

GRAMMUND

**TECHNICAL
GUIDE**

The purpose of this manual is to explain not only how to use the complete range of tools, but also the particular features of each item in the system, indicating their advantages, disadvantages or any limitations on use. The different groups will be covered in:

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For information concerning dimension ranges, cutting conditions, regrinding information and drawings, please see our main catalogue.

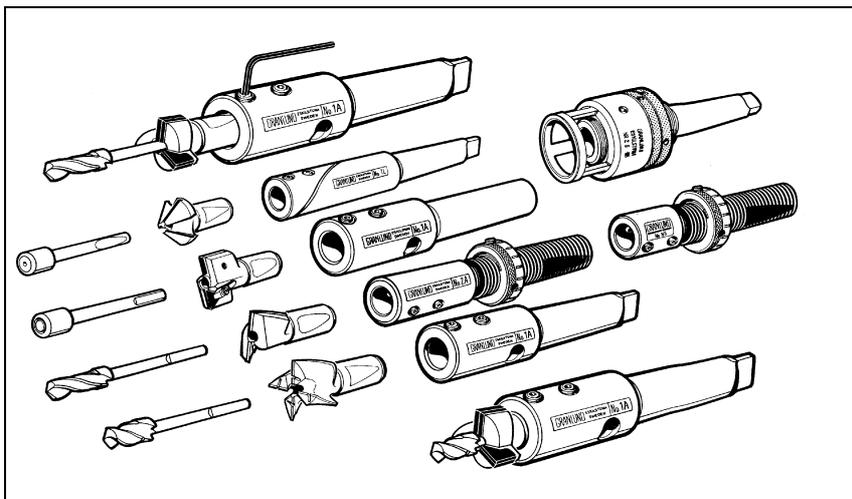
INTERCHANGEABLE TOOL SYSTEM

OBJECTIVE

The main objective with the Granlund modular tool system, is to provide the enduser with the possibility to easily build practically any special counterboring/ countersinking combination, using a wide range of standard components. In fact, with some 1300 components, the possible combinations are more than 1.500.000.

Each tool is made by combining three parts:

- A. TOOLHOLDER
- B. COUNTERBORE or COUNTERSINK
- C. PILOT or DRILL



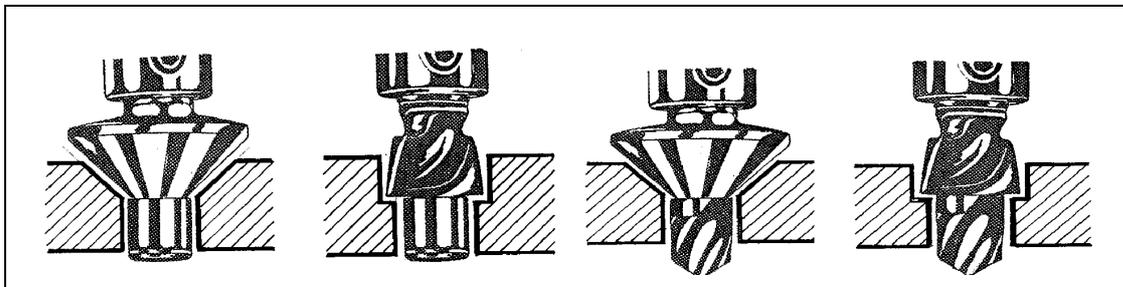
Picture 1

- A. The same toolholder can be used in many different combinations. With 16 types of holders available, most applications can be covered.
- B. The counterbore or countersink is selected to suit the demands of each specific operation and material. In the catalogue you will find our recommendations for most cases.
- C. If the workpiece is predrilled, a pilot should be used, otherwise operation can be made with an insert drill.*
* IMPORTANT! When step drilling, the drill must break through the workpiece before secondary cutting commences.

-Advantages-

1. Immediate availability of the right type and size within the system range.
2. If a part of the tool is damaged or broken, it is possible to substitute only this particular element and not the whole tool.
3. When the worn tool has to be reground it is easier to remove the cutter and to regrind only this, than to regrind a monoblock tool.
4. When a tool is worn unevenly it is possible to substitute only the more worn element.

