# Software-Modules

## Specifications



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# Index

# Index

## Index

# 1   End Mills                                           Specifications

## 1.1  Cylindrical and tapered standard end mills
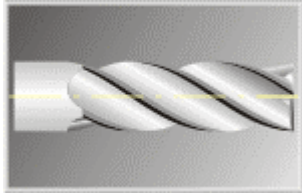
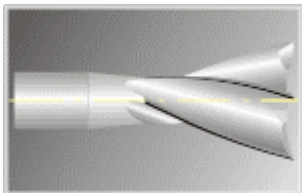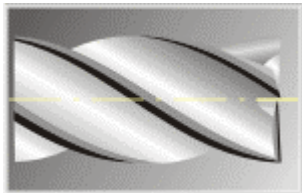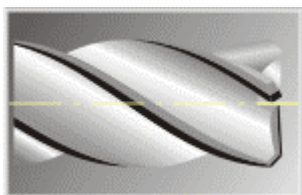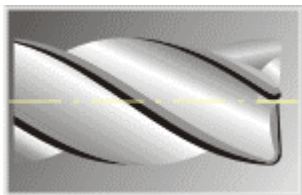| | |
|---|---|
| Work Piece:<br><br><br>Cylinder<br><br><br>Taper<br><br><br>Angular Cutter<br><br>Tool End Face Geometry:<br><br><br>Plane<br><br><br>Chamfer<br><br><br>Corner Radius | **Workpiece:**<br>1. Cylinder<br>2. Taper<br>3. Angular Cutter<br>**Point:**<br>1. Plan Face<br>2. Chamfer<br>3. Corner Radius<br>4. Ball Nose<br>5. Circular Arc<br>6. Double Radius<br>**Geometry:**<br>1. Regulare<br>2. 2 at Center<br>3. 1 above Center<br>4. Centring Point<br>5. 3 at Center<br>**Cutting Edge Combination:**<br>- right helix/right cutting<br>- left helix/left cutting<br>- right helix/left cutting<br>- left helix/right cutting<br>**Division:**<br>- Equal / unequal division of teeth<br>**Production / Regrinding:**<br>- Production by different infeed (several steps)<br>- Regrinding with calculation of removal length, periphery and rake.<br>- Regrinding, finishing with different wheels<br>**Preparation**<br>- Separating<br>- Profile roughing<br>- Profile finishing<br>**Main Fluting**<br>- Meas. definition: Point-/ normal cut<br>- Grind direction: Forward / backward<br>- Optional spark out grinding<br>- **Taper**:<br>- Constant angle / constant helix<br>- Regrinding with undefined helix<br>**Periphery**<br>- Linear relief: 1st/ 2nd /3rd relief angle<br>- Radial relief: Cross-/ longitudinal<br>- Roughing<br>- Grind direction: Forward / backward<br>- Optional spark out grinding<br><br><br>**Heel**<br>- Grind procedure: Crosswise-/ longitudinal<br>- Production by different infeed (several steps)<br>- Grind direction: Forward / backward<br>- Optional spark out grinding<br>**End Face**<br>- Linear relief grinding<br>- Hollow grinding |

Tool End Face Geometry:
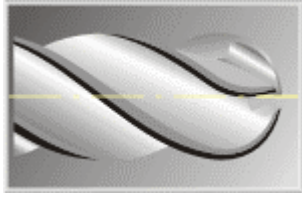


Ball Nose
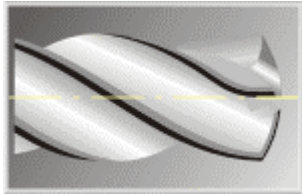


Circular Arc
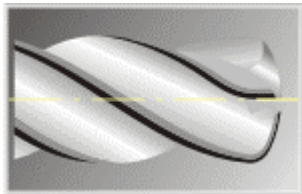


Double Radius

End Face Cutting Edge Geometry:
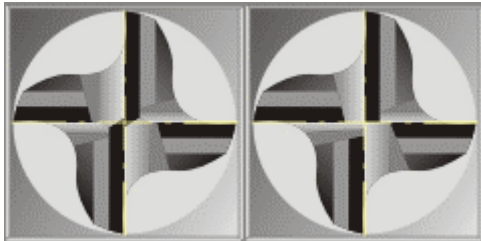


2 to center      1 above center
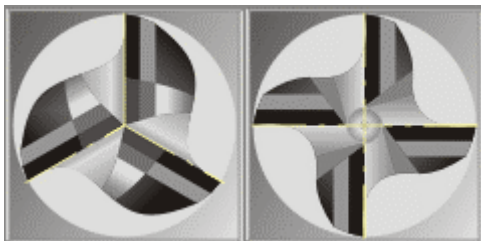


Centring point      Regular
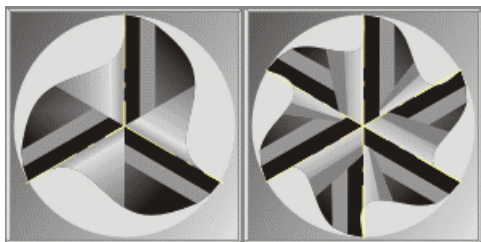


3 und 6 Schneider: 3 zum Zentrum

**Chamfer Clearance/Chamfer**
- Linear relief: 1st/ 2nd /3rd relief angle
- Grind. direction: Forward / backward
- Optional spark out grinding

**Gashing**
- Grinding procedure: Recessing / Interpolation
- Radius at entry and exit
- Variable aperture angle

**Notching**
- Radius at entry and exit
- Variable entry- and aperture angle

**Profile Simulation**
- Simulation of intersection at all operations
- Wheel/workpiece-simulation
- Machining simulation

**Shank**
- Reducing the shank diameter
- Clamping area

**1.2 Ball**
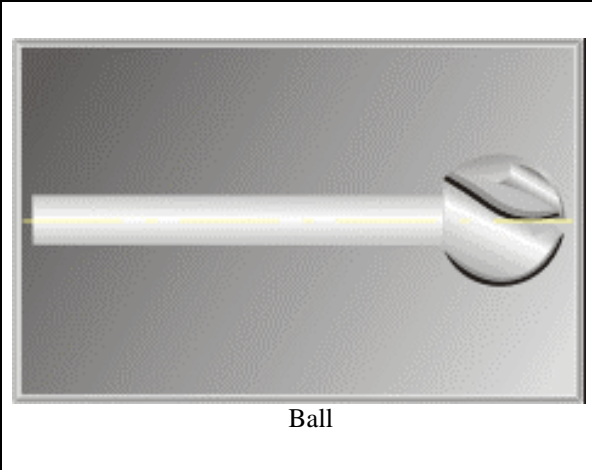
| | |
|---|---|
| <br>Ball | **Extension to 1.1:**<br><br>**Ball:** |

