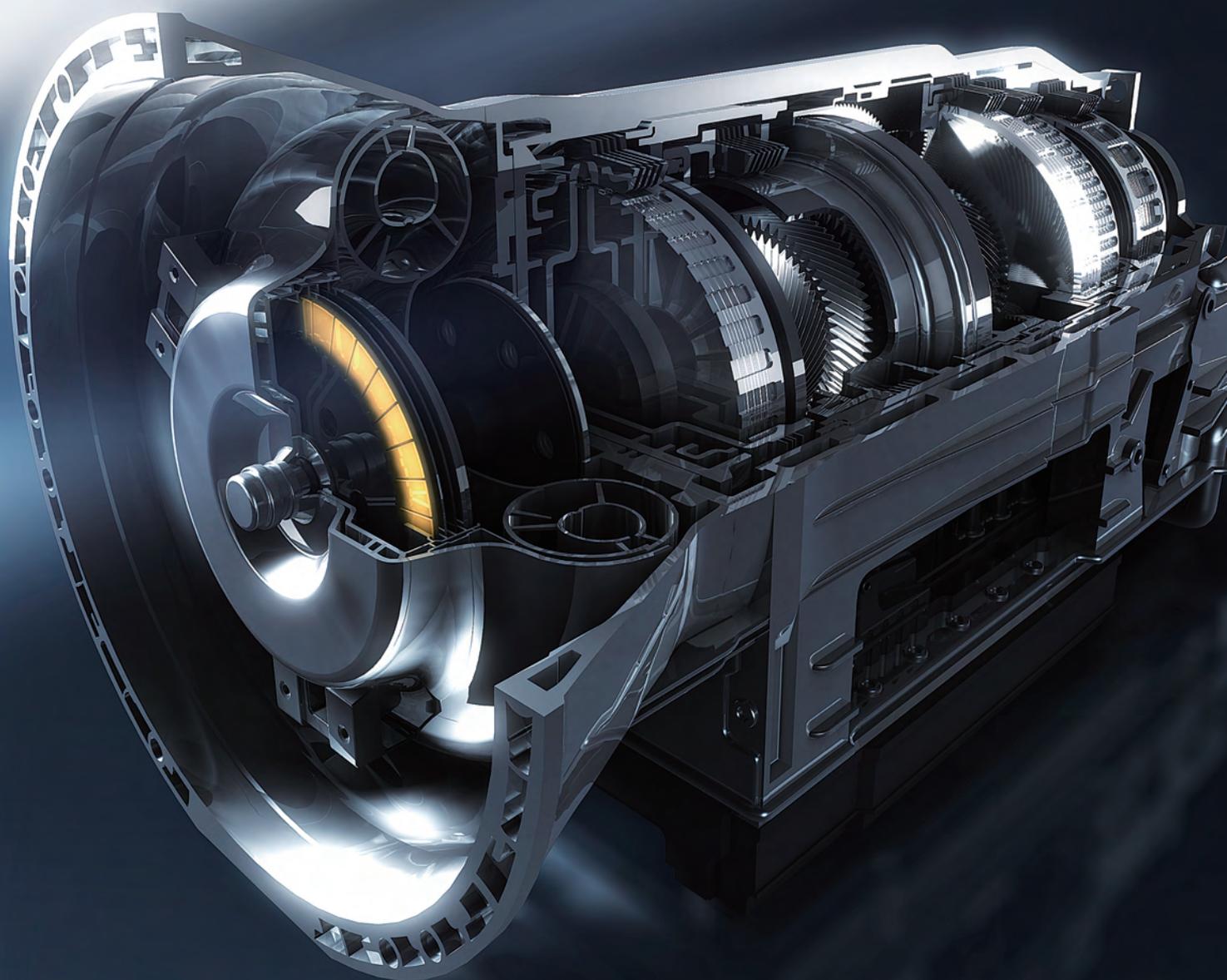
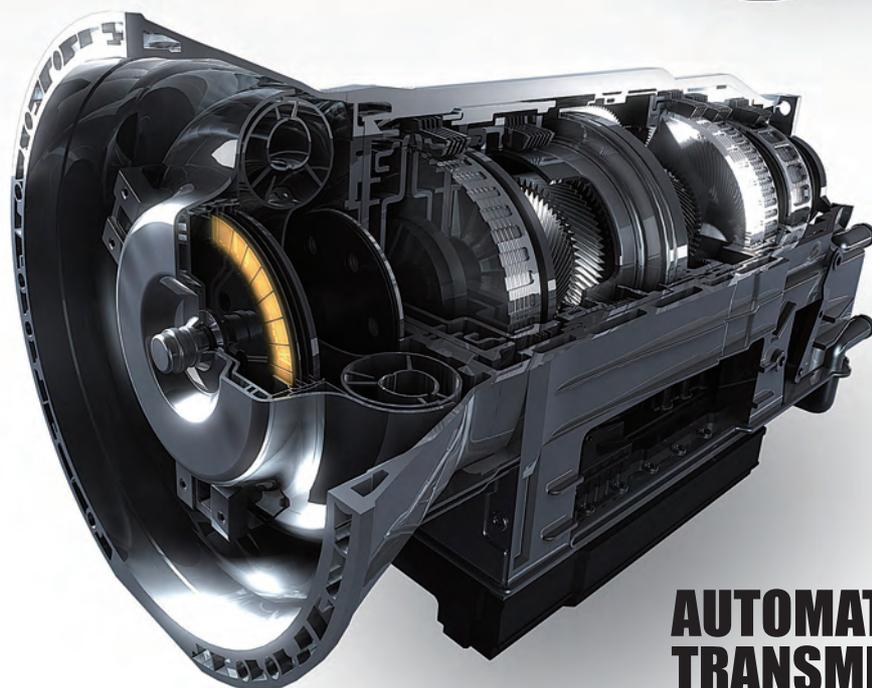
