00 | 1,30 | 20 |
| 21160-20-8000-00110-T | 80 | 22 | 6 | 26,4 | 6,00 | 0,30 | 20 |
| 21160-25-8000-00135-T | 80 | 22 | 6 | 26,4 | 6,50 | 0,30 | 25 |
| 21160-30-90000-00155-T | 90 | 22 | 6 | 26,4 | 6,70 | 2,30 | 30 |
| 21160-30-90000-00167-T | 90 | 22 | 6 | 26,4 | 7,70 | 2,50 | 30 |
| 21160-30-8000-00117-R008-T | 80 | 22 | 6 | 26,4 | 9,40 | 0,83 | 30 |
| 21160-30-8000-00334-R008-T | 80 | 22 | 6 | 26,4 | 9,60 | 1,80 | 30 |
| 21160-30-8000-00193-R008-T | 80 | 22 | 6 | 26,4 | 9,00 | 0,83 | 30 |

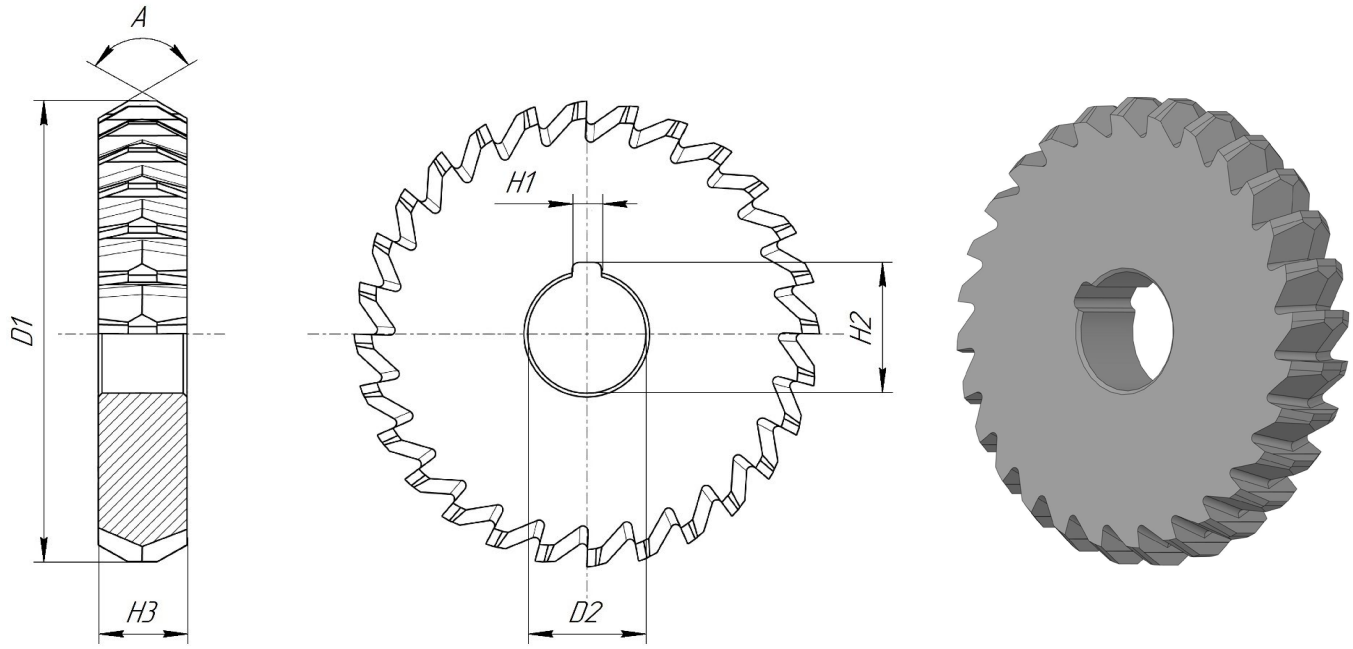
# PROFILE SIDE MILLS

HM | AlTiN | TiSiXN | F | R

- The profile deviation is no higher than ±0.005 mm
- The radial runout is no higher than 0,01 mm

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| | ◎ | | | ◎ | ◎ | |




| Article | D1 | D2 | H1 | H2 | H3 | A | ZEFP |
|---|---|---|---|---|---|---|---|
| 21160-28-6300-00389-T | 63 | 16 | 4 | 17,7 | 12 | $120^0$ | 28 |
| 21160-28-6300-00390-T | 63 | 16 | 4 | 17,7 | 13 | $125^0$ | 28 |
| 21160-28-6300-00405-T | 63 | 16 | 4 | 17,7 | 14 | $13^0$ | 28 |
| 21160-32-8000-00389-T | 80 | 16 | 4 | 17,7 | 12 | $120^0$ | 32 |
| 21160-32-8000-00390-T | 80 | 16 | 4 | 17,7 | 13 | $125^0$ | 32 |
| 21160-32-8000-00405-T | 80 | 16 | 4 | 17,7 | 14 | $130^0$ | 32 |
| 21160-36-9000-00389-T | 90 | 16 | 4 | 17,7 | 12 | $120^0$ | 36 |
| 21160-36-9000-00390-T | 90 | 16 | 4 | 17,7 | 13 | $125^0$ | 36 |
| 21160-36-9000-00405-T | 90 | 16 | 4 | 17,7 | 14 | $130^0$ | 36 |
| 21160-40-9000-00389-T | 90 | 16 | 4 | 17,7 | 10 | $120^0$ | 40 |
| 21160-40-9000-00390-T | 90 | 16 | 4 | 17,7 | 12 | $125^0$ | 40 |
| 21160-40-9000-00405-T | 90 | 16 | 4 | 17,7 | 13 | $130^0$ | 40 |
| 21160-40-9000-00410-T | 90 | 16 | 4 | 17,7 | 14 | $135^0$ | 40 |