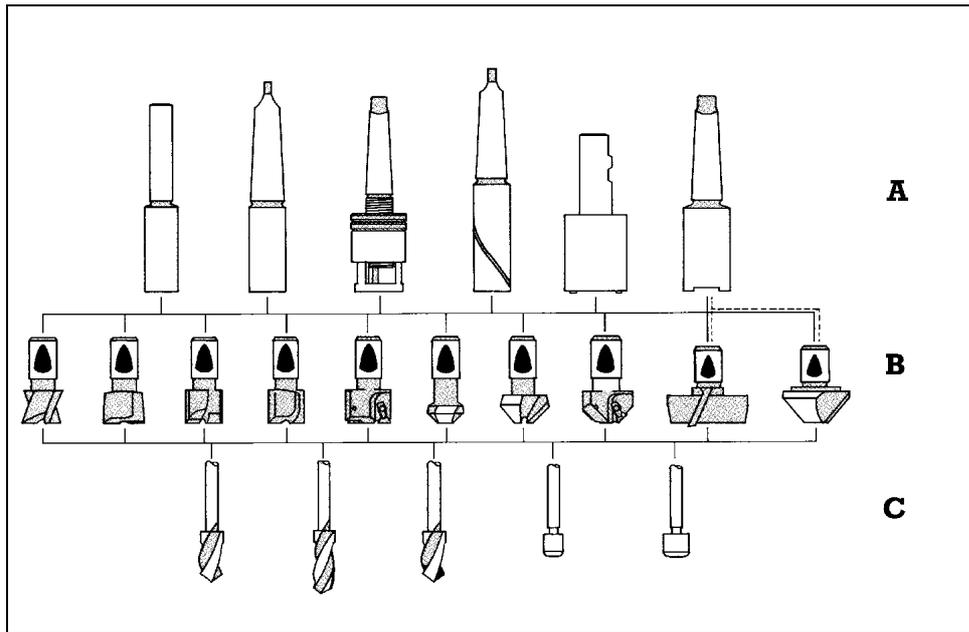
-Typical Operations-



Picture 2

Shown are some typical operations for the interchangeable tool system. So as to cover the whole range of diameters available for counterbores (5 mm-85 mm) and countersinks (6 mm-85 mm), the system is made up from 4 groups, these are 01, 0, 1 and 2.

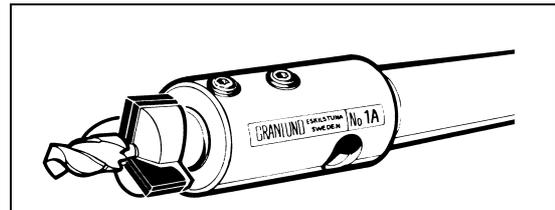
HOW TO CHOOSE THE CORRECT COMBINATION



Picture 3

Each complete tool is made up by three parts:

- A. Toolholder
- B. Counterbore or Countersink
- C. Pilot or Insert drill



Picture 4

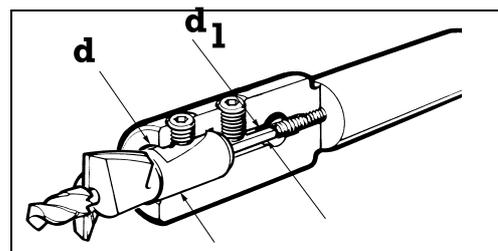
GROUPS: 01 - 0 - 1 and 2

A division into four groups is made, taking into consideration the relationship between the tool diameter and the size of the two connecting zones, i.e. Shank diameter of cutter (d), shank diameter of insert (d_1).

The four groups can each be identified by the size of either (d) or (d_1).

All combinations have to be made with elements belonging to the same group, groups are not interchangeable.

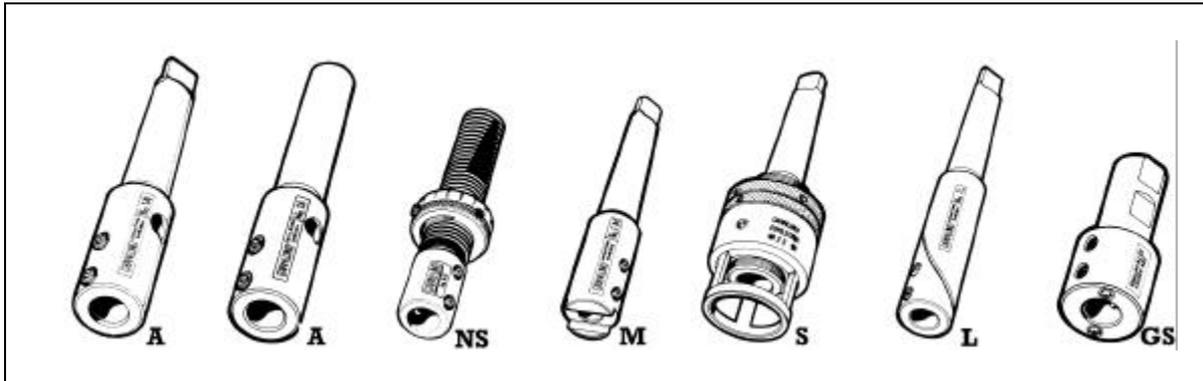
Group	Shank sizes	
	Counterbores/ Countersinks (d)	Pilots/ Insert drills (d_1)
01	7 mm	2,4 mm
0	10 mm	4,0 mm
1	14 mm	6,0 mm
2	22 mm	10,0 mm



Picture 5

Within each group a range of cutter/insert diameter combinations are available.

TOOLHOLDERS



Picture 6

Standard toolholders are available with various body/shank combinations. A number of shank types are available, to suit most machines.

For all toolholders, except the S-type, the outer diameter of the body has a g7 tolerance, offering the facility for use in guide bushes.