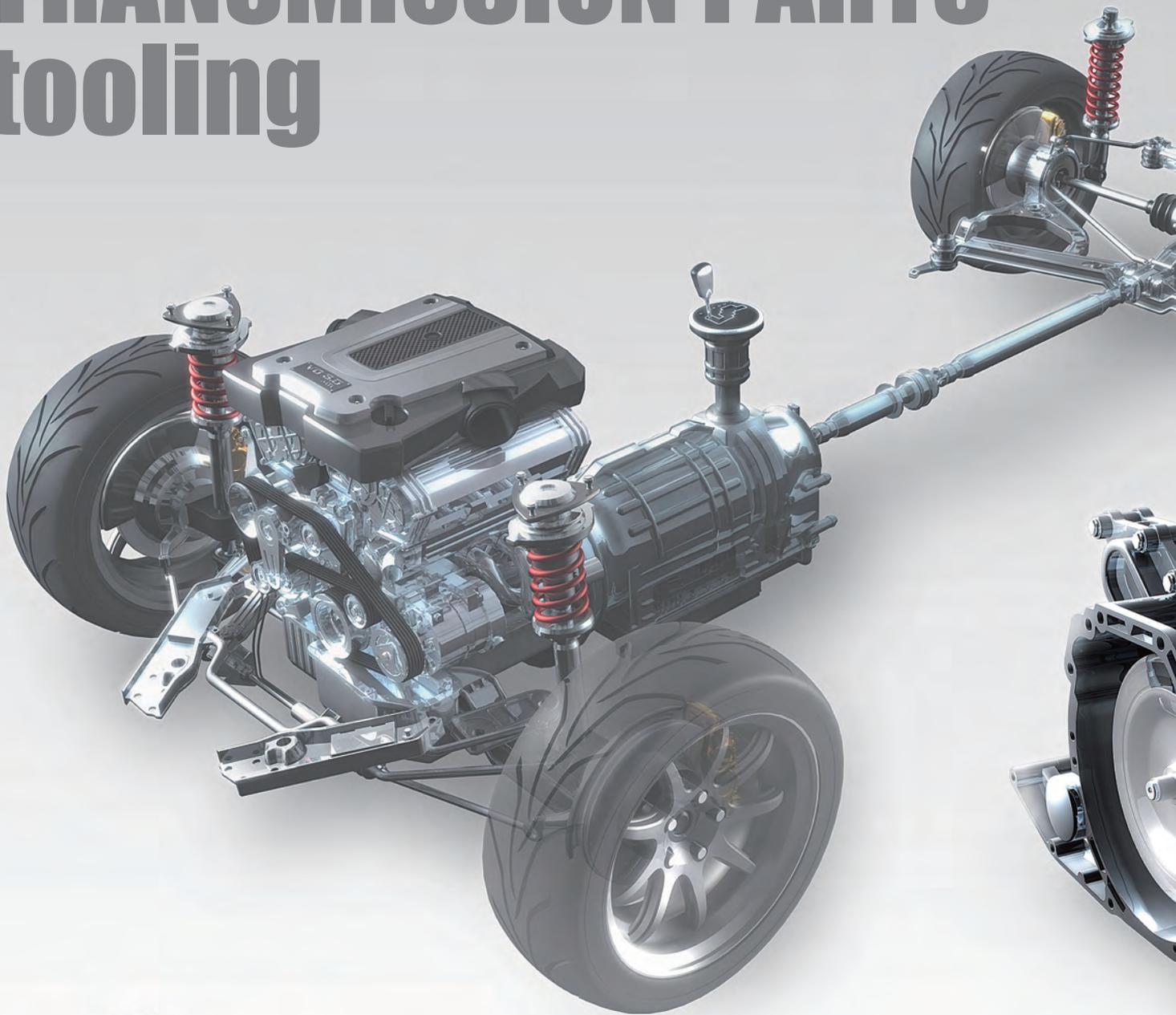