**1.3 Variably Helix**
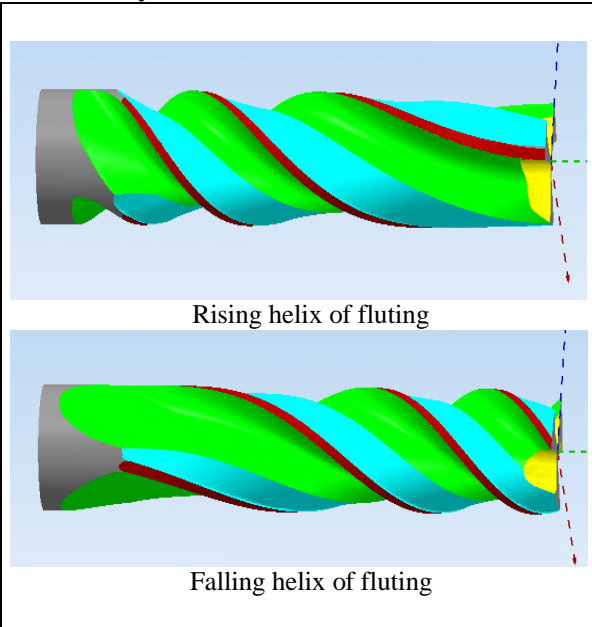
| | |
|---|---|
| <br>Rising helix of fluting<br><br><br>Falling helix of fluting | **Extension to 1.1:**<br><br>**Variably Helix of Fluting:**<br><br>- Cylindrical and tapered tools<br>- Front and rear angle of helix<br>- 3 sections: Constant angle within 1. and 3. section; transition between front and rear helix-angle within 3. section<br>- Rising or falling helix |

**1.4 Wavecut**
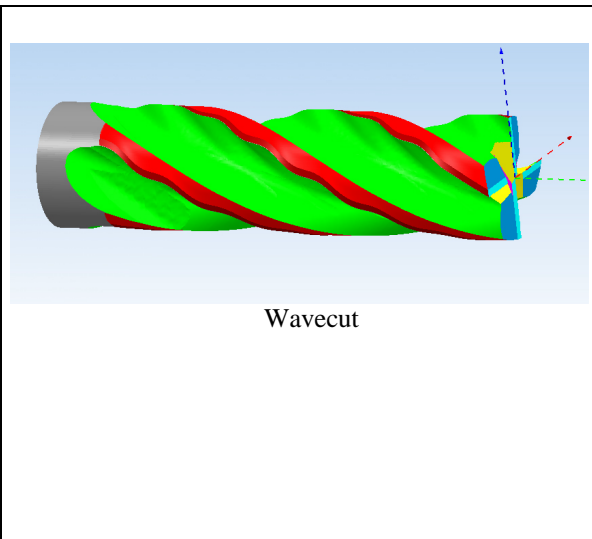
| | |
|---|---|
| <br>Wavecut | **Extension to 1.1:**<br><br>**Wavecut:**<br><br>- Cylindrical tools<br>- Roughing cutting corresponding to a sinusoidal cutting edge along the helix<br>- Period and amplitude of wave according to sinus-function<br>- Starting point offset at every tooth<br>- Orientation of wave to the tool-center or to the cutting edge |

## 2. Multi Cutter End Mills                                    Specifications

### 2.1  Multi Cutter End Mills



**Specification:**
- Cylindrical standard end mills
- 2 teeth at center: max. 8 teeths

**Geometry:**
- Tools with 2 at center geometry
- Tools with groups of different fluting and periphery cutting edges:

  2 teeth: 2 groups

  3 teeth: 3 groups

  4 teeth: 2 or 4 groups

  5 teeth: 5 groups

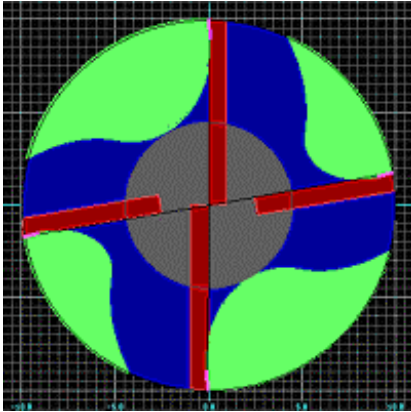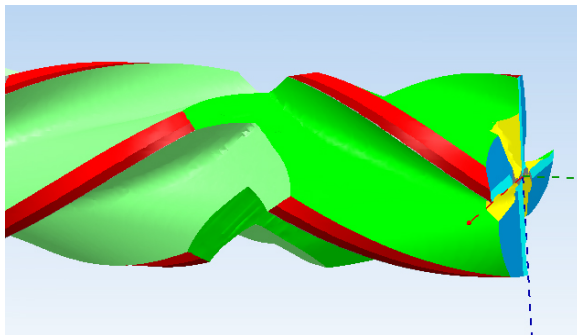  6 teeth: 2 or 3 groups

  8 teeth: 2 or 4 groups

**Division:**
- Different tooth division

### 2.2  Cross Cutting (Up-Down-End Mill)
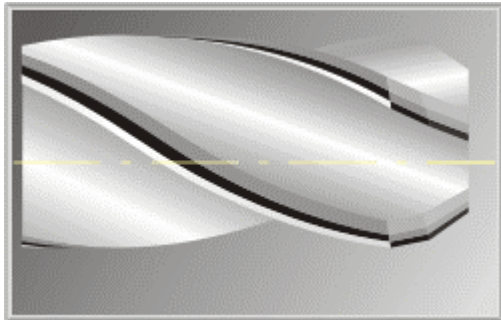


Up-Down-End Mill

**Extension to 2.1:**

- 2, 3 or 4 teeth tools with two crosswise cutting edges for each tooth:
- Primary fluting: right helix
- Cross cutting: left helix
- Axial and radial tooth offset

## 3 Reamer                                                    Specifications

### 3.1 Reamer



Side view
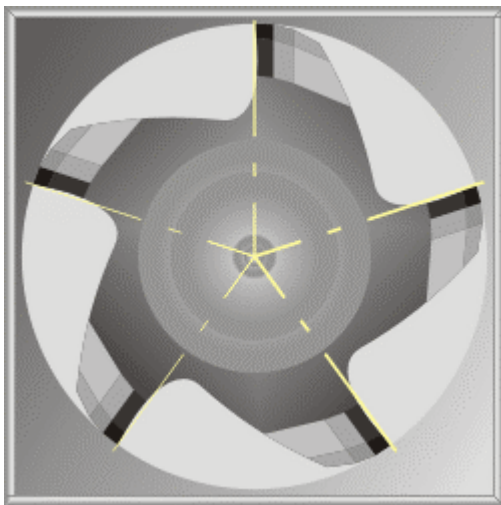


Front view

**Work Piece:**
- 1. Cylinder
- 2. Taper

**Face:**
- Plane without cutting edge
- Milling end face

**Cutting Edge Combination:**
- right helix/right cut
- left helix/left cut
- right helix/left cut
- left helix/right cut