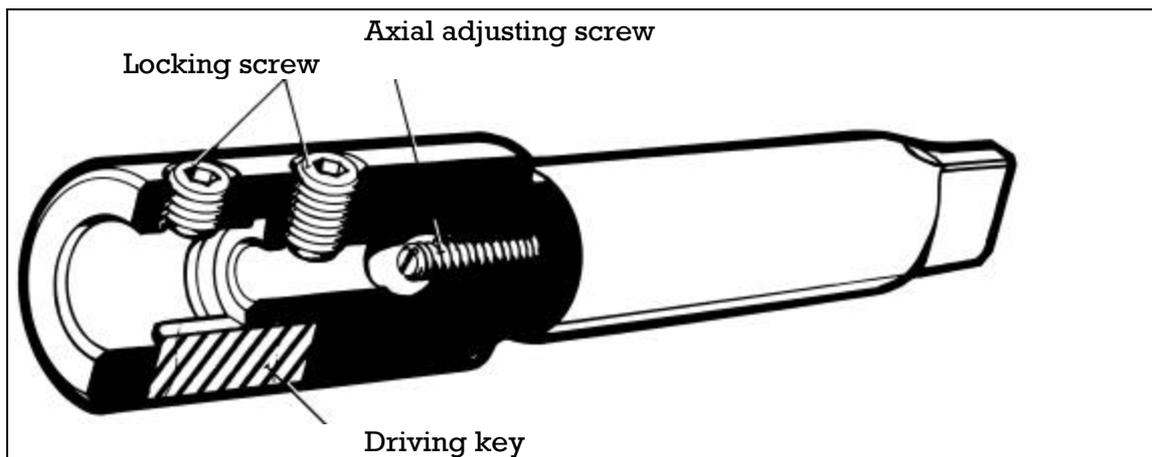
-Locking Screws-

These have the purpose to hold the cutter and pilot in the holder.

-Axial Adjusting Screw-

This screw acts as an end stop for the pilot or drill and has two functions:

1. When the pilot or drill is inserted, the axial adjusting screw should be set so as a gap is created between the cutter and insert. This is to prevent damage by accidental impact, especially when using carbide cutters.



Picture 7

2. If you are using a drill and it is necessary to keep it at a determined cutting length, (e.g. so as to breakthrough workpiece before secondary cutting commences), it is possible to re-adjust this screw after regrinding. Dimensions for the amount of adjustment can be found in the drawing section of the general catalogue.

- Type A Toolholder-

This is the most popular toolholder, it has a cylindrical case-hardened body to a g7 tolerance. Can be used in guide bushings. Cutters are driven by a key in the bore of the holder.

- Type M Toolholder-

This toolholder has a driving slot across the front of its body to drive the cutter and not the internal driving key, as with the other toolholders.

Should be used on size 1 cutters having a diameter of 30 mm and larger, or size 2 cutters 50 mm diameter and larger.

- Type S Toolholder-

For use on manual machines (hand feed only).

This toolholder utilises a rotating depth stop, which when pre-set, allows constant depth counterbores or countersinks to be produced, accurate to 0,05 mm.

The adjustment range for these toolholders is shown in the drawing section of the general catalogue.

- Type L Toolholder-

Extra long toolholder, with lubrication grooves along the body diameter, for use in guide bushings. They are manufactured in different lengths in groups 0,1 and 2. Lengths available are shown in the catalogue.

- Type NS Toolholder-

This is a short series toolholder and its use is recommended in the following cases:

- when maximum rigidity is needed.
- when there is restricted space between machine spindle and the workpiece.

- Type GS Toolholder-

Holder with through coolant. The direction of the coolant can be adjusted.

COUNTERBORES

The types and sizes of counterbores available are shown in the catalogue.

Special diameters can be ground from standards.

The manufacturing process of the brazed carbide counterbores is such that the brazed insert is positioned away from the centre hole, therefore when using the brazed carbide type counterbores H, HA, or WH, there are some pilot or drill sizes (the smallest ones in each group), that should not be combined with these types of counterbore, these are indicated in the catalogue with an asterisk*.

- Type WHV Rotatip -

2-flute counterbore with indexable inserts.

Pilot type R is recommended, always check the minimum pilot diameter that can be used, these are shown in the general catalogue. In certain special applications, an insert drill could be used, but the surface speed of the counterbore must be compatible with the HSS-drill.

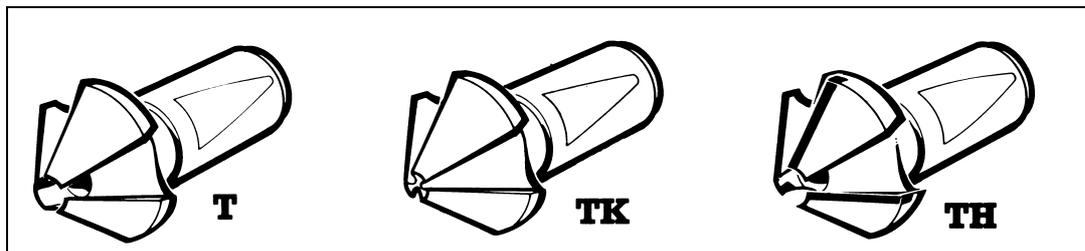
COUNTERSINKS

The types and sizes of countersinks available are shown in the catalogue.

Special diameters can be ground from standards.