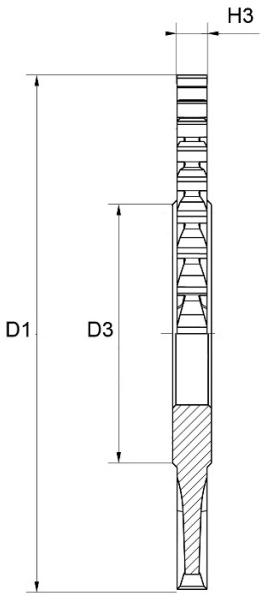
# PROFILE SIDE MILLS

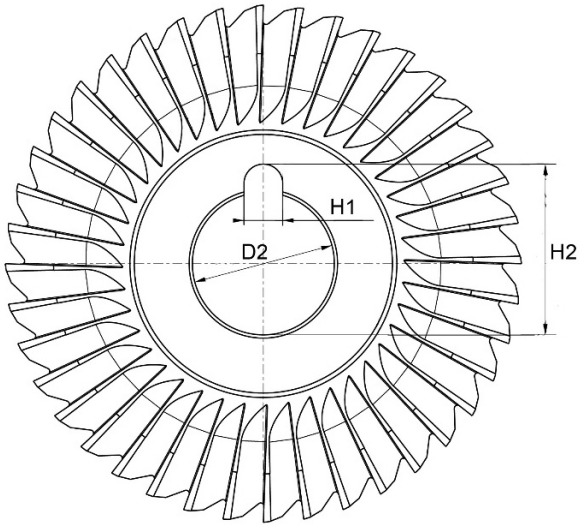
HM | AlTiN | TiSiXN | F | R

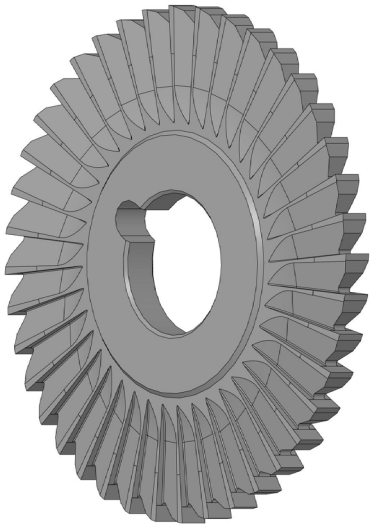
- The profile deviation is no higher than ±0.005 mm
- The radial runout is no higher than 0,01 mm

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| | ◎ | | | ◎ | ◎ | |



| Article | D1 | D2 | D3 | H1 | H2 | H3 | ZEFP |
|---|---|---|---|---|---|---|---|
| 21160-32-6300-01500-T | 63 | 22 | 40 | 6 | 24,1 | 4,00 | 32 |
| 21160-32-6300-01500-T | 63 | 22 | 40 | 6 | 24,1 | 4,65 | 32 |
| 21160-32-6300-01500-T | 63 | 22 | 40 | 6 | 24,1 | 4,75 | 32 |
| 21160-32-6300-01500-T | 63 | 22 | 40 | 6 | 24,1 | 5,00 | 32 |
| 21160-40-8000-01500-T | 80 | 22 | 50 | 6 | 24,1 | 4,65 | 40 |
| 21160-40-8000-01530-T | 80 | 22 | 50 | 6 | 24,1 | 4,75 | 40 |
| 21160-40-8000-01300-T | 80 | 22 | 50 | 6 | 24,1 | 3,30 | 40 |
| 21160-40-8000-01650-T | 80 | 22 | 50 | 6 | 24,1 | 4,90 | 40 |
| 21160-40-8000-02400-T | 80 | 22 | 50 | 6 | 24,1 | 5,50 | 40 |
| 21160-40-9000-03700-T | 90 | 22 | 50 | 6 | 24,1 | 6,00 | 40 |
| 21160-40-9000-04400-T | 90 | 22 | 50 | 6 | 24,1 | 6,55 | 40 |
| 21160-40-9000-06500-T | 90 | 22 | 50 | 6 | 24,1 | 7,50 | 40 |
| 21160-40-9000-07400-T | 90 | 22 | 50 | 6 | 24,1 | 8,00 | 40 |

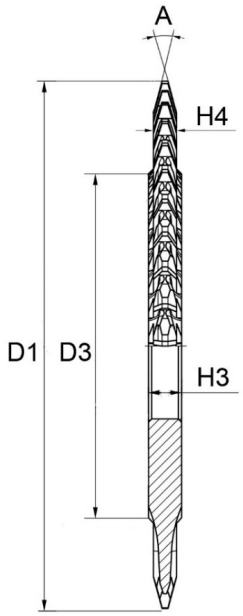
# PROFILE SIDE MILLS

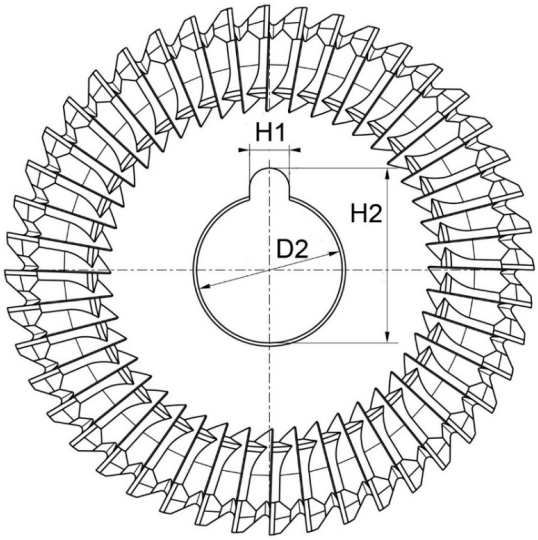
HM | AlTiN | TiSiXN | F | R

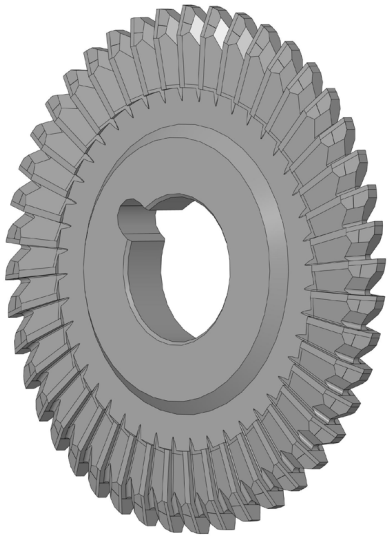
- The profile deviation is no higher than ±0.005 mm
- The radial runout is no higher than 0,01 mm

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| | ◎ | | | ◎ | ◎ | |



| Article | D1 | D2 | D3 | H1 | H2 | H3 | H4 | A | ZEFP |
|---|---|---|---|---|---|---|---|---|---|
| 21160-24-6300-00300-T | 63 | 22 | 45 | 6 | 26,4 | 5 | 3,00 | 300 | 24 |
| 21160-24-6300-00350-T | 63 | 22 | 45 | 6 | 26,4 | 5 | 3,50 | 320 | 24 |
| 21160-24-6300-00400-T | 63 | 22 | 45 | 6 | 26,4 | 5 | 4,00 | 330 | 24 |
| 21160-24-6300-00450-T | 63 | 22 | 45 | 6 | 26,4 | 5 | 4,50 | 340 | 24 |
| 21160-24-8000-00350-T | 80 | 22 | 52 | 6 | 26,4 | 5 | 3,50 | 300 | 24 |
| 21160-24-8000-00450-T | 80 | 22 | 52 | 6 | 26,4 | 5 | 4,50 | 320 | 24 |
| 21160-24-8000-00500-T | 80 | 22 | 40 | 6 | 26,4 | 8 | 5,00 | 400 | 24 |
| 21160-24-8000-00550-T | 80 | 22 | 52 | 6 | 26,4 | 5 | 5,50 | 430 | 24 |
| 21160-24-8000-00536-T | 80 | 22 | 40 | 6 | 26,4 | 8 | 5,36 | 300 | 24 |
| 21160-34-9000-00536-T | 90 | 22 | 60 | 6 | 26,4 | 8 | 5,36 | 330 | 34 |
| 21160-34-9000-00550-T | 90 | 22 | 60 | 6 | 26,4 | 8 | 5,50 | 350 | 34 |
| 21160-34-9000-00600-T | 90 | 22 | 60 | 8 | 26,4 | 8 | 6,00 | 400 | 34 |
| 21160-34-9000-00650-T | 90 | 22 | 60 | 8 | 26,4 | 8 | 6,50 | 450 | 34 |
| 21160-34-9000-00700-T | 90 | 22 | 60 | 8 | 26,4 | 8 | 7,00 | 480 | 34 |