MITSUBISHI CARBIDE
MOTOR PARTS TOOLING
**MOTOR PARTS
SPECIAL TOOLING**
Vol.2 TRANSMISSION PARTS

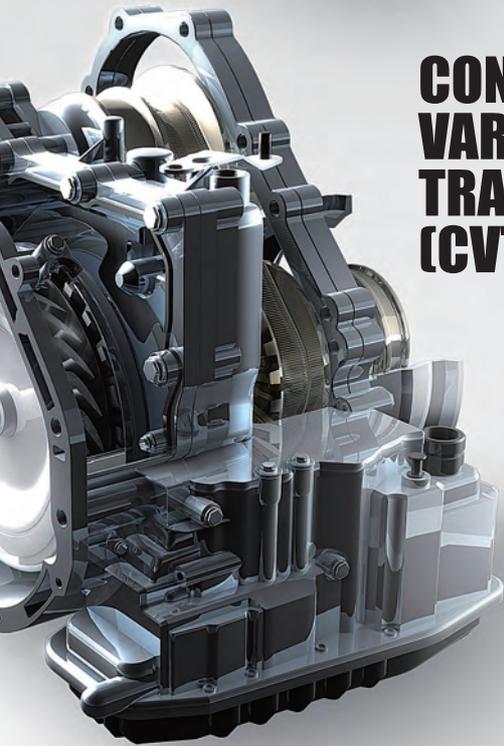
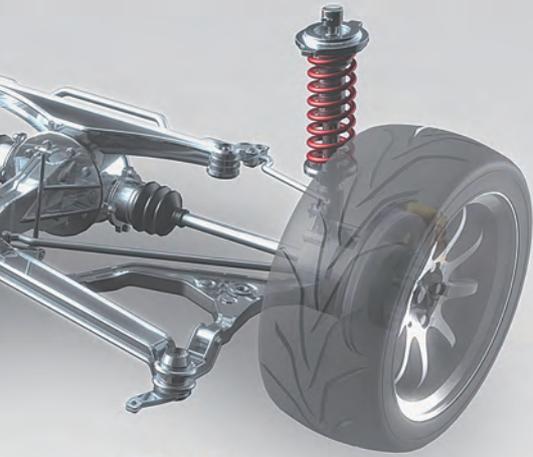


TRANSMISSION PARTS

tooling

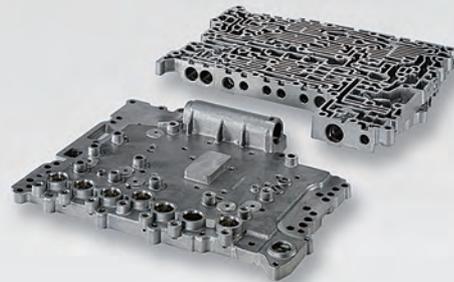
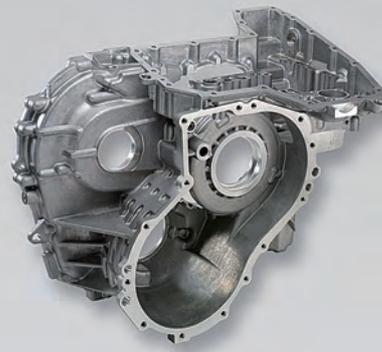


**AUTOMATIC
TRANSMISSION (AT)**



CONTINUOUSLY VARIABLE TRANSMISSION (CVT)