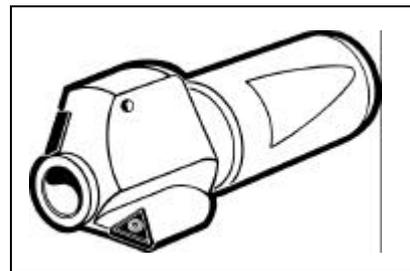
The manufacturing process of the brazed carbide countersinks, type TH, is the same as for brazed carbide counterbores, therefore some pilots or drill sizes (the small ones in each size range) should not be combined with this type of countersink. These are indicated in the catalogue with an asterisk *.

Countersinks 2TH, 2TK, and 2T of 50 mm diameter and above are manufactured with a driving lip. These sizes should be used in the appropriate 2M type holder. Type TK cannot be used with insert drills or pilots.



Picture 8

-Type KV Conotip-
2 flute countersink with indexable inserts.



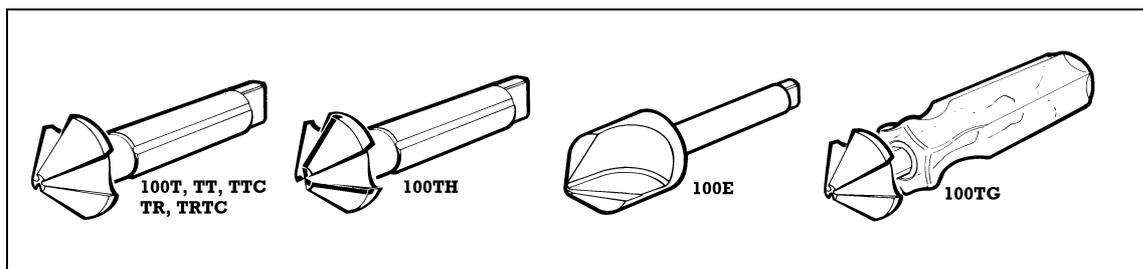
Picture 9

Pilot type R is recommended, always check the minimum pilot diameter that can be used, these are shown in the general catalogue.

-Type 100T, TL, TT, TR, E, TTC, TRTC -

With cylindrical shank, can be combined with taper sleeves type 102 to offer morse taper shank facility.

Cannot be used in the Interchangeable Tool System.



Picture 10

T= HSS, TT = HSS TiN, TTC = HSS TiCN, TR = HSS for stainless, TRTC = HSS TiCN for stainless, TH = Carbide K10, E = HSS, TG = HSS

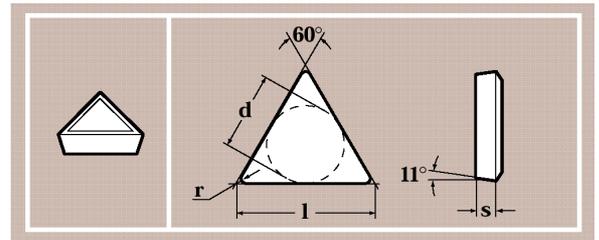
INDEXABLE CARBIDE INSERTS

Only Granlund indexable inserts can be used, standard ISO-inserts are not suitable.
Differences:

1. Thicker inserts, to give more rigidity to the whole tool and better location.
2. Multi layer coating is harder and more resistant to wear than conventional coatings, giving longer tool life.
3. Special chip-breaker design enables higher feed rates to be achieved.

Note: The 07T and 10T sizes of inserts have a 0,4 c/rad as standard, and the 12T size insert has a 0,8 c/rad as standard.

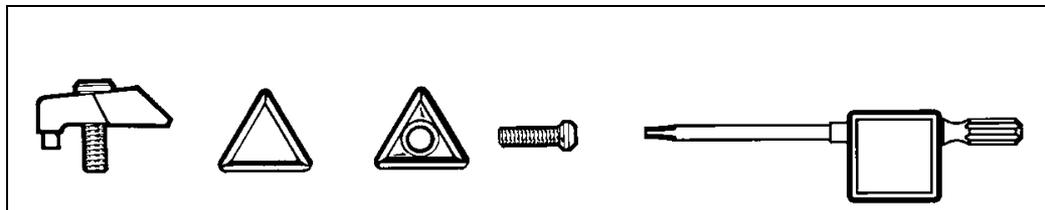
Chipangle 5°	I	d TPMT ±0,05 TPMR ±0,05 TPGR ±0,025	s ± 0,13	r ± 0,10
TPMR-07T TPMR-07H TPMT-07T TPGR-07T	7,45	4,30	2,10	0,40
TPMR-10T TPMR-10H TPMT-10T TPGR-10T	10,22	5,90	2,90	0,40
TPMR-12T TPMR-12H TPMT-12T TPGR-12T	11,60	6,70	3,70	0,80
TPMT-17T TPMT-17H	17,32	10,00	4,95	0,8



Picture 11

Clamp/Centre Screw Fixing

A stronger clamping action is obtained when using the clamp, however, the centre screw fixing allows for better swarf evacuation.



Picture 12

PILOTS / INSERT DRILLS

Pilots are manufactured to tolerance c9. This is minimal size to a minus on diameter, therefore when ordering pilots the pre-drilled hole size should be quoted.