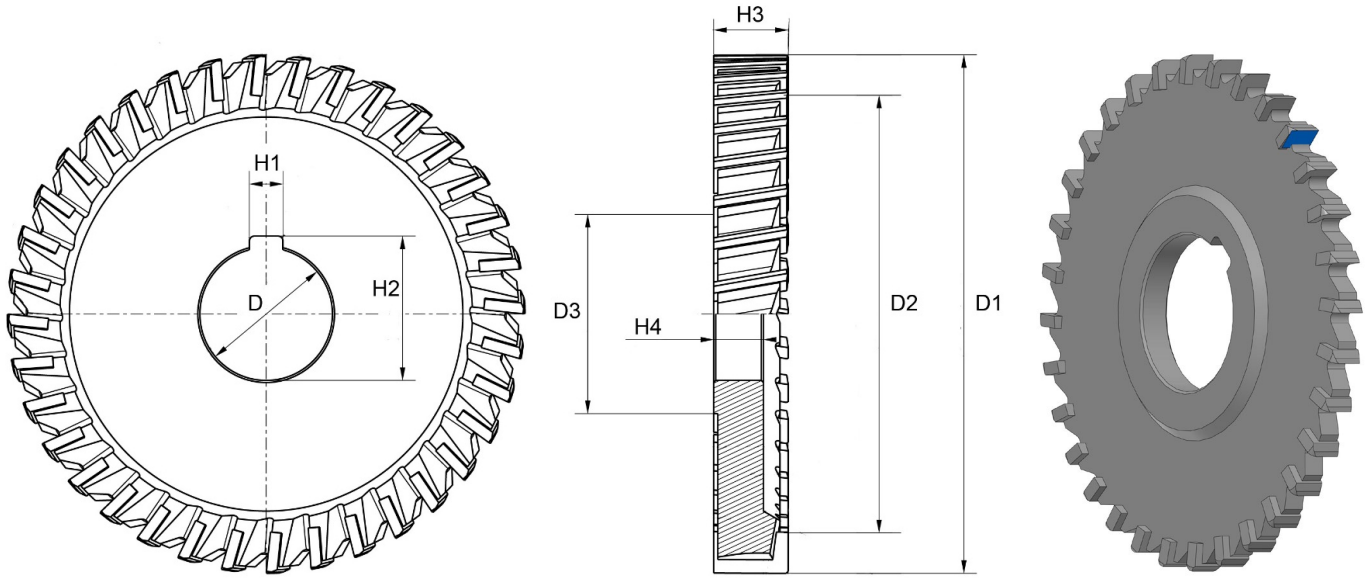
# PROFILE SIDE MILLS

HM | AlTiN | TiSiXN | F | R

- The profile deviation is no higher than ±0.005 mm
- The radial runout is no higher than 0,01 mm

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| | ◎ | | | ◎ | ◎ | |




| Article | D | D1 | D2 | D3 | H1 | H2 | H3 | H4 | ZEFP |
|---|---|---|---|---|---|---|---|---|---|
| 21110-22-6300-09000-T | 22 | 63 | 40 | 32 | 6,0 | 26,4 | 9 | 6 | 22 |
| 21110-22-6300-10000-T | 22 | 63 | 40 | 32 | 6,0 | 26,4 | 10 | 7 | 22 |
| 21110-22-6300-11000-T | 22 | 63 | 40 | 32 | 6,0 | 26,4 | 11 | 8 | 22 |
| 21110-22-6300-12000-T | 22 | 63 | 40 | 32 | 6,0 | 26,4 | 12 | 9 | 22 |
| 21110-30-8000-10000-T | 32 | 80 | 60 | 40 | 8,1 | 34,8 | 10 | 6 | 30 |
| 21110-30-8000-11000-T | 32 | 80 | 60 | 40 | 8,1 | 34,8 | 11 | 7 | 30 |
| 21110-30-8000-12000-T | 32 | 80 | 60 | 40 | 8,1 | 34,8 | 12 | 8 | 30 |
| 21110-30-8000-13000-T | 32 | 80 | 60 | 40 | 8,1 | 34,8 | 13 | 9 | 30 |
| 21110-30-8000-14000-T | 32 | 80 | 60 | 40 | 8,1 | 34,8 | 14 | 9 | 30 |
| 21110-36-9000-12000-T | 32 | 90 | 70 | 45 | 8,1 | 34,8 | 12 | 7 | 36 |
| 21110-36-9000-13000-T | 32 | 90 | 70 | 45 | 8,1 | 34,8 | 13 | 8 | 36 |
| 21110-36-9000-14000-T | 32 | 90 | 70 | 45 | 8,1 | 34,8 | 14 | 9 | 36 |
| 21110-36-9000-15000-T | 32 | 90 | 70 | 45 | 8,1 | 34,8 | 15 | 10 | 36 |
| 21110-36-9000-16000-T | 32 | 90 | 70 | 45 | 8,1 | 34,8 | 16 | 11 | 36 |

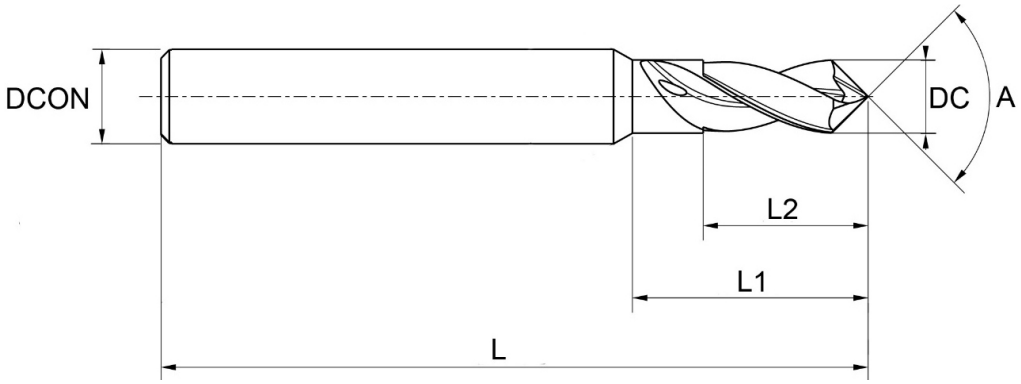
# DRILLS

HM | AlTiN | TiSiXN

- Available to produce with internal coolant supply
- There is a possibility to produce a combined type of a drill