MANUAL TRANSMISSION (MT)



CVT 01

6AT 21

5AT 33

5AT 38

5AT 45

CVT 50

CVT 64

AT 71

AT 74

4AT 78

GEAR 81

Transmission cases

Clutch housings

Torque converter cover

Valve body Upper side

Valve body lower side

CVT pulley Primary FIX

CVT pulley Primary SLID

Epicyclic carriers

Stators

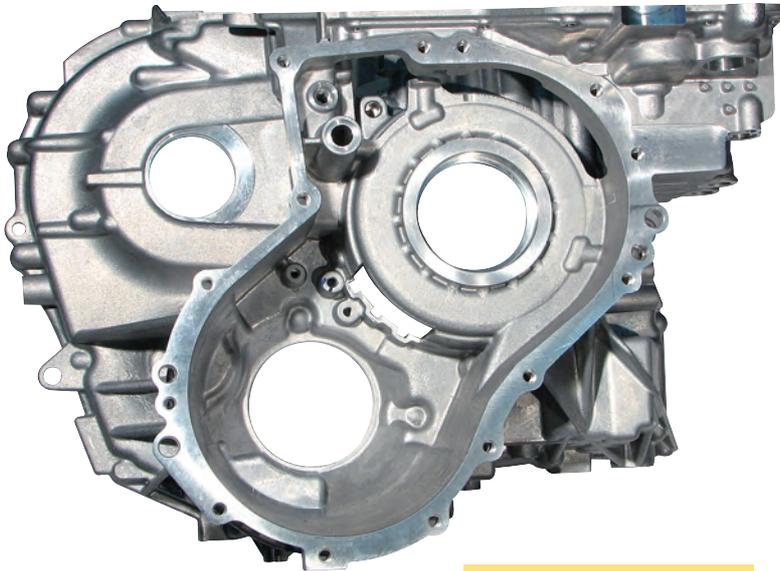
Output shafts

Gears

MITSUBISHI AUTOMOTIVE TOOLING



Transmission cases



Work material : ADC12

Main machining

- ① Mounting face
- ② Various locating holes
- ③ Various locating faces
- ④ Various bores

Machining methods

Milling

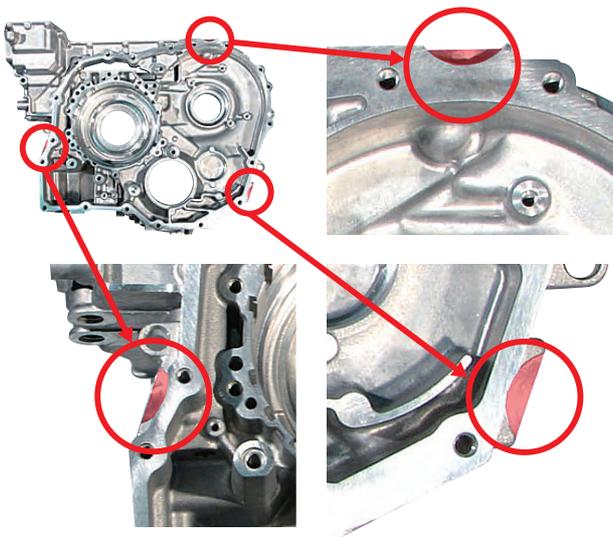
Drilling

Boring

Reaming

OP.1 (Reference face)

For machining centres



BXD4000R403SA42SA
XDGT1550PDFR-G04 TF15

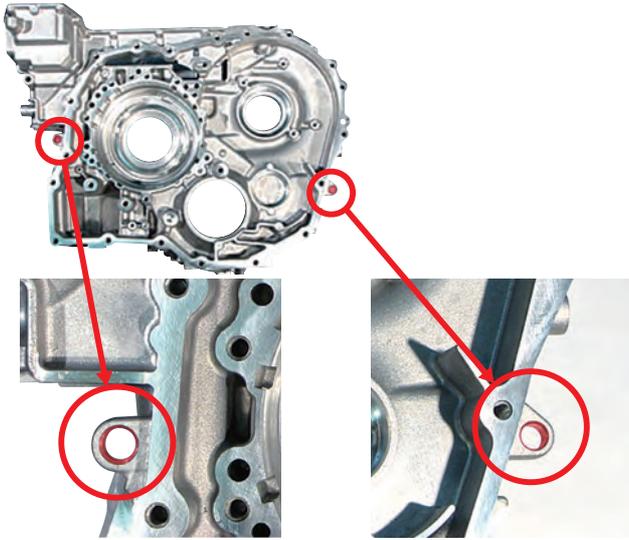
Tool features

Standard BXD type cutter with TF15 inserts.
Specially designed G-class inserts for excellent wall accuracy.