**Devision:**
- equal
- unequal (free division between all teeth)

**Preparation:**
- Separation
- Profile roughing
- Profile finishing

**Production / Regrinding**
- Production in several infeeds

**Main Fluting**
- Workpiece with pairs of different fluting geometries

**Periphery**
- Like end mills Pos. 1.

**Heel:**
- Like end mills Pos. 1.

**Chamfer**
- Linear relief: 1./2./3. relief angle
- Radial relief: transverse/longitudinal

**2nd Chamfer**
- Optional: 2nd chamfer

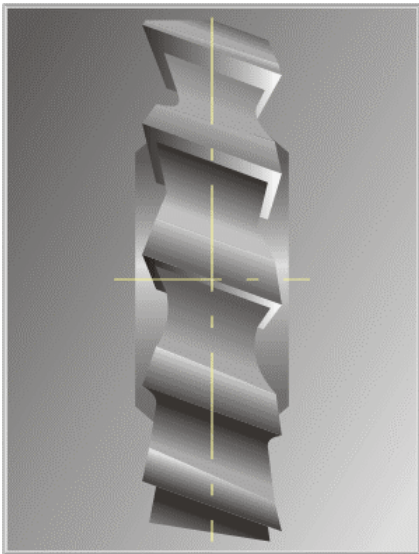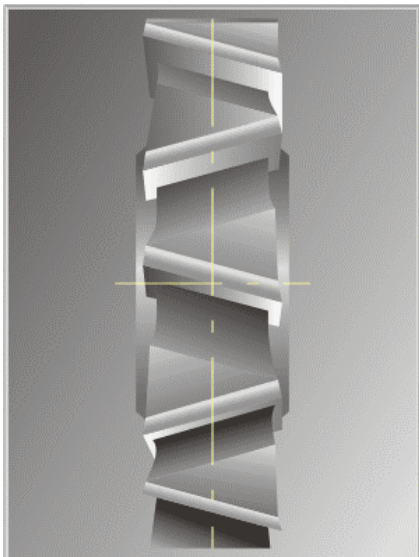## 4. Side Milling Cutter                                    Specifications
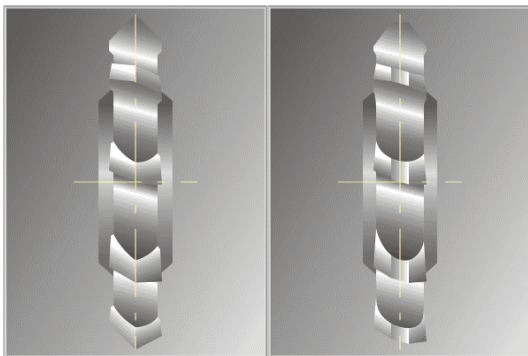


standard teeth



staggered teeth



**Workpiece:**
1. Cylinder
2. Trapecoid
3. Prisma
4. Half Angle
5. Full Radius

**End Faces:**
1. Plan Face
2. Chamfer
3. Corner Radius

**Teeth:**
- Standard teeth
- Staggered teeth
- Staggered/skipping teeth

**Production / Regrinding**
- Production by different infeed in several steps
- Regrinding with calculation of removal length, periphery and rake.
- Regrinding, finishing with different wheels

**Main Fluting**
- Meas. definition: Point-/ normal cut
- Grind direction: Forward / backward
- Optional spark out grinding

**Periphery:**
- Linear relief: 1st/ 2nd /3rd relief angle
- Radial relief: Cross-/ longitudinal
- Grind direction: Forward / backward
- Optional spark out grinding

**Heel**
- Grind proc.: Crosswise-/ longitudinal
- Production by different infeed (several steps)
- Grind direction: Forward / backward
- Optional spark out grinding
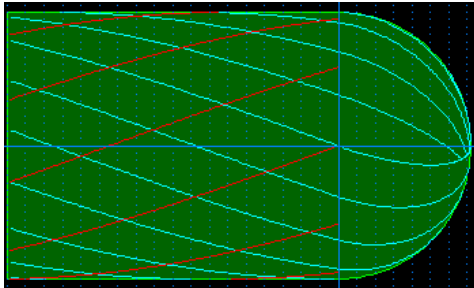
**Face Relief:**
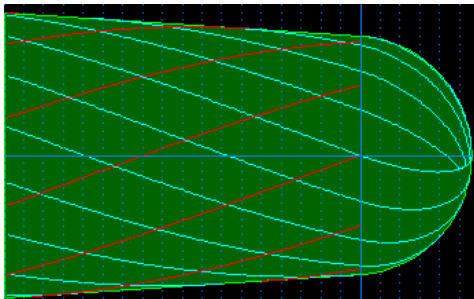- like end mills

**Gashing, front/rear:**
- like end mills

**Chamfer front/rear:**
- like end mills

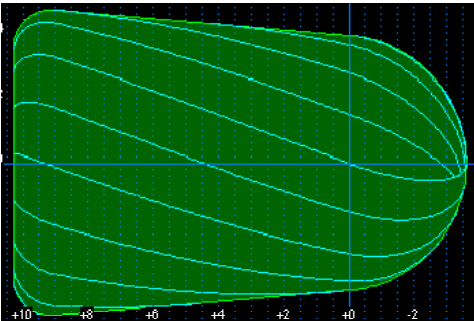**5 Burs/Dental-tools**          **Specifications**

Front section: Exp. Ball Nose



Middle section: Exp. Front Taper



Back section: Exp. Radius



Standard Fluting: Cut to Center / Groove Cut
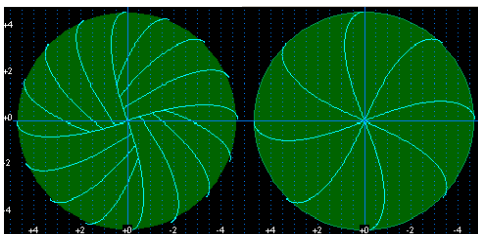


**Profile Construction:**
Free selectable sequence including:

Front:
1. End face
2. Point
3. Chamfer
4. Sphere
5. Ball nose
6. Enlarged radius
7. Double radius

Middle:
1. Cylinder
2. Increasing taper
3. Downgrade taper
4. Convex radius
5. Concav radius

Back:
1. Cylinder
2. Taper
3. Radius

**Standard Fluting:**
- Cut to center
- Section fluting
- Two to center
- Groove cut

**Double Cutting:**
- Optional

**Periphery:**
- Optional

**Chip breaker:**
- Optional

**Grinding Direction:**
- Forward
- Backward
- Bidirectional

# 6 Drills                                                    Specifications
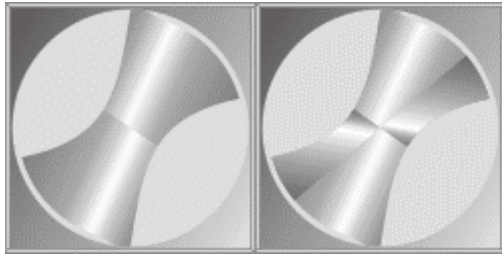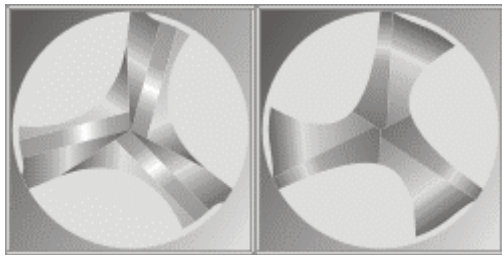
### 6.1 Standard Drills

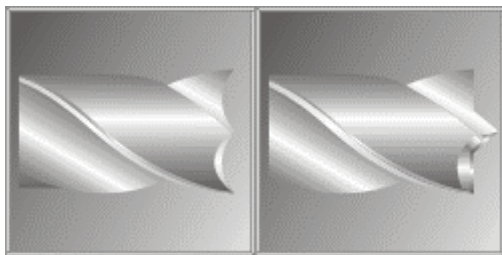| | |
|---|---|
| right helix/ right cutting<br>left helix/ left cutting work pieces | **Work Piece**<br>- 2 or 3 teeth<br>- 1 – 5 Steps<br>**Cutting Edge Combination:**<br>- right helix/right cut<br>- left helix/left cut |