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| ◎ | | | | ◎ | ◎ | |




| Article | DC | DCON | L | L1 | L2 | A |
|---|---|---|---|---|---|---|
| 20261-02-0310-00700-T | 3,10 | 4 | 30 | 10 | 7 | 90⁰ |
| 20261-02-0360-00700-T | 3,60 | 4 | 30 | 10 | 7 | 90⁰ |
| 20261-02-0380-00700-T | 3,80 | 4 | 30 | 10 | 7 | 120⁰ |
| 20261-02-0400-00800-T | 4,00 | 6 | 38 | 12 | 8 | 90⁰ |
| 20261-02-0420-00800-T | 4,20 | 6 | 38 | 12 | 8 | 90⁰ |
| 20261-02-0440-00800-T | 4,40 | 6 | 38 | 12 | 8 | 90⁰ |
| 20261-02-0460-00800-T | 4,60 | 6 | 38 | 12 | 8 | 90⁰ |
| 20261-02-0480-01200-T | 4,80 | 6 | 55 | 20 | 12 | 120⁰ |
| 20261-02-0500-01200-T | 5,00 | 6 | 55 | 20 | 12 | 120⁰ |
| 20261-02-0520-01200-T | 5,20 | 6 | 55 | 20 | 12 | 120⁰ |
| 20261-02-0540-01800-T | 5,40 | 6 | 55 | 25 | 18 | 120⁰ |
| 20261-02-0560-01800-T | 5,60 | 6 | 55 | 25 | 18 | 120⁰ |
| 20261-02-0580-02000-T | 5,80 | 8 | 60 | 30 | 20 | 120⁰ |
| 20261-02-0600-02000-T | 6,00 | 8 | 60 | 30 | 20 | 120⁰ |
| 20261-02-0620-02000-T | 6,20 | 8 | 60 | 30 | 20 | 120⁰ |
| 20261-02-0640-02000-T | 6,40 | 8 | 60 | 30 | 20 | 120⁰ |
| 20261-02-0660-02000-T | 6,60 | 8 | 60 | 30 | 20 | 120⁰ |
| 20261-02-0680-02000-T | 6,80 | 8 | 60 | 30 | 20 | 120⁰ |
| 20261-02-0700-02000-T | 7,00 | 8 | 60 | 30 | 20 | 120⁰ |

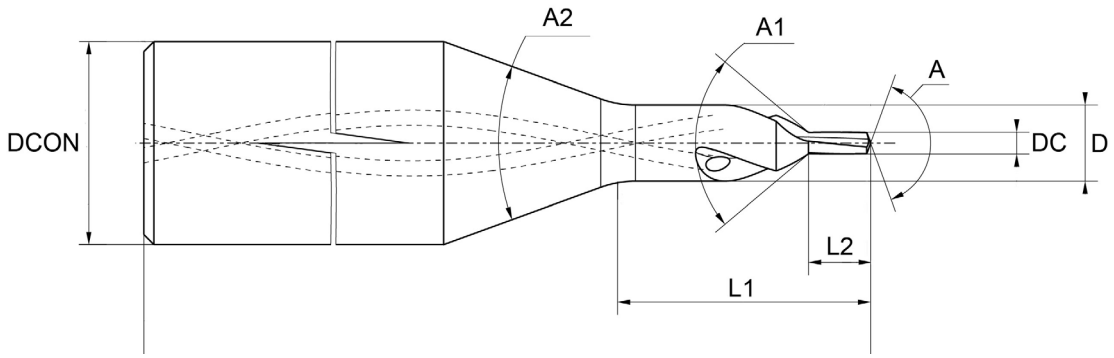
# DRILLS

HM | AlTiN | TiSiXN

- Available to produce with internal coolant supply
- There is a possibility to produce a combined type of a drill

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| ◎ | | | | ◎ | ◎ | |

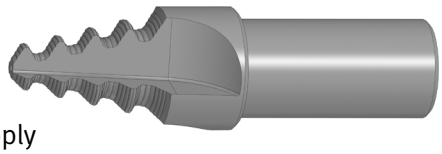



| Article | DC | D | DCON | L | L1 | L2 | A | A1 | A2 |
|---|---|---|---|---|---|---|---|---|---|
| 20261-02-0040-00115-T | 0,40 | 1,5 | 4 | 30 | 5,0 | 1,15 | 140° | 80° | 40° |
| 20261-02-0043-00115-T* | 0,43 | 1,5 | 4 | 30 | 5,0 | 1,15 | 140° | 80° | 40° |
| 20261-02-0050-00115-T | 0,50 | 1,5 | 4 | 30 | 5,0 | 1,15 | 140° | 80° | 40° |
| 20261-02-0053-00115-T | 0,53 | 1,5 | 4 | 30 | 5,0 | 1,15 | 140° | 80° | 40° |
| 20261-02-0060-00120-T* | 0,60 | 1,5 | 4 | 48 | 4,2 | 1,2 | 140° | 90° | 40° |
| 20261-02-0065-00200-T | 0,65 | 2,0 | 4 | 48 | 6,0 | 2,00 | 140° | 90° | 40° |
| 20261-02-0070-00200-T | 0,70 | 2,0 | 4 | 48 | 6,0 | 2,00 | 140° | 90° | 40° |
| 20261-02-0075-00200-T | 0,75 | 2,0 | 4 | 48 | 6,0 | 2,00 | 140° | 90° | 40° |
| 20261-02-0080-00200-T | 0,80 | 2,0 | 4 | 48 | 6,0 | 2,00 | 140° | 90° | 40° |
| 20261-02-0085-00200-T | 0,85 | 2,0 | 4 | 48 | 6,0 | 2,00 | 140° | 90° | 40° |
| 20261-02-0100-00300-T | 1,00 | 3,0 | 4 | 48 | 6,0 | 3,00 | 140° | 90° | 40° |
| 20261-02-0150-00300-T | 1,50 | 3,0 | 4 | 48 | 6,0 | 3,00 | 140° | 90° | 40° |
| 20261-02-0200-00300-T | 2,00 | 3,0 | 4 | 48 | 6,0 | 3,00 | 140° | 90° | 40° |
| 20261-02-0220-01280-T* | 2,20 | 4,5 | 6 | 65 | 12,80 | 4,10 | 170° | 90° | 40° |
| 20261-02-0250-01280-T | 2,50 | 4,5 | 6 | 65 | 12,80 | 4,10 | 170° | 90° | 40° |
| 20261-02-0280-01300-T | 2,80 | 4,5 | 6 | 65 | 12,80 | 4,10 | 170° | 90° | 40° |
| 20261-02-0300-01950-T* | 3,00 | 4,7 | 6 | 65 | 25,00 | 19,50 | 141° | 90° | 40° |
| 20261-02-0350-01950-T | 3,50 | 4,7 | 6 | 65 | 25,00 | 19,50 | 141° | 90° | 40° |
| 20261-02-0370-01950-T | 3,70 | 4,7 | 6 | 65 | 25,00 | 19,50 | 141° | 90° | 40° |
| 20261-02-0400-02400-T* | 4,00 | 4,0 | 6 | 78 | 36,00 | 24,00 | 140° | - | 40° |
| 20261-02-0450-02700-T* | 4,50 | 4,5 | 6 | 80 | 40,50 | 27,00 | 140° | - | 40° |
| 20261-02-0500-03000-T* | 5,00 | 5,0 | 6 | 84 | 45,00 | 30,00 | 140° | - | 40° |