Cutting conditions

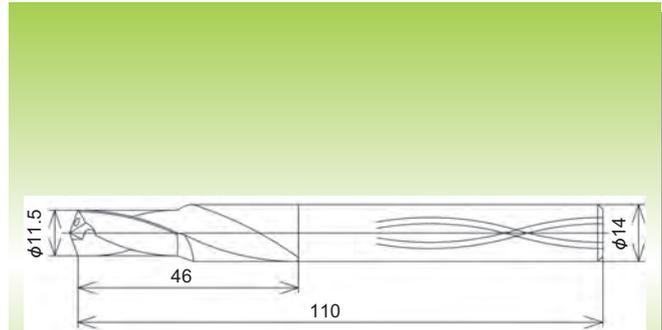
$vc=1,000\text{m/min}$ $n=7,962\text{min}^{-1}$ $fz=0.1\text{mm/tooth}$
 $vf=2,389\text{mm/min}$ Wet

OP.2 (Pre-drilling of the locating holes) For machining centres



Tool features

Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)



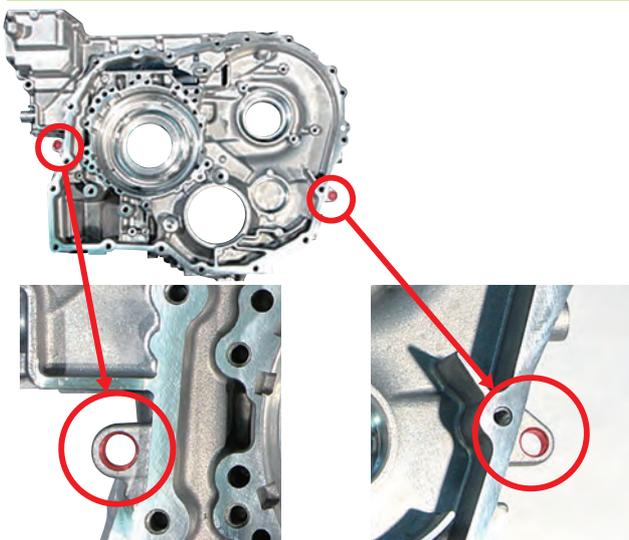
MZE/MZS drill (Special)
HTi10

Cutting conditions

$vc=150\text{m/min}$ $n=4,154\text{min}^{-1}$ $fr=0.1\text{mm/rev}$
 $vf=415\text{mm/min}$ Wet

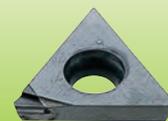
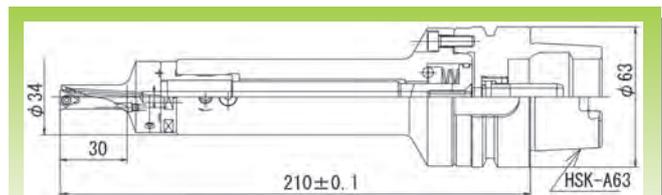
Tooling Sheet 2

OP.3 (Finishing of locating holes) For machining centres



Tool features

Boring bar with a diameter adjustment function. Use of an adjustable unit makes it possible to adjust the cutting edge diameter to a desired value.