Standard          Split point
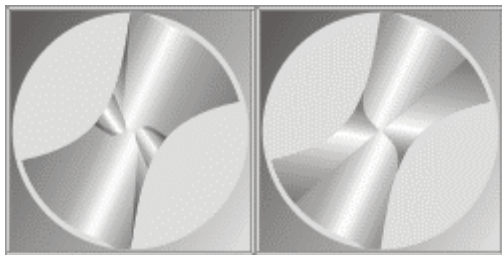


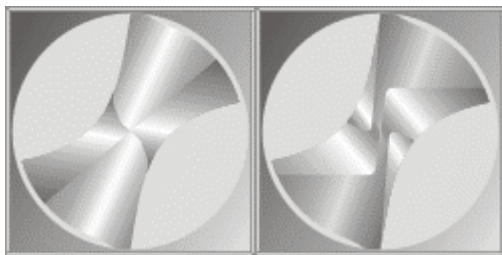2-,4-,6- facet point          M-point



Kevlar point          Centring point



corr. main cutting edge/          S-web thinning
corr. chisel edge



RGR-web thinning          A-web thinning

**Work Piece**
- 2 or 3 teeth
- 1 – 5 Steps

**Cutting Edge Combination:**
- right helix/right cut
- left helix/left cut

**Produktion / Regrinding**
- Production by different infeed (several steps)
- Regrinding with calculation of removal length, periphery and rake.
- Regrinding, finishing with different wheels

**Preparation:**
- Separation
- Profile roughing
- Profile finishing

**Point**
- Standard
- Split point
- 2-facet point
- 4-facet point
- 6-facet point
- Delta – point
- M – point
- Kevlar – point
- Centring point
- Milling end face

**2$^{nd}$ Chamfer**
- Optional: 2$^{nd}$ chamfer

**1$^{st}$ Web Thinning**
- Correction of main cutting edge
- Correction of chisel edge
- S-web thinning (incl. Sumitomo like)
- Free constructed notchings / corrections

**2$^{nd}$ Web Thinning**
- Correction of main cutting edge
- Correction of chisel edge

**Main Fluting**
- Meas. definition: Point-/ normal cut
- Grind. direction: Forward / backward
- Optional spark out grinding
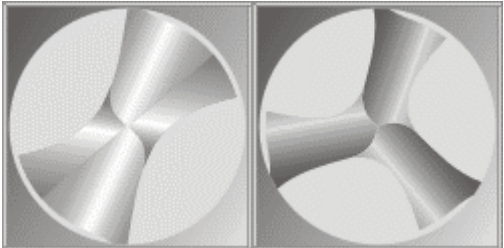- Separated fluting per step

**Periphery**
- Radial grinding / Round grinding
- Transverse/longitudinal positioning
- Linear relief: 1./2. relief angle

5-steping drill

**Steps**
- Standard step (axial/radial relief angle)
- Step aperture angle: 45 - 200°
- Linear relief step (aperture angle $\geq$ 170°)

**Chip Breaker**
- 1 or 2 chip breakers per tooth

**Simulation**
- Simulation of intersection at all operations
- Wheel/workpiece-simulation
- Machining simulation

**Production from standard- to step drill**
- Special measurement and calculation program
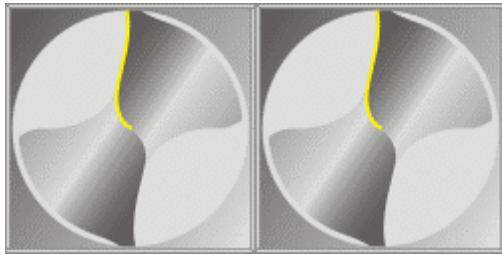
### 6.2  Subland Drills



**Extension to 6.1:**

**Specification according to Standard-/Stepping Drills**

**Secondary Fluting**
- Defined rotation against main fluting

### 6.3  S-Point


2-Teeth          3-Teeth

**Extension to 6.1:**

**S-point like Hertel**

**-** 2 and 3 teeth
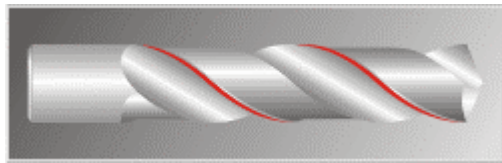
### 6.4  Chamfering Web Thinning



Chamfer of S- and RGR-Web Thinning

**Extension to 6.1:**

**Chamfering at cutting edge of S- and RGR-Web Thinning**

### 6.5  Chamfering of the flute cutting edge



Chamfer of the flute cut

**Extension to 6.1:**

**Chamfering at cutting edge of flute:**

- Chamfer Angle
- Chamfer Width

# 7 Deep Hole Drill                    Specifications
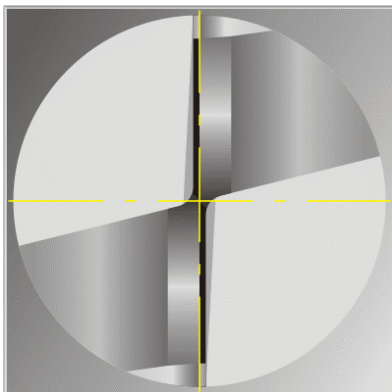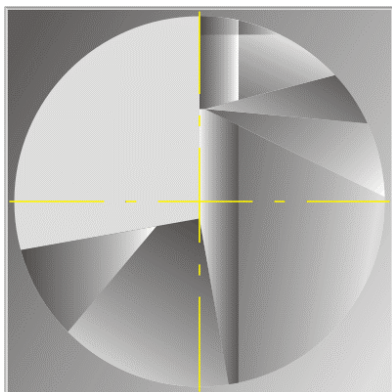


**1- and 2-Cutter**

**Preparation**
- Cut-off
- Roughing

**Point Clearance:**
- Up to 5 different clearances

**Chamfer:**
- Optional: Chamfer grinding

**Main Fluting:**
- Straight Gashing

**Secondary Fluting:**
- Optional: Sec. flute

**Web Thinning:**
- Corrected main cutting edge
- Corrected chisel edge

# 8 Profile Tools                                                    Specifications

### 8.1 Basic program „Increasing / Downgrade Profile"

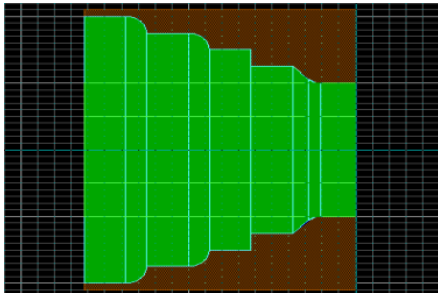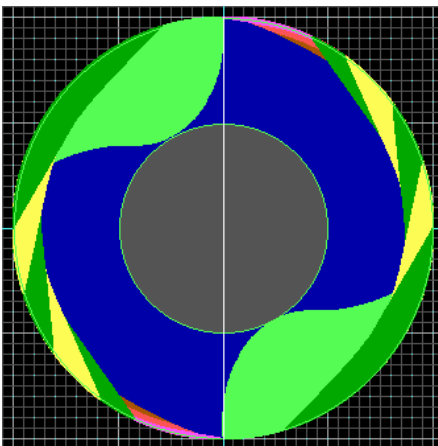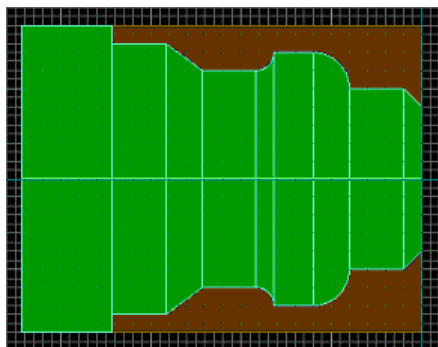| | |
|---|---|
| **Profile End Mills / Spade End Mills**<br><br>**Profile Drills / Spade Drills**<br><br>right helix / right cutting<br>left helix / left cutting<br><br><br>Side view<br><br><br>Front view<br><br><br>side view | **Workpiece:**<br>- Tools with increasing and **falling** profile<br>**Point:**<br>A) Milling End Face like 1.1<br>B) Drills Point like 6.1<br>**Geometry:**<br>A) Milling End Face like 1.1<br>B) Drills Point like 6.1<br>**Cutting Edge Combination:**<br>- right helix/right cut<br>- left helix/left cut<br>**Production / Regrinding:**<br>- Production by different infeed (several steps)<br>- Regrinding with calculation of removal length, periphery and rake.<br>- Regrinding, finishing with different wheels<br>**Profile:**<br>- CAD-system for profile construction<br>**Profile Element:**<br>- Straight line<br>- Edge<br>- Convex / concave radius<br>- Chamfer<br>- Increasing / downgrade profile<br>- Free selectable sequence of the profile elements<br>**Preparation:**<br>- Separation (cut off)<br>- Profile roughing<br>- Profile finishing<br>- Straight polishing<br>- Corresponding to a defined blank profile<br>**Main Fluting:**<br>- Straight fluting<br>- Tapered fluting<br>- Spade drill fluting<br>**Periphery:**<br>- Linear relief: 1st/ 2nd /3rd relief angle<br>- Radial relief: 1st relief angle<br>- Cylindrical relief<br>- Raised land fluting<br>- Multi facet raised land fluting |