- Pilot type F (Fixed) -

Of one piece construction, this pilot is the most commonly used.

Intermediate diameters can be ground from standard sizes, maximum reduction 0,5 mm.

- Pilot type R (Roller) -

Rotating pilot

Recommended to be used with the type WHV Rotatip counterbores and KV Conotip countersinks.

If the pre-machined pilot hole is of a good surface finish i.e. reamed or ground, this type of pilot should be used.

When machining dry on certain cast materials, pilot must be lubricated with grease or oil.

-Drill Type B -

HSS-Co short flute length. Manufactured to tolerance h8, shank g8.

- Drill Type BH -

Equipped with brazed carbide tips K20 micrograin.

-Drill Type LB-

HSS-Co long flute length. Manufactured to tolerance h8, shank g8.

CARBIDE REAMERS (BRAZED)

Common features:

-Carbide grade K10.

- Reamers are stocked in tolerance H7 and also semi-finished for quick conversion to customers requirements.

- Differential pitched blades, for a better surface finish and elimination of vibration.

- Type 507 MTS Reamer -

Solid reamer, L.H. 8 - 10 deg., extreme differential pitch.

Especially recommended for large holes.

- Type 507 C, Straight Shank Reamer -

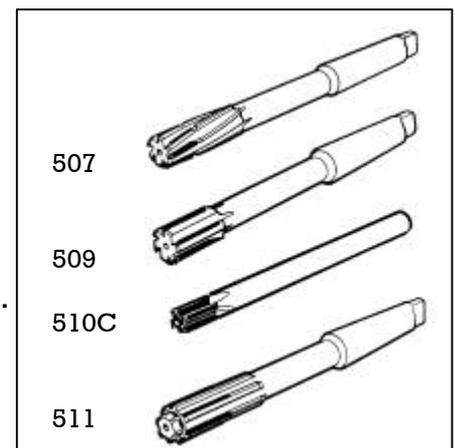
- Type 509 MTS Reamer -

Solid reamer, straight flutes with extreme differential pitch.

- Type 510C Straight Shank Reamer -

Solid reamer, with straight flutes, differential pitch .

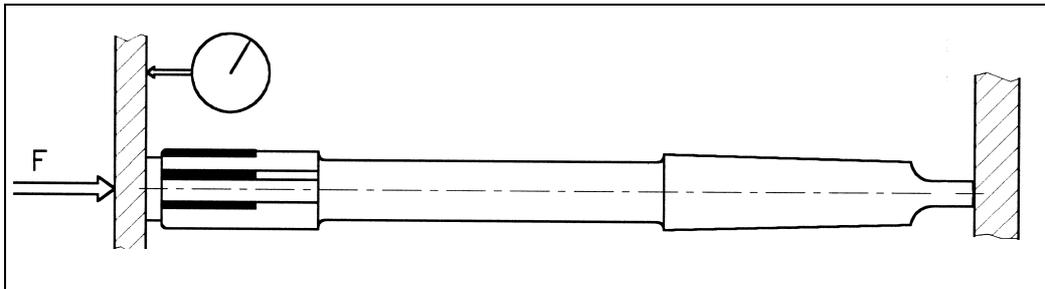
Picture 13



- Type 511 MTS Reamer -

Re-sizeable reamer with straight flutes and differential pitch, for through holes.

The expanding reamer can be re-sized to offset wear by driving the expansion plug further into the reamer. Re-sizing can normally be done 2-3 times with regrinding. Driving the plug 1 mm further into the reamer will increase the diameter by 0.033 mm.



Picture 14

Note: Type 511 reamer cannot be re-sized to smaller diameters.

As a general rule the reamer should be used in conjunction with floating toolholders, types 520 and 522.

Refer to general catalogue for cutting data and technical information.

SINGLE BLADE REAMERS

Common features:

- Round, straight holes.
- High repeatability.
- Quick change/indexing of the insert.
- The insert is located in a special seating that automatically sets correct back taper.
- Quick and simple diameter adjustment with one setting screw.

-Type RDC-

For through holes and blind holes 10 mm - 15 mm diameter.

Uses inserts type DC-04 or DCT-04 (coated).

-Type RBC-

For blind holes 16 mm - 50 mm diameter.

For 15.91 mm - 21.60 mm diameters, uses BC-08 or BCT-08 (coated inserts) 2 cutting edges.

For 21.61 mm - 50.00 mm diameters, uses BC-11, BCC-11 (Cermet) or BCT-11 (coated inserts) 2 cutting edges.

Specials (both diameters and lengths) are available upon request.

-Type RAC-

For through holes 16 mm - 50 mm diameter.

For 15.91 mm - 21.60 mm diameters, uses AC-08, ACC-08 (Cermet) or ACT-08 (coated inserts) 2 cutting edges.