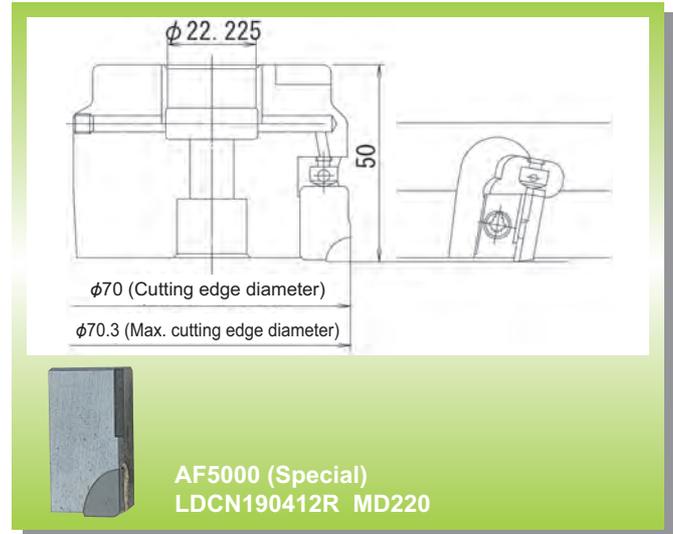
TPGV090204L-F MD220

Cutting conditions

$vc=300\text{m/min}$ $fz=0.06\text{mm/tooth}$ $vf=500\text{mm/min}$ Wet

Tooling Sheet 3

OP.4 (Rough machining of the mounting faces) For machining centres



Tool features

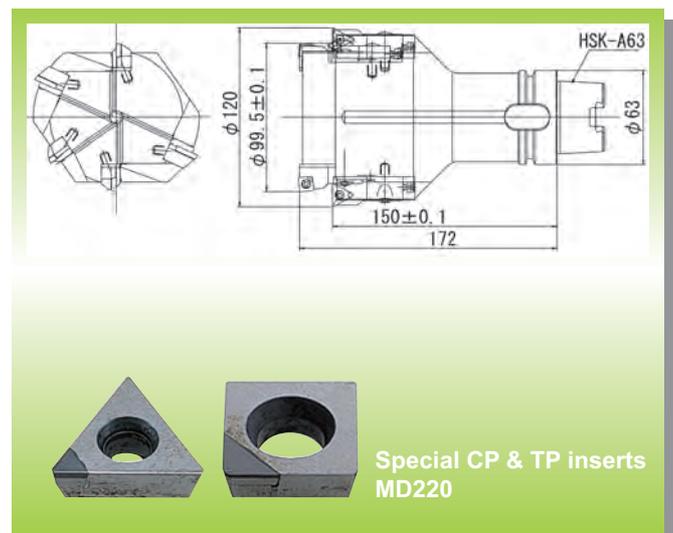
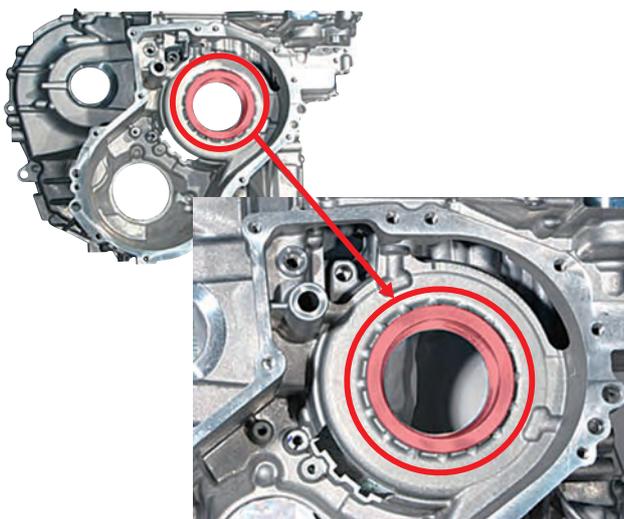
Special AF5000 type cutter with MD220 inserts.
Possible to finely adjust the axial run-out of the inserts.

Cutting conditions

$vc=1,760\text{m/min}$ $fz=0.1\text{mm/tooth}$ $vf=4,000\text{mm/min}$ Wet

Tooling Sheet 4

OP.5 (Roughing of shaft hole) For machining centres



Tool features

Combination boring cutter with special MD220 inserts.
Boring, facing and chamfering are carried out in one plunge process. Cartridge type for high precision machining.

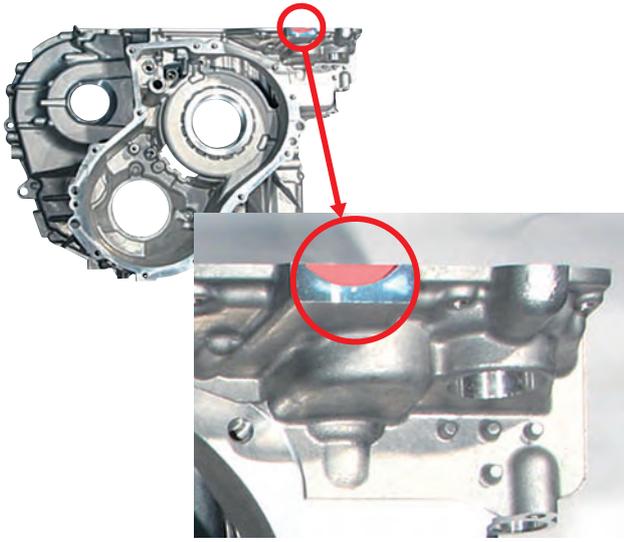
Cutting conditions

$vc=350\text{m/min}$ $fz=0.1\text{mm/tooth}$ $vf=200\text{mm/min}$ Wet

Tooling Sheet 5

OP.6 (Conveyor seat face)