# CHIRSTMAS TREE ENDMILLS

HM HSS AlTiN TiSiXN R

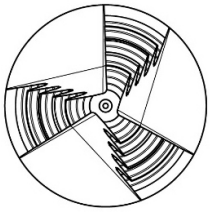
- The profile deviation is no higher than ±0.05 mm
- The radial runout is no higher than 0,015 mm
- Internal coolant

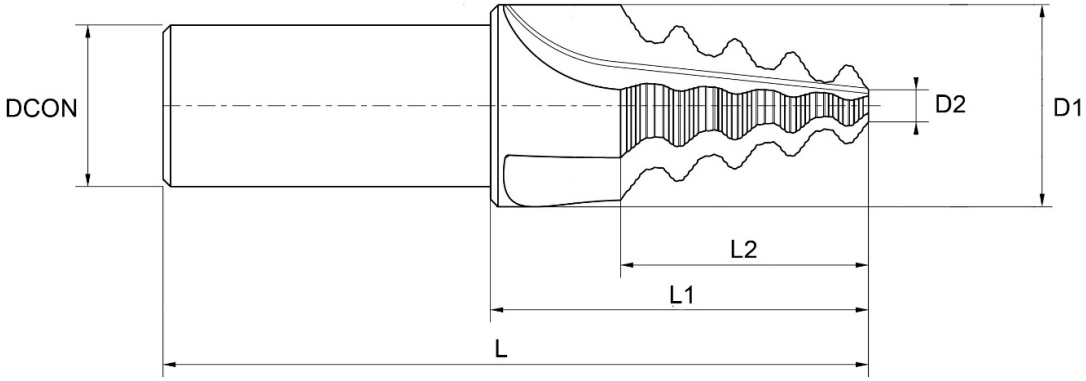


There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums

◎ ◎ ◎



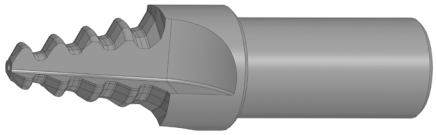



| Article | D1 | D2 | DCON | L | L1 | L2 | ZEFP |
|---|---|---|---|---|---|---|---|
| 20169-03-2660-02325-T | 32 | 12,70 | 32 | 110 | 40 | 23,25 | 3 |
| 20169-03-1605-04000-A | 36 | 15,05 | 32 | 120 | 60 | 40,00 | 3 |
| 20169-03-1913-03003-A | 52 | 19,13 | 32 | 130 | 80 | 30,03 | 3 |
| 20169-03-2013-03681-A | 55 | 20,13 | 32 | 130 | 70 | 36,81 | 3 |
| 20169-03-1713-03730-A | 50 | 17,13 | 32 | 130 | 70 | 37,30 | 3 |
| 20169-03-1978-09541-A | 55 | 19,78 | 32 | 185 | 135 | 95,41 | 3 |
| 20169-03-1480-03147-T | 40 | 14,80 | 32 | 130 | 60 | 31,47 | 3 |
| 20169-03-2047-04800-A | 37 | 20,47 | 32 | 130 | 70 | 48,00 | 3 |
| 20169-03-1903-03252-A | 52 | 19,03 | 32 | 130 | 70 | 32,52 | 3 |
| 20169-03-2158-09440-A | 52 | 21,58 | 32 | 190 | 135 | 94,40 | 3 |
| 20169-03-1325-03850-A | 36 | 13,25 | 32 | 130 | 70 | 38,50 | 3 |
| 20169-03-1125-03850-A | 36 | 11,35 | 32 | 130 | 70 | 38,50 | 3 |
| 20169-03-2020-04990-A | 45 | 9,54 | 32 | 135 | 75 | 50,34 | 3 |
| 20169-03-2320-04990-A | 45 | 12,54 | 32 | 135 | 75 | 50,08 | 3 |

# CHIRSTMAS TREE ENDMILLS

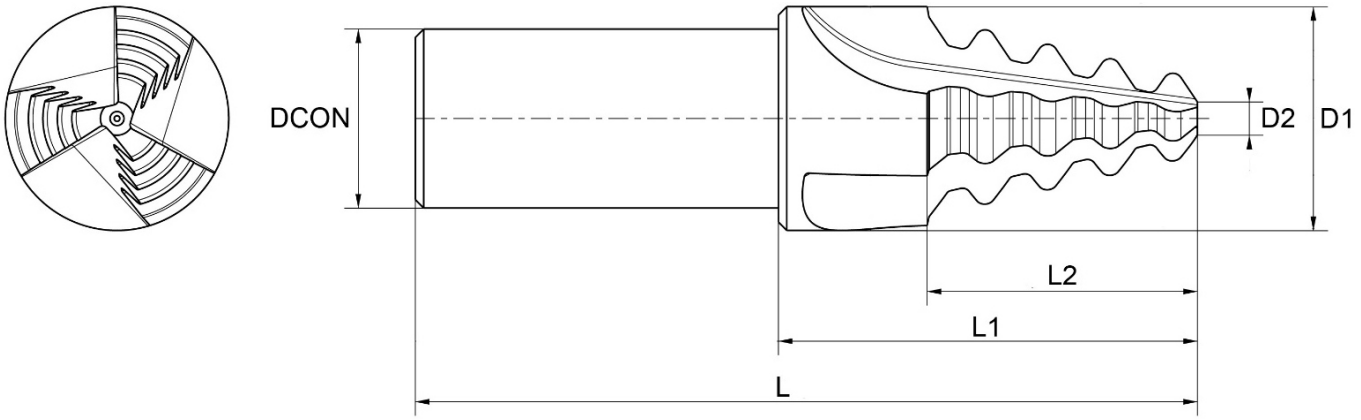
HM HSS AlTiN TiSiXN R

- The profile deviation is no higher than ±0.03 mm
- The radial runout is no higher than 0,015 mm
- Internal coolant