**8.2 Extension: Multi Fluting Geometry**
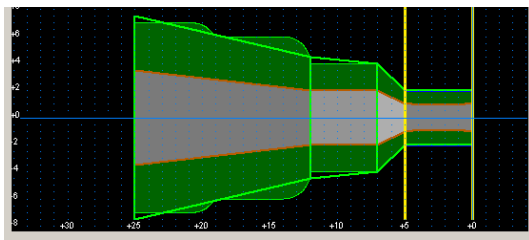
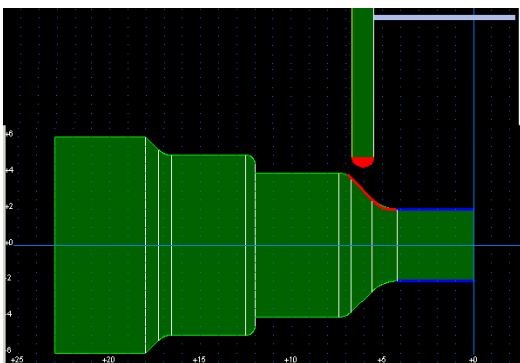| | |
|---|---|
|  Workpiece with 4 flutings | Extension of basic program: **„Multi Fluting Geometry"** - Up to 5 flutings with separate definition but common cutting edge |

**8.3 Extension: Receding Profile**
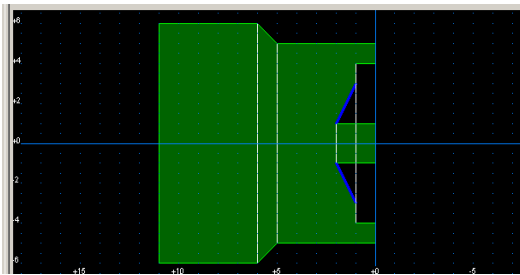
| | |
|---|---|
|  Workpiece with „Receding Profile" | Extension of basic program: **„Receding Profile":** - Extension of profile including receding sections |

**8.4 Extension: Radial Periphery**
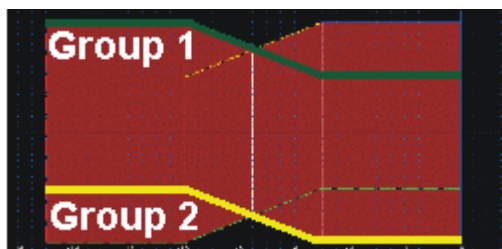
| | |
|---|---|
|  Grinding with radius wheel | Extension of basic program: **„Radial Periphery":** - Radial periphery along discretionary sections - Special grinding procedure by radius wheel |

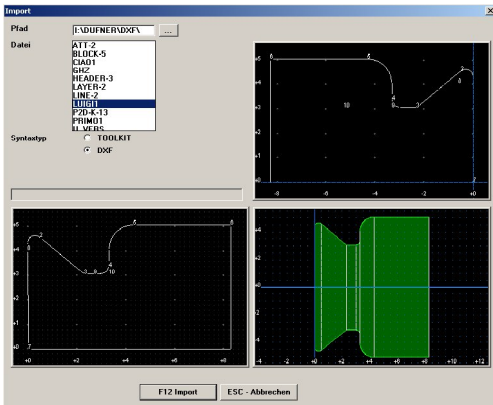**8.5 Extension: Multi Cutting Geometry**

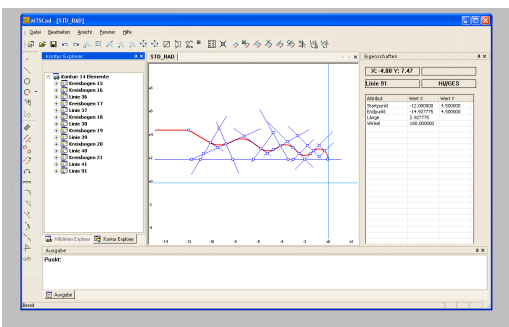| | |
|---|---|
|  | Extension of basic program: **„Multi Cutting Geometry":** - Multi cutting tools with 2 Groups - In pairs different cut geometry |

**8.6 Extension: Reading DXF-Format**



Extension of basic program:

- Reading an external created **DXF-file**
- Konverting into MTS-file-format
- autom. sorted elements
- autom. corrected sequence
- autom. corrected orientation
- Selecting the particular layer
- DXF-Standard:
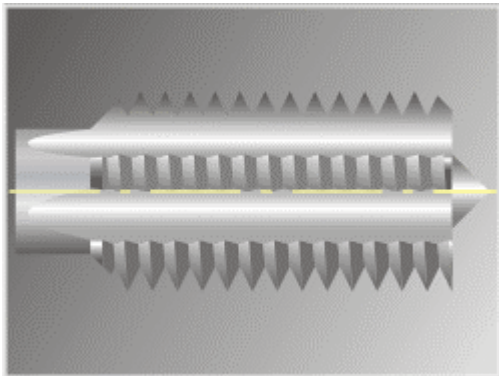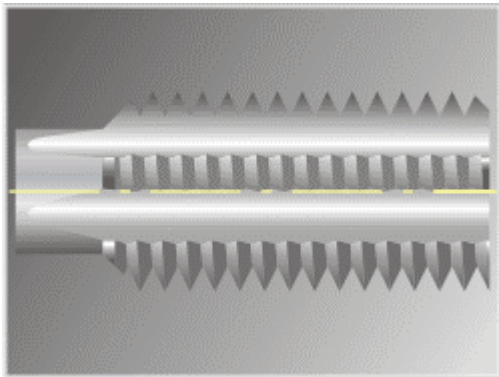  AutoCAD Version 12
  DXF-identification-code „AC1008"

**8.7 CAD-Module**



Extension of basic program:

-

# 9 Taps                                    Specifications

## 9.1 Taps, Basic



Taps with flatgrind or centring point

**End Face:**
- Plan Face
- Centering Point
- Clearance
- Centering P. + Clearance
- Spigot

**Cutting Edge Combination:**
- right helix/right cutting
- left helix/right cutting
- left helix/left cutting
- right helix/left cutting