For machining centres



Tool features

Standard BXD type cutter with TF15 inserts.
Specially designed G-class inserts for excellent wall accuracy.



BXD4000R403SA42SA
XDGT1550PDFR-G04 TF15

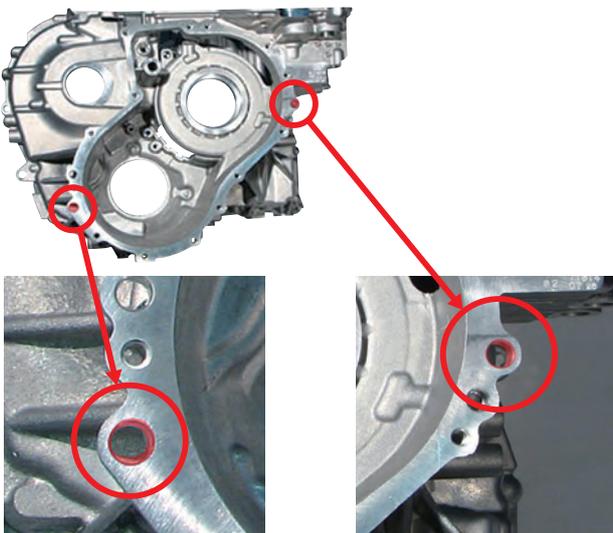
Cutting conditions

$vc=1,000\text{m/min}$ $n=7,962\text{min}^{-1}$ $fz=0.3\text{mm/tooth}$
 $vf=7,166\text{mm/min}$ Wet

Tooling Sheet 6

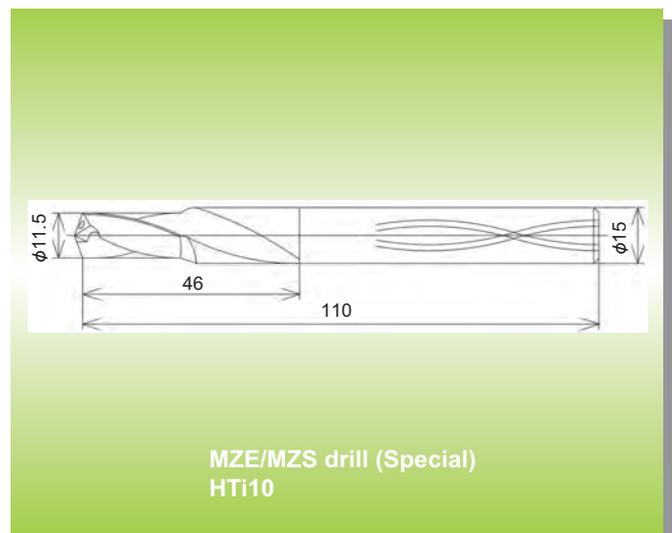
OP.7 (Pre-drilling of assembly locating holes)

For machining centres



Tool features

Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)



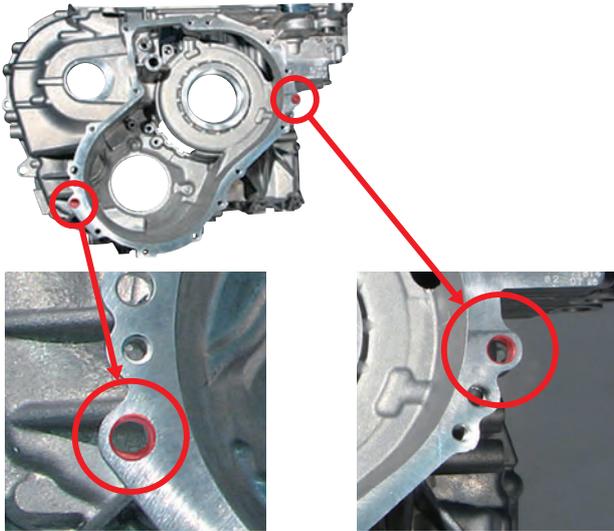
MZE/MZS drill (Special)
HTi10

Cutting conditions

$vc=150\text{m/min}$ $n=4,154\text{min}^{-1}$ $fr=0.1\text{mm/rev}$
 $vf=415\text{mm/min}$ Wet