There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| | ◎ | | | ◎ | ◎ | |




| Article | D1 | D2 | DCON | L | L1 | L2 | ZEFP |
|---|---|---|---|---|---|---|---|
| 20169-04-0600-04391-T | 40 | 6,00 | 32 | 130 | 60 | 43,91 | 4 |
| 20169-04-1947-05000-A | 36 | 19,47 | 32 | 130 | 70 | 50,00 | 4 |
| 20169-04-1893-03003-A | 52 | 18,93 | 32 | 130 | 80 | 30,03 | 4 |
| 20169-04-1713-03638-A | 50 | 17,13 | 32 | 130 | 70 | 36,38 | 4 |
| 20169-04-1998-09541-A | 55 | 17,13 | 32 | 185 | 135 | 95,41 | 4 |
| 20169-04-1545-04100-A | 35 | 15,45 | 32 | 120 | 60 | 41,00 | 4 |
| 20169-03-1793-04500-A | 40 | 17,93 | 32 | 130 | 70 | 45,00 | 3 |
| 20169-03-2710-09740-A | 62 | 27,10 | 32 | 190 | 130 | 97,40 | 3 |
| 20169-04-1225-03850-A | 36 | 12,25 | 32 | 130 | 70 | 38,50 | 4 |
| 20169-04-1025-03850-A | 36 | 10,25 | 32 | 130 | 70 | 38,50 | 4 |
| 20169-04-1693-04500-A | 40 | 16,93 | 32 | 130 | 70 | 45,00 | 4 |
| 20169-04-2730-09740-A | 62 | 27,30 | 32 | 190 | 130 | 97,40 | 4 |
| 20169-04-0599-04935-A | 40 | 5,99 | 32 | 140 | 75 | 49,35 | 4 |
| 20169-04-1672-02909-A | 25 | 16,72 | 25 | 110 | 45 | 29,09 | 4 |
| 20169-04-2020-04990-A | 45 | 9,25 | 32 | 135 | 75 | 50,49 | 4 |

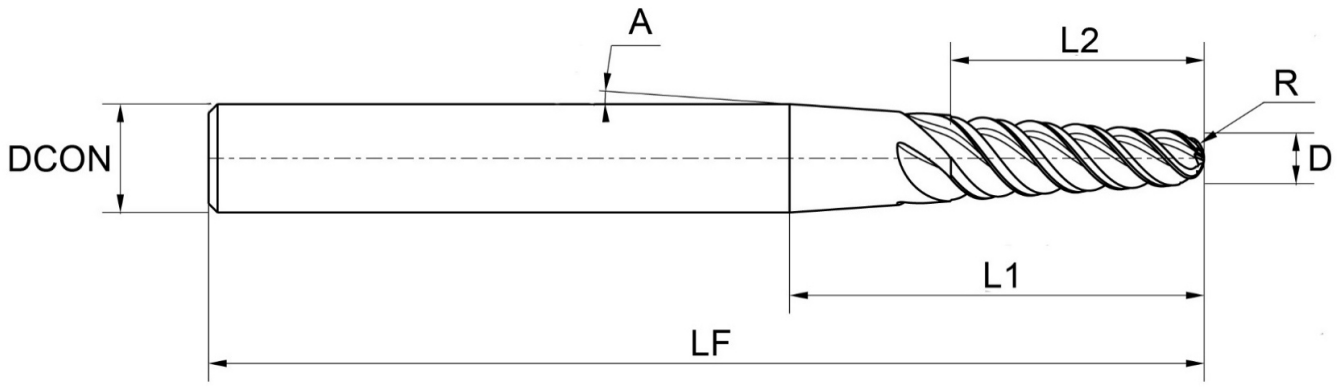
# CARROT MILLS

HM | AlTiN | TiSiXN | F | R

- The profile deviation is no higher than ±0.005 mm
- The radial runout is no higher than 0,005 mm

There are 2 options of tools manufacturing: with or without internal coolant supply
When ordering more than 10 pieces of each item, changing of some sizes is possible (geometry)

| Steels | Stainless Steels | Cast irons | Hardened Steel | Titanium | Super Alloys | Aluminiums |
|---|---|---|---|---|---|---|
| | ◎ | | | ◎ | ◎ | |