**Preparation:**
- Separation
- Profile roughing
- Profile finishing

**Main Fluting:**
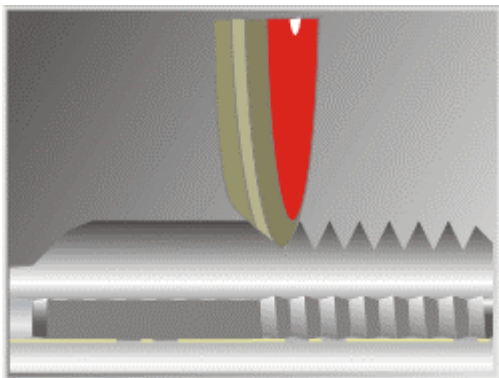- Using standard- or radius wheels

**Chamfer:**
- Type of grinding: longitudinal/transverse
- Chamfer angle
- Chamfer length
- Chamfer radial relief

**Gashing:**
- Radial cut angle
- Axial cut angle
- With radius- or rounded cup wheel
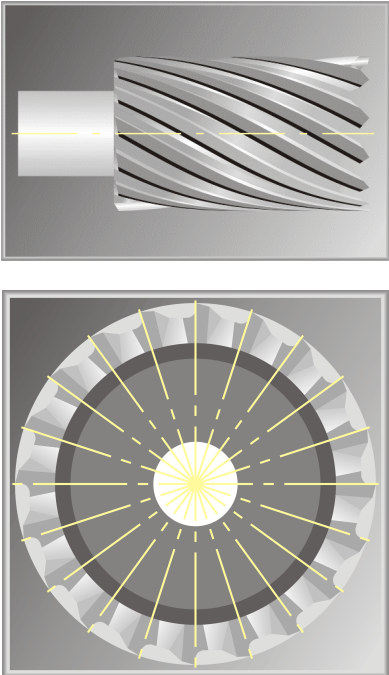
## 9.2  Taps / Production



**Extension to 9.1:**

**Tap production:**
- Production by profile-wheel
  (Wheel-defintion by  DXF- or
   point discription)
- Radial relief
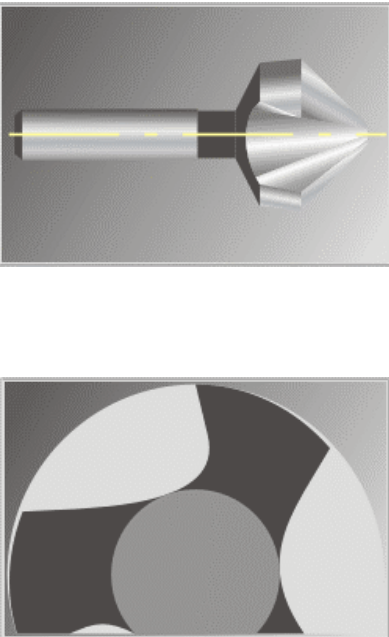
## 10 Core Dril                                              Specifications



**Workpiece:**
- Cylindical workpiece ( like 1)

**End Face:**
- 1./2. relief angle
- Concavity
- Negat./posit. dish angle
- Outer cutting edge, inner cutting edge
- Regular/changing teeth geometry

**Chamfer:**
- 1./2./3. relief angle

**Notching:**
- 1 to 3 notchings per tooth
- Constructable cutting positions
- Roundings at entry and exit
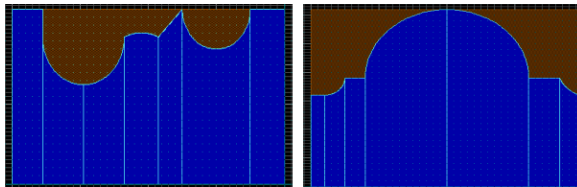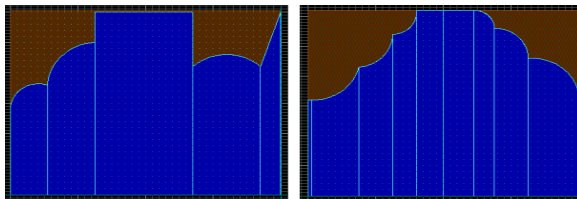- Variable aperture angle

## 11 Countersink                                            Specifications



Counter flute with special grinding procedure

**Point:**
- Plane

**Cutting Edge Combination:**
- right helix/right cutting
- left helix/left cutting

**Production / Regrinding:**
- Production by different infeed (several steps)
- Regrinding with calculation of removal length, periphery and rake.
- Regrinding, finishing with different wheels

**Preparation:**
- Separation
- Profile roughing
- Profile finishing

**Fluting:**
- Taper flute like end mills
- Counter flute with special grinding procedure

**Chamfer:**
- Axial/radial relief angle

**Rear Section:**
- Cylindrical grinding

**Plane End Face**

## 12 Profile Cutter                                                    Specifications

6 Examples:
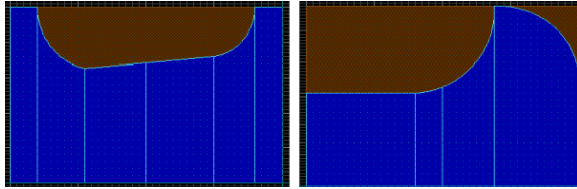


**Workpiece:**
- Tools with free selectable profile

**Profile:**
- CAD-System for profile construction

**Profile Element:**
- Straight line
- Edge
- Convex / concave radius
- Chamfer
- Free selectable sequence of the profile elements
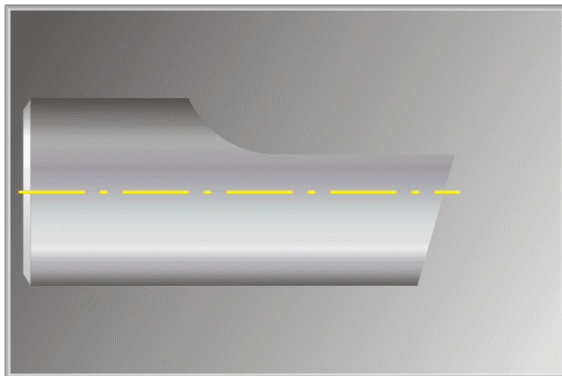
**Preparation:**
- Profile roughing
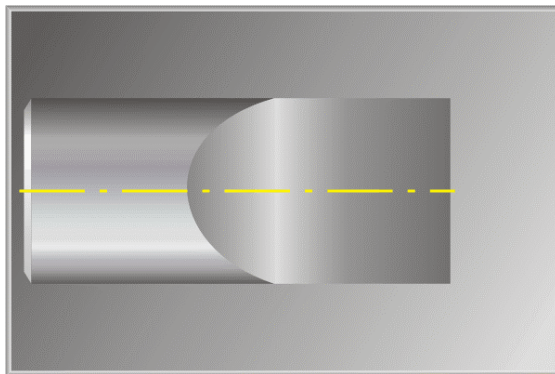- Profile finishing

**Lateral Clamping:**
- Straight
- Helix
- Rake angle

**Periphery:**
- Axial part of relief
- Radial part of relief
- Free selectable grinding position per element

## 13 Burins / Lathe Tools                                    Specifications

Side view

view from topside

**Workpiece:**
-   Tools with free selectable profile

**Profile:**
-   CAD-System for profile construction

**Profile Element:**
-   Straight line
-   Edge
-   Convex / concave radius
-   Chamfer
-   Free selectable sequence of the profile elements