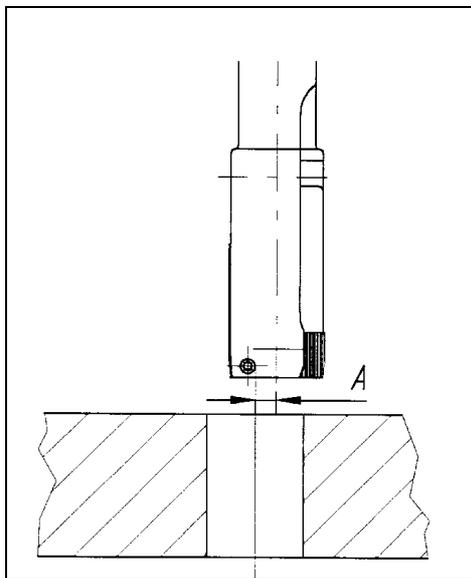
For 21.61 mm - 50.00 mm diameters, uses AC-11, ACC-11 (Cermet) or ACT-11 (coated inserts).

Specials (both diameters and lengths) are available upon request.

Recommendations:

If the reaming operation is to be carried out on a conventional machine, this reamer must be used with a 518 or 524 reamer holder, this is to take up any miss-alignment between the reamer and the hole.

The pivoting holder type 518 should be used when the deviation A is less than 0,05mm, and the fully floating holder type 524 should be used when the deviation A is more than 0,05 mm. Picture 15.



Picture 15

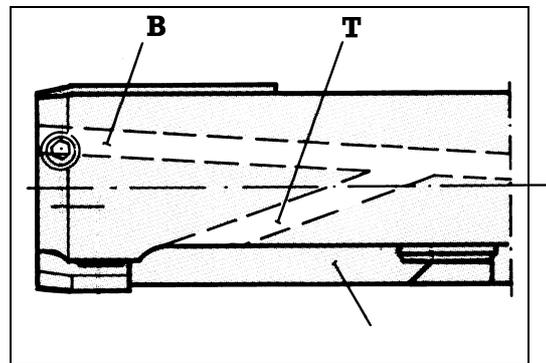
Due to the high positional accuracy achievable when machining on CNC machines, the use of reamer toolholders is not so important.

In the reaming operation, the coolant is very important for both cooling and lubrication purposes, but more importantly to wash the swarf away from the cutting edges.

Reamers above 12 mm diameter are manufactured with through coolant facility for both blind and through hole applications. Picture 16.

Setting of the RDC, RBC and RAC reamers

Setting of the reamer can be made with a micrometer, but the simplest and most accurate setting of the diameter is by using a plug gauge in the Granlund 519-1051 setting fixture.



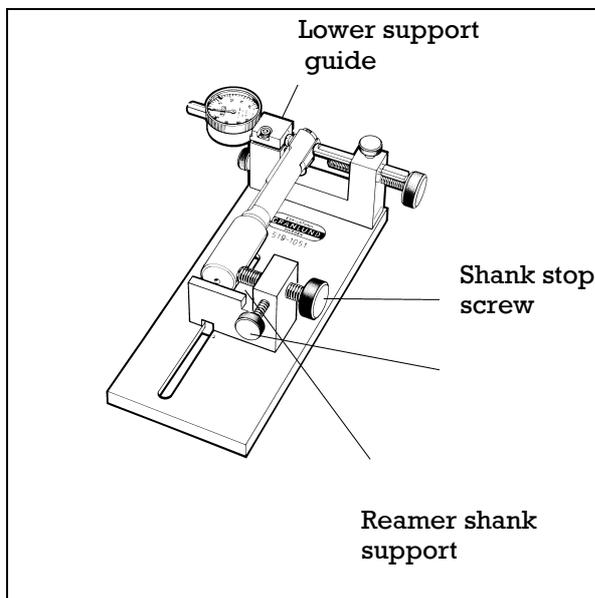
Picture 16
Reamers with internal coolant:
Blind holes, type B
Through holes, type T and/or
external coolant

PREPARATION

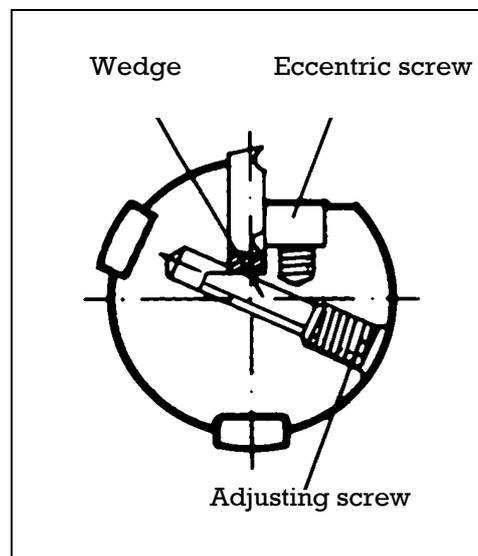
1. Adjust the fixtures lower support guide to the correct diameter according to the scale.
2. Adjust the support for the reamer shank to the correct position.
 - a) High support guide for reamer type RDC.
 - b) Low support guide for reamer type RBC and RAC.
3. Set the dial to the minimum hole tolerance, using the GO gauge.