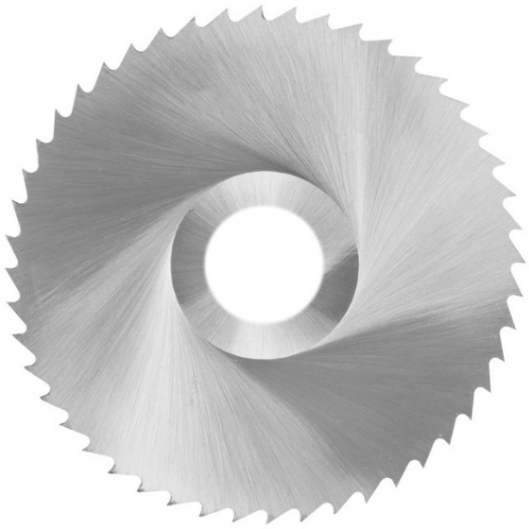



| Article | D | DCON | LF | L1 | L2 | R | A | Z |
|---|---|---|---|---|---|---|---|---|
| 20193-04-0600-028-040-R030-T | 6 | 12 | 110 | 45,8 | 28 | 3 | $4^0$ | 4 |
| 20193-04-0400-010-040-R020-T | 4 | 6 | 65 | 46 | 10 | 2 | $4^0$ | 4 |
| 20193-04-0320-010-020-R016-T | 3,2 | 6 | 80 | 46 | 10 | 1,6 | $2^0$ | 4 |
| 20193-04-0320-010-060-R016-T | 3,2 | 6 | 90 | 46 | 10 | 1,6 | $6^0$ | 4 |
| 20193-04-0320-010-040-R016-T | 3,2 | 6 | 70 | 40 | 10 | 1,6 | $4^0$ | 4 |
| 20193-04-0500-020-040-R025-T | 5 | 12 | 100 | 46 | 20 | 2,5 | $4^0$ | 4 |
| 20193-04-0400-028-040-R020-T | 4 | 12 | 100 | 46 | 28 | 2 | $4^0$ | 4 |
| 20193-04-0600-028-040-R030-T | 6 | 12 | 100 | 46 | 28 | 3 | $4^0$ | 4 |
| 20193-04-0400-040-040-R020-T | 4 | 8 | 80 | 40 | 40 | 2 | $4^0$ | 4 |
| 20193-04-0400-040-040-R025-T | 4 | 10 | 100 | 40 | 40 | 2,5 | $4^0$ | 4 |
| 20193-04-0600-060-050-R030-T | 6 | 12 | 150 | 60 | 60 | 3 | $5^0$ | 4 |
| 20193-04-0300-035-040-R015-T | 3 | 14 | 110 | 35 | 35 | 1,5 | $4^0$ | 4 |
| 20193-04-0800-050-040-R040-T | 8 | 14 | 110 | 50 | 50 | 4 | $3^0$ | 4 |
| 20193-04-0200-008-150-R010-T | 2 | 6 | 50 | 8,5 | 8 | 1 | $15^0$ | 4 |
| 20193-03-0600-020-035-R030-T | 6 | 12 | 120 | 52 | 20 | 3 | $3,5^0$ | 3 |
| 20193-04-0600-020-035-R030-T | 6 | 12 | 120 | 52 | 20 | 3 | $3,5^0$ | 4 |
| 20193-04-0300-012-040-R015-T | 3 | 14 | 110 | 35 | 12 | 1,5 | $4^0$ | 4 |
| 20193-04-0800-015-040-R040-T | 8 | 14 | 110 | 50 | 15 | 4 | $3^0$ | 4 |
| 20193-03-0600-028-040-R030-T | 6 | 12 | 100 | 46 | 28 | 3 | $4^0$ | 3 |
| 20193-03-0400-010-040-R020-T | 4 | 6 | 65 | 46 | 10 | 2 | $4^0$ | 3 |
| 20193-03-0500-020-040-R025-T | 5 | 12 | 100 | 46 | 20 | 2,5 | $4^0$ | 3 |

# SIDE MILLS WITH SMALL BLADE PITCH

HM | AlTiN | TiSiXN

The tool material can be HSS or solid carbide.
It is available to apply the coating if necessary.
The tool can be used on any type of workpiece material.



## ARTICLE:

**21110-XXX-XXX–XXX – X – X**

Series | Number of flutes | Mill diameter | Thickness of mill | Coating | Tool material

## EXAMPLE:

21110-080-025-010-T-HSS
Side mill with small blade pitch, diameter is 25 мм, number of flutes is 80, thickness is 0,1 mm, with coating Tisaflex, tool material is HSS

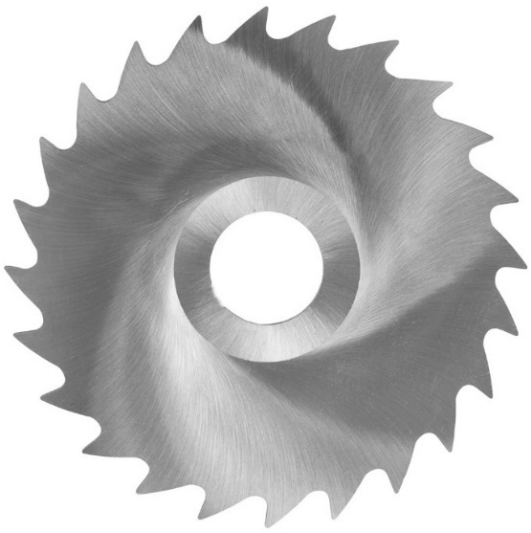
| Thickness of mill | Mill diameter | 15 | 20 | 25 | 30 | 40 | 50 | 63 | 80 | 100 | 125 | 150 | 160 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Arbor diameter | 5 | 5 | 8 | 8 | 10 | 13 | 16 | 22 | 22 | 22 | 32 | 32 |
| 0,10-0,40 | | 64 | 80 | 80 | 80 | 96 | 120 | 96 | 120 | - | - | - | - |
| 0,50-0,70 | | 48 | 60 | 60 | 70 | 80 | 96 | 96 | 120 | 120 | 160 | - | - |
| 0,80-1,00 | | 40 | 48 | 48 | 60 | 70 | 80 | 96 | 120 | 120 | 160 | - | - |
| 1,10-1,20 | | 40 | 48 | 48 | 60 | 70 | 80 | 96 | 120 | 120 | 128 | 150 | 160 |
| 1,30-1,90 | | 40 | 40 | 40 | 48 | 60 | 70 | 80 | 96 | 120 | 128 | 150 | 160 |
| 2,00-2,20 | | 40 | 40 | 40 | 48 | 60 | 70 | 80 | 80 | 120 | 100 | 128 | 128 |
| 2,30-2,90 | | 40 | 40 | 40 | 48 | 60 | 70 | 80 | 80 | 120 | 100 | 128 | 128 |
| 3.00-4,20 | | 24 | 35 | 35 | 40 | 48 | 60 | 70 | 80 | 96 | 100 | 128 | 128 |
| 4,30-6,00 | | 24 | 24 | 24 | 32 | 40 | 48 | 60 | 70 | 80 | 100 | 100 | 100 |

Number of teeth

# SIDE MILLS WITH BIG BLADE PITCH

HM | AlTiN | TiSiXN

The tool material can be HSS or solid carbide.
It is available to apply the coating if necessary.
The tool can be used on any type of workpiece material.



## ARTICLE:

**21111-XXX-XXX–XXX – X – X**

Series | Number of flutes | Mill diameter | Thickness of mill | Coating | Tool material

## EXAMPLE:

21111-020-025-010-L-SC
Side mill with big blade pitch, mill diameter is 25 мм, number of flutes is 20, thickness is 0,1, with coating Lumena, tool material is solid carbide.

| Thickness of mill | Mill diameter | 15 | 20 | 25 | 30 | 40 | 50 | 63 | 80 | 100 | 125 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Arbor diameter | 5 | 5 | 8 | 8 | 10 | 13 | 16 | 22 | 22 | 22 |
| 0,10-0,40 | 20 | 20 | 20 | 32 | 40 | 48 | 48 | 48 | - | - | - |
| 0,50-0,70 | 20 | 20 | 20 | 32 | 40 | 40 | 48 | 48 | 60 | - | 160 |
| 0,80-1,00 | 20 | 20 | 20 | 24 | 32 | 32 | 40 | 48 | 60 | 80 | 160 |
| 1,10-1,20 | 20 | 20 | 20 | 24 | 32 | 32 | 40 | 48 | 60 | 80 | 128 |
| 1,30-1,90 | 20 | 20 | 20 | 24 | 32 | 32 | 40 | 48 | 48 | 64 | 128 |
| 2,00-2,20 | 20 | 20 | 20 | 24 | 32 | 32 | 40 | 48 | 40 | 48 | 100 |
| 2,30-2,90 | 20 | 20 | 20 | 24 | 32 | 32 | 40 | 48 | 40 | 40 | 100 |
| 3.00-4,20 | 15 | 20 | 20 | 24 | 32 | 32 | 32 | 40 | 40 | 40 | 100 |
| 4,30-6,00 | 15 | 15 | 15 | 20 | 24 | 24 | 24 | 32 | 40 | 40 | 100 |