**Preparation:**
-   Profile roughing
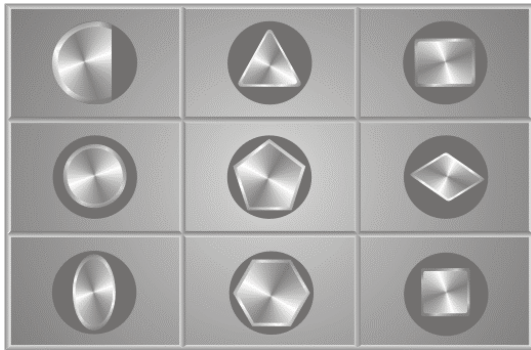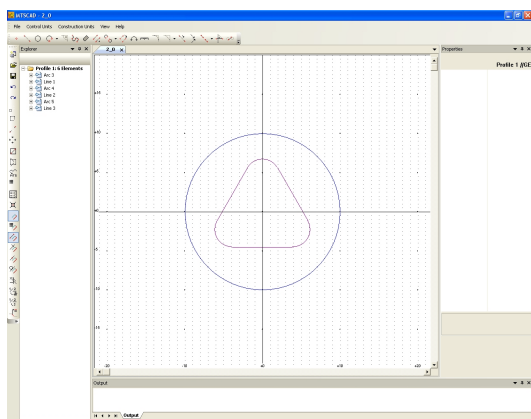-   Profile finishing

**Clamping:**
-   Frontal

**Periphery:**
-   Axial part of relief
-   Radial part of relief
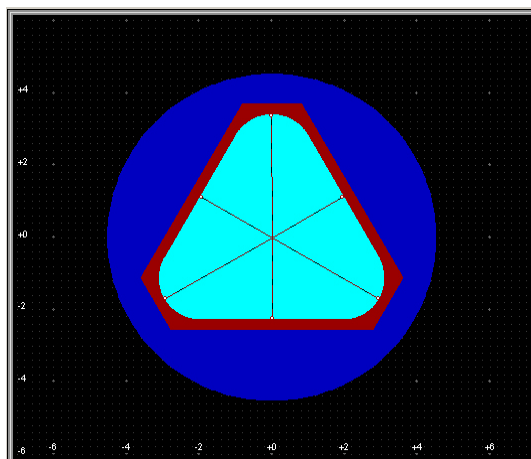-   Free selectable grinding position per element

**Main Fluting:**
-   Straight fluting
-   Sec. gashing

## 14 Punches                                                        Specifications


9 samples of typical intersections


Im.-/export; CAD-program


Polygon-preparation
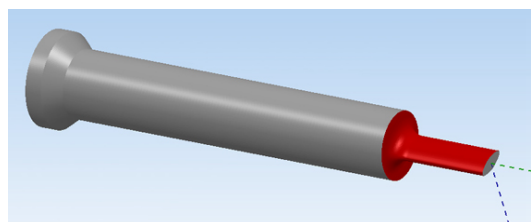

Exampel punch

**Workpiece:**
- Circular grinding of any radial profile
- Any axial profile (shank)

**Profile:**
- Standard profiles (integrated database)
- Special profiles by integrated CAD-System for profile-construction
- DXF-Import
- Centrical/excentrical profiles

**Machining:**
- Polygon-preparation
- Profile roughing
- Profile finishing
- Profile polishing

**Grinding Procedure:**
- Deep grinding
- Circular grinding (equal infeed)
- Circular grinding (dynamical infeed)
- Surface grinding

## 15 Flow Drills                                      Specifications
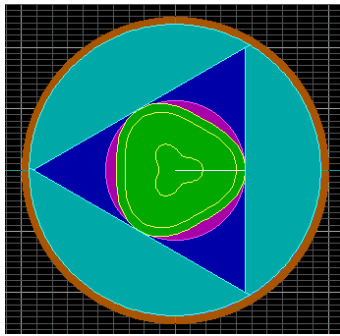

Front view


Side view

**Workpiece:**
- Round grinding with free selectable profile

**Profile:**
- Cross simulation construction by CAD polygon forms

**Machining:**
- Profile roughing
- Profile finishing
- Profile polishing

## 16 Preparation / Profile Processing          Specification



Exp: Clamping Surface Form E_2 / Form B, 1Land
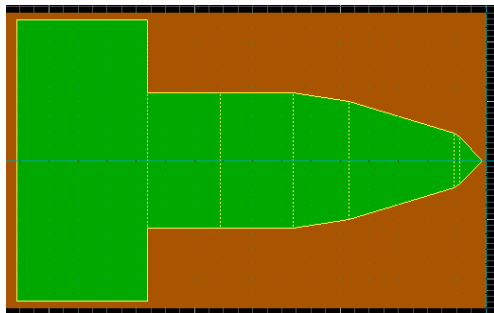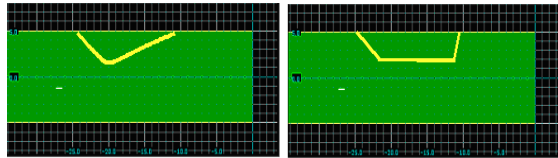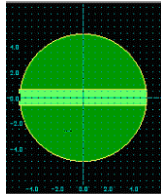


Slog
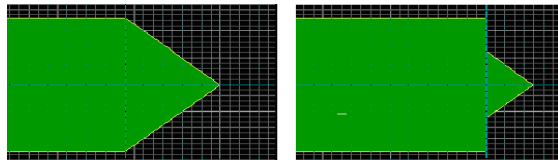


Full Point / Centring Point
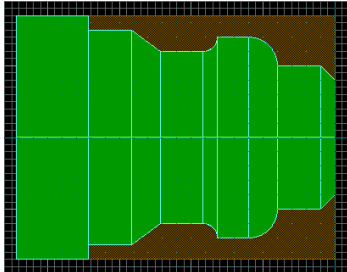


Example: Tools with increasing / downgrade profile

**A) Preparation**
**Separation:**
- Round Grinding / Depth Grinding

**Point Machining:**
- Full Point / Centring Point
- With / no oszillation

**Chamfer:**
- Round Grinding / Depht Grinding
- With / no oszillation

**Slot:** (Cooling Channel Connection)

**Clamping Surface:**
- Form B, 1 Land
- Form B, 2 Land
- Form E_1
- Form E_2

**B) Profile Machining**
- Increasing / downgrade profiles

**Operations**
- Roughing
- Finishing
- Polishing

**Type of End Face:**
- Plane
- Point
- Centering point

## 17 Construction of Flute Profile / Wheel Profile        Specification

### 18.1 Construction of Flute Profile / Wheel Profile

with profile-wheels



Flute construction        Wheel
calculation
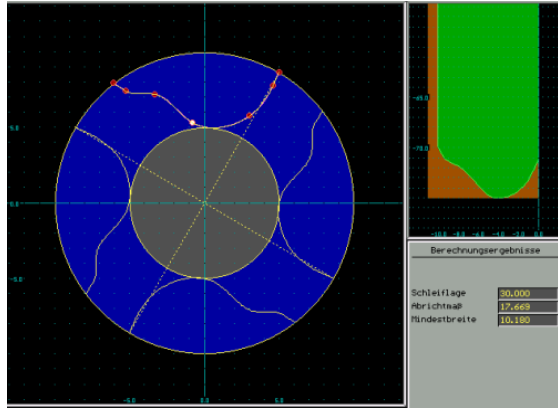