CHANGING THE INSERT AND SIZE ADJUSTMENT

1. Loosen the adjustment screw one revolution and loosen the eccentric screw which secures the insert a $\frac{1}{4}$ of a revolution (NOTE: LEFT HAND THREAD).
2. Dismantle insert and pivot clamp.
3. Replace the pivot clamp and insert, ensuring both seatings are clean.
4. Hold the insert in place and secure with the eccentric screw (lightly).
5. Place the reamer in the setting fixture and with the cutting edge of the insert in the centre of the dial indicators probe, turn the reamer to show a maximum dia reading.
6. Centre the reamer axis with the shank stop screw to show the minimum reading on the dial indicator, lock in position.
7. Turn the adjustment screw on the reamer until a reading of 0.02mm before zero is achieved.
8. Finally secure the insert, then adjust the diameter to the required size with the adjusting screw i.e. to zero on the dial indicator.
9. The reamer can now be tested in operation for correct hole size.



Picture 17



Picture 18

BACKSPOTFACING SYSTEM

Features:

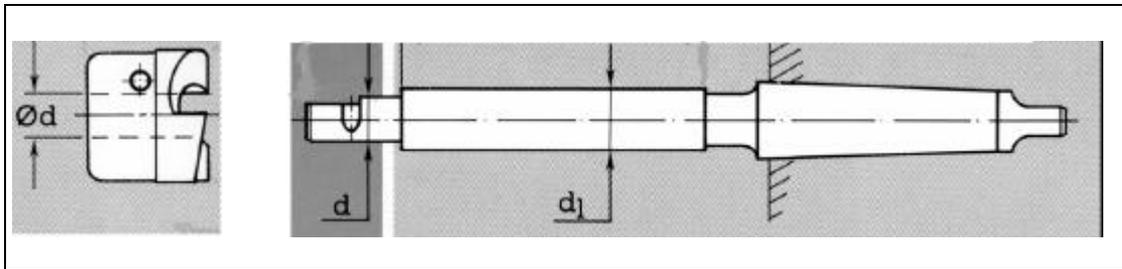
Quick change through bayonet fitting.
 Strong and rigid drive.
 No complicated blade fixing.
 Cutters in HSS and carbide tipped.

-Holders (Driving bar) - Type US-

Morse Taper Shank with a removable tang, providing a draw bar facility for pull back if required. Weldon Shank available for smaller sizes.

Bar diameter d_1 (tol. $d8$), is the guide (pilot) diameter that is to be the same as the nominal diameter of the hole to be backspotfaced.

Cutter location diameter (d) must be the same as the hole diameter (d) in the backspotface cutter.

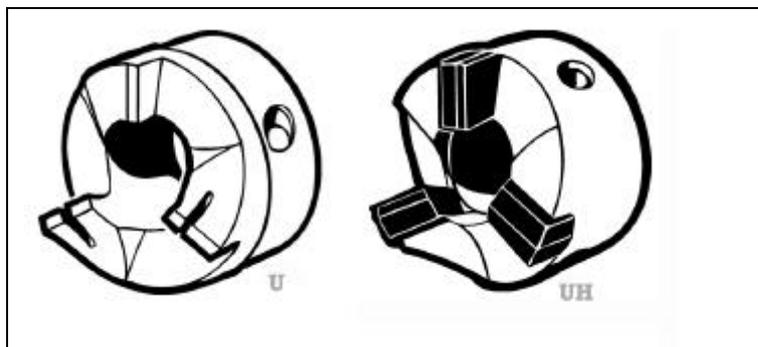


Picture 19

BACKSPOTFACERS

-Type U-
 3 Flute HSS, suitable for shallow spotfacing.

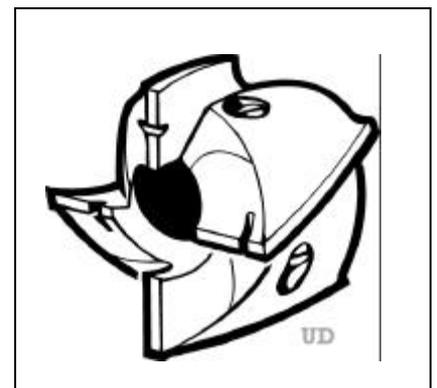
-Type UH-
 3 Flute Brazed Carbide tipped, suitable for shallow spotfacing.



Picture 20

-Type UD-
 4 Flute HSS, suitable for backspotfacing,
 and counterboring deep holes.

Picture 21



The catalogue indicates with an asterisk *, the small bar diameters in each size range that cannot be used with type UH (brazed carbide) cutters, as the manufacturing process is the same as for brazed counterbores.

Special diameter bars and cutters can be modified from standard sizes.

If a bore to be backspotfaced is larger than standard diameter bars, it is possible to sleeve the bar to suit the bore. It is better to choose the smallest bar diameter so as to enable a thicker sleeve to be made.