Number of teeth

# PROPERTIES OF COATING BALINIT®

| Type of coating | Abbrev-iation | Com-pound | Micro-hardness HV (0,05) | Friction against steel (dry running) | Radial thickness (µm) (1) | Max. service tempe-rature (°C) | Deposition tempe-rature (°C) | Coating colour (3) |
|---|---|---|---|---|---|---|---|---|
| Balinit ® A | A | TiN | 2300 | 0,4 | 1 ÷ 5 | 600° C | 500° C | golden yellow |
| Balinit ® B | B | TiCN | 3000 | 0,4 | 1 ÷ 5 | 400° C | 500° C | grey-blue |
| Balinit ® C - WC/C | C | (a-C:H:W) | 1000-1500 | 0,1 - 0,2 | 1 ÷ 4 | 300° C | 250° C | anthracite |
| Balinit ® C STAR | CS | CrN + (a-C:H:W) | 1000-1500 | 0,1 - 0,2 | 3 ÷ 5 | 300° C | 250° C | anthracite |
| Balinit ® D | D | CrN | 1750 | 0,5 | 1 ÷ 4 | 700° C | 500° C | silver gray |
| Balinit ® CNI - Crovega | CNI | CrN | 1750 | 0,5 | 1 ÷ 4 | 700° C | 250° C | silver gray |
| Balinit ® Croma | CA | CrN | 2800 (± 200) | 0,57 | 6 ÷ 8 | 700° C | 250°-450°C | silver gray |
| Balinit ® Croma Plus | CP | CrN + OX | 2800 (± 200) | 0,5 | 6 ÷ 8 | 700° C | 250°-450°C | rainbow |
| Balinit ® DLC (2) | DLC | a-C:H | ›2000 | 0,1 - 0,2 | 0,5 ÷ 3 | 350° C | 250° C | black |
| Balinit ® DLC STAR (2) | DLCS | CrN + a-C:H | ›2000 | 0,1 - 0,2 | 2 ÷ 4 | 350° C | 250° C | black |
| Balinit ® Alcrona Advanced | AC ADV | N2 + AlCrN | 3500 | 0,35 | 1 ÷ 4 | 1100 °C | 500° C | light grey |
| Balinit ® Alcrona Mod | ALC | TiN+AlCrN | 3200 | 0,35 | 5 ÷ 10 | 1100 °C | 500° C | light grey |
| Balinit ® Alcrona Pro | AP | AlCrN | 3200 | 0,35 | 1 ÷ 5 | 1100 °C | 500° C | light grey |
| Balinit ® Alnova | AN | AlCrN | 3200 | 0,3 | 1 ÷ 4 | 1100 °C | 500° C | light grey |
| Balinit ® Formera | FO | CrAlN-based | 2800 (± 200) | 0,35 | 6 ÷ 12 | 900° C | 480° C | light grey |
| Balinit ® Futura Nano | FN | TiAlN | 3300 | 0,30 - 0,35 | 1 ÷ 6 | 900° C | 500° C | purple-grey |
| Balinit ® Futura Nano Advanced | FN ADV | N2 +TiAlN | 3300 | 0,30 - 0,35 | 1 ÷ 6 | 900° C | 500° C | purple-grey |
| Balinit ® Hardlube | HL | TiAlN + (a-C:H:W) | 3000 | 0,15 - 0,20 | 2 ÷ 6 | 800° C | 500° C | dark gray |

| Type of coating | Abbrev-iation | Com-pound | Micro-hardness HV (0,05) | Friction against steel (dry running) | Radial thickness (µm) (1) | Max. service tempe-rature (°C) | Deposition tempe-rature (°C) | Coating colour (3) |
|---|---|---|---|---|---|---|---|---|
| Balinit ® Hardcarbon | HC | ta-C | 5000 | ‹0,15 | 0,3 ÷ 1,00 | 500° C | ‹150° C | rainbow-black |
| Balinit ® Diamond Micro | DIA micro | C | 10000 | 0,1 | 6 ÷ 8 | 600 °C | 800-850 ° C | grey |
| Balinit ® Diamond Nano | DIA nano | C | 10000 | 0,1 | 6 ÷ 12 | 600 °C | 800-850 ° C | grey |
| Balinit ® Latuma | LM | AlTiN | 3000 | 0,35 | 1 ÷ 3 | 1000° C | 500 ° C | purple-grey |
| Balinit ® Lumena | L | TiAlN | 3400 | 0,30 - 0,35 | 8 ÷ 10 | 900° C | 500 ° C | purple-grey |
| Balinit ® Lumena Advanced | L ADV | N2 +TiAlN | 3400 | 0,30 - 0,35 | 8 ÷ 10 | 900° C | 500 ° C | purple-grey |
| Balinit ® Pertura | PT | TiAlN | 3200 | 0,25 | 1 ÷ 4 | 1000° C | 500 ° C | purple-grey |
| Balinit ® Tisaflex | T | AlTiN/ TiSiN | 3800 | 0.6 | 1 ÷ 5 | 1100° C | 600° C | copper-brown |
| Balinit ® Triton (2) | TRITON | a-C:H | 2500 | 0,10 - 0,20 | 1 ÷ 2 | 350°C | 350° C | black |
| Balinit ® ALDURA | AD | AlCrN-based | 3300 | 0,35 - 0,40 | 1 ÷ 3 | 1100 °C | 550 °C | blue-grey |
| Balinit ® Altensa | AT | AlCrN-based | 3800 | 0,7 | 1 ÷ 5 | ›1100°C | 480° C | light grey |
| Balinit ® X.Cell | XCE | TiCrN | 2100 | 0,5 | 8 ÷ 10 | 700°C | 500° C | dark gray |
| Balinit® ARCTIC Coating Series | A ARC | TiN | 2300 | 0,4 | 1 ÷ 5 | 600° C | 200° C | golden yellow |
| | FN ARC | TiAlN | 3300 | 0,30 - 0,35 | 1 ÷ 6 | 900° C | 200° C | purple-grey |
| | D ARC | CrN | 1750 | 0,5 | 1 ÷ 4 | 700° C | 200° C | silver gray |

(1) The value reported in the column called «radial thickness» is considered guaranteed for coatings carried out in homogeneous charges and dedicated processes. For mixed composition charges and non-dedicated processes, the indicated radial thickness could be various

(2) Deposited with PACVD (Plasma Assisted CVD) method

(3) The color may undergo different shades that cannot be linked to functional problems of the covering