Simulation        Dressing

**Construction of Flute Profile:**

- Construction by integr. CAD
- Calculation of wheel-profile
- Calculation of grinding track
- Intersection simulation
- Output of wheel discription
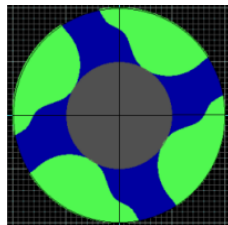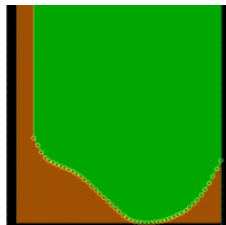
## 18 Construction of Wheel Profile / Flute Calculation        Specification
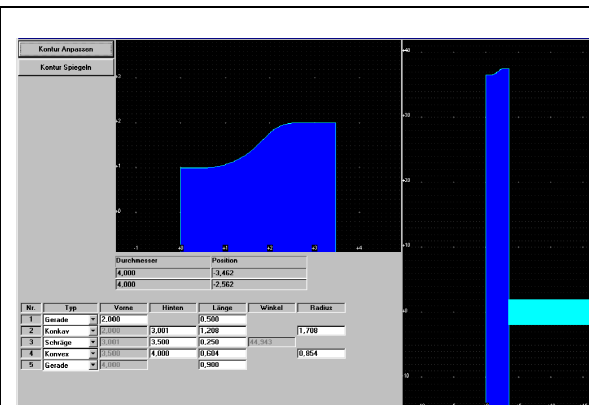


Wheel Construction

**Construction of the Wheel Profil:**

- Input by DXF-interface or geometrically discription
- Construction by integrated CAD
- Calculation of fluting
- Simulation of fluting
- Output of flute positioning

## 19 Dressing cycle / Wheel profile                                      Specification

**Wheel dressing:**

- Input of dressing parameter within machine world
- Calculation of dressing cycle driven by given wheel profile (Pos. 19)

## 20 Open Procedure Generator                                              for all moduls

Construction and generating of selfmade additional operations. Integration at any operation-position.
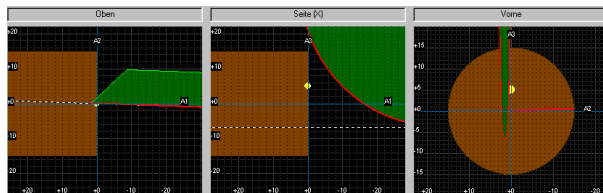


Graphical construction of movements
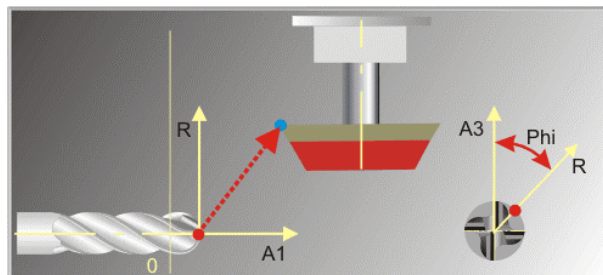


**Generating of open procedures**:

- Graphical construction of open procedures
- Up to 10 different additional operations per modul
- Import/Export by global database
- Inserting at any position within machining order
- Seperate wheel and technology to each open procedure
- Movement- and intersection-simulations

## 21 CNC-Collision-Control                                        Specification



Diagram of a collision of the grinding wheel with the clamping.

.

**Functions:**

NC_start without collision-control
NC_start with collision-control and auto-stop at first collision.
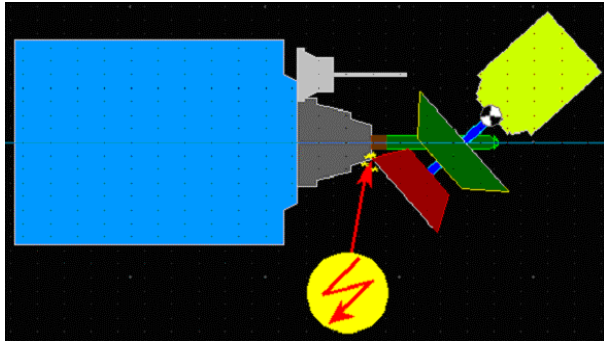NC_start with collision-control and collision protocoll of all situations
NC_simulation without collision display
NC_simulation with collision display

Extended CNC-Generator:
Collision-control: Yes / No
Mode-selection:
„Stop at first collision" / "All collisions"

Mode „Stop at first collision":
The modul stops the calculation of the CNC-code by recognition of the 1st collision and shows these graphically on the scope.

Mode „All collisions":
First the CNC code will be calculated completely. Subsequently we will have a listing of all collision situations.
In the following these can be individually plotted and examined.

Administration of the collision objects (Setup):
4 object lists:
Basical objects, tool-objects, clamping- and spindle-objects.
The list administration takes place in each case by inserting, copying, renaming or deleting. The selection of the objects which
can be considered concerning the
collision takes place via activating in the object lists.
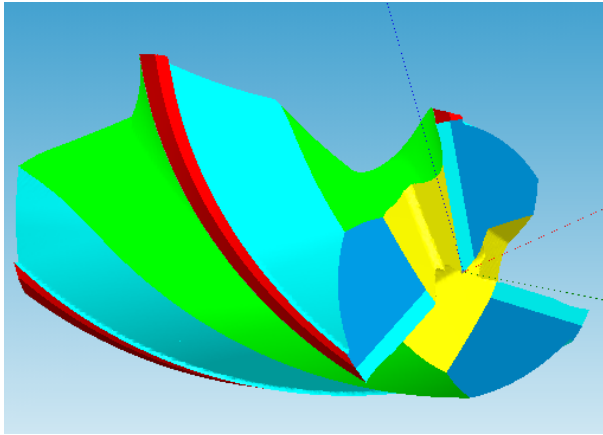
Collision calculation:
Examining the penetration of all activated objects, as well as the active grinding wheel outside of the workpiece.
Generating the collision protocol.

## 22 3D-Simulation

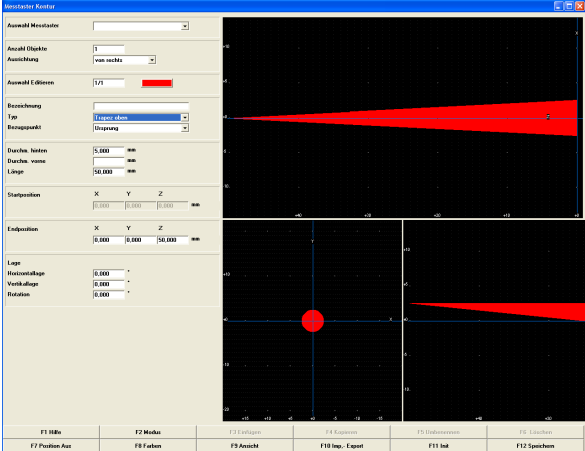### 22.1 3D-Simulation Workpiece / Wheel

<table>
<tr>
<td>



</td>
<td>

**Tool-simulation in 3D:**

- Integrated call of 3D-simulation from all moduls
- Selecting of operations to simulate
- Different dissolutions
- Free online rotating, relocating and enlarging of the tool

</td>
</tr>
</table>

## 23 Measurement-Cycles

### 23.1 Measurement-Cycles (to all MTS-moduls)

| | |
|---|---|
|   Insert Probing Profile | **Measurement-Cycles for 3D-probing-system**<br><br>- Length<br>- Tooth-positioning<br>- Helix lead (zylindrical, conical)<br>- Diameter (zylindrical, conical)<br>- Teeth-indexing |

## 24 Measurement-Machine

### 24.1 MTS-interface to an external Measurement-Machine

| | |
|---|---|
| | Interface within tool-kit PROFESSIONAL to a measurement-maschine (Exp. Zoller genius 3). The machine will be setted by the geometry-data out of tool-kit PROFESSIONAL. Measurement of tool-data and wheel-geometry. |