CNC-TOOLS

-Type BV-

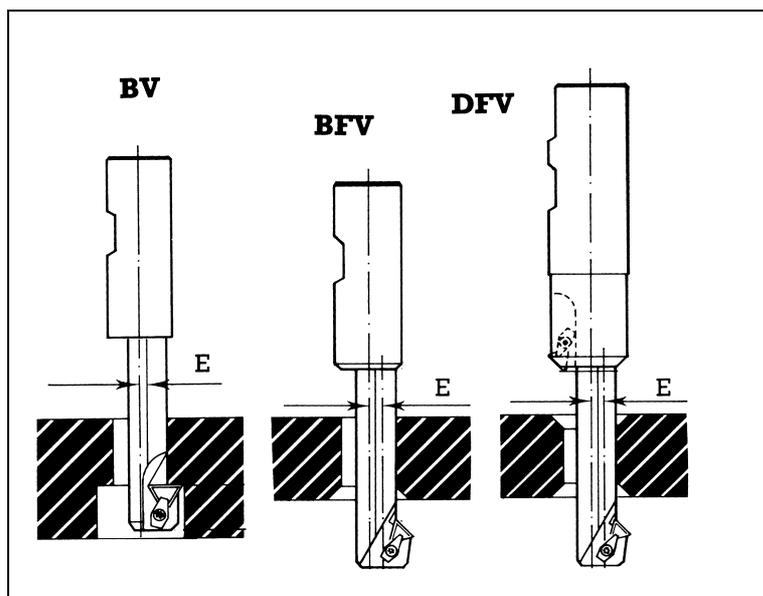
Backspotfacer with indexable inserts.

-Type BFV-

Backspotchamfer with indexable inserts. Can be used in circular interpolation.

-Type DFV-

Front and backspotchamfer with indexable inserts. Can be used in circular interpolation.

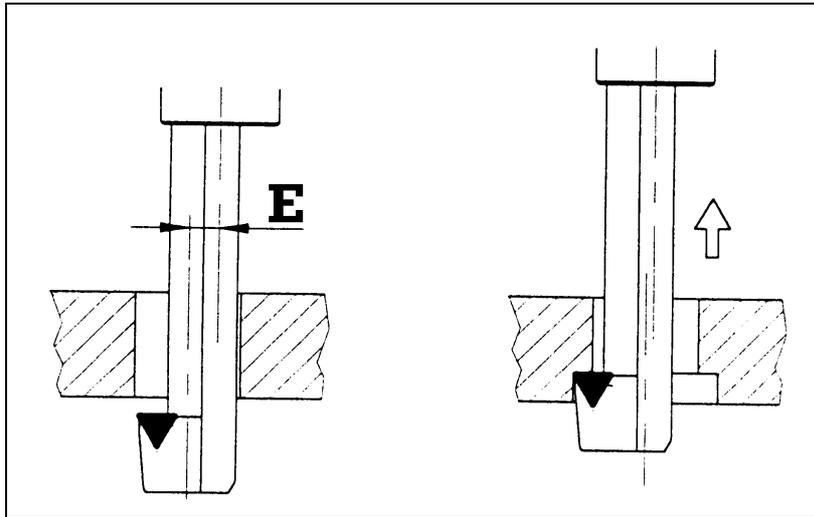


Picture 22

These types of tool (BV, BFV and DFV), need exact parameters to be programmed for the whole cycle.

The programme has to be written in the following sequence:

1. The spindle is positioned in the centre of the hole to be machined, then orientated to a known position.
2. The spindle is offset by the E value, given on the bar and in the general catalogue.
3. The tool is fed through the hole, and the spindle returned to the centre line.
4. The spindle is then started, and is fed back into the workpiece, producing a spotface or chamfer etc.
5. When the feature is completed, the spindle is stopped, returned to the original position (as in step 1), offset by the E value, then retracted through the workpiece.



Picture 23

Tools are ordered by quoting the backspotface/chamfer diameter (D) required, and the hole diameter (d_1).

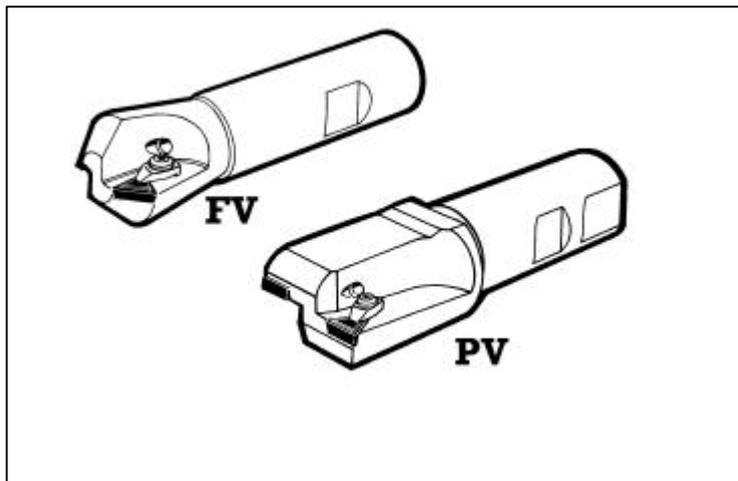
e.g. BV 20,0/13,0

-Type FV-

Countersink and chamfering cutter with indexable inserts. Can be used to chamfer larger diameters by circular interpolation, and can also be used for edge chamfering.

-Type PV-

Counterbore with indexable inserts. Will not cut to centre.



Picture 24

Check on minimum pre-drilled hole diameter given in the general catalogue.

Note: Maximum cutting depth is $0.9 \times D$.