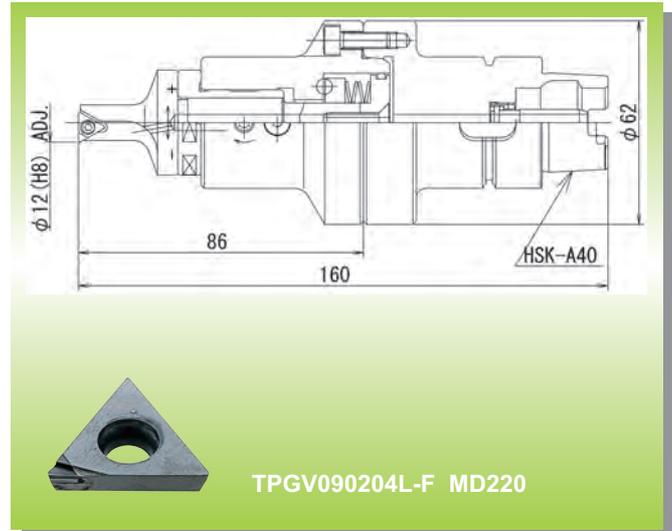
Tooling Sheet 7

OP.8 (Finishing of assembly locating holes) For machining centres



Tool features

Boring bar with a diameter adjustment function.
Use of an adjustable unit makes it possible to adjust the cutting edge diameter to a desired value.

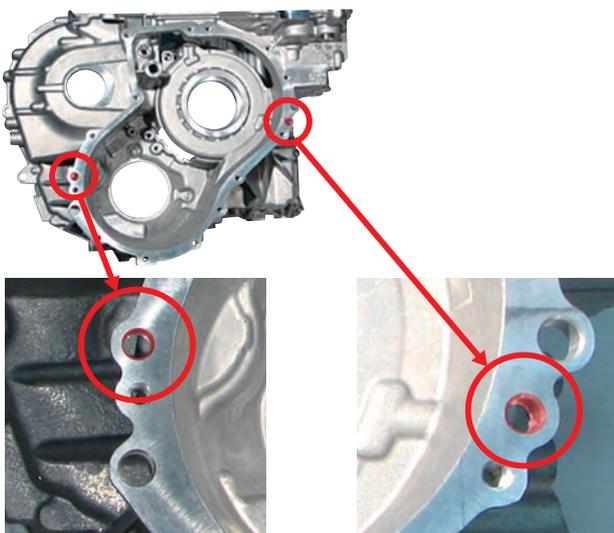


Tool features

$vc=300\text{m/min}$ $fz=0.06\text{mm/tooth}$ $vf=500\text{mm/min}$ Wet

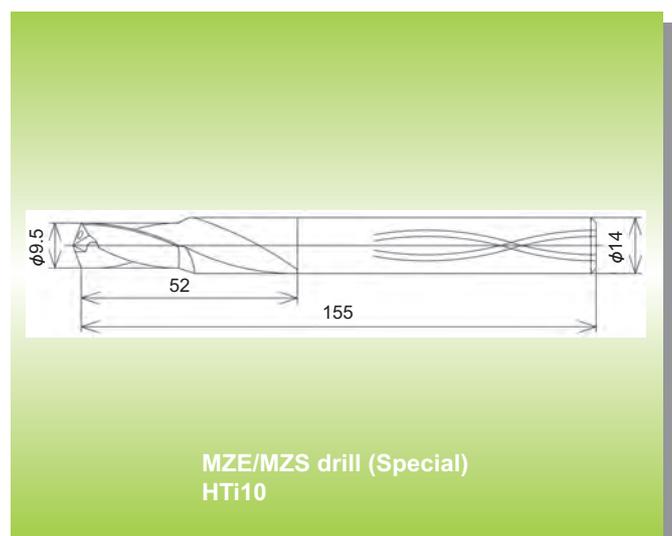
Tooling Sheet 8

OP.9 (Side cover dowel location holes) For machining centres



Tool features

Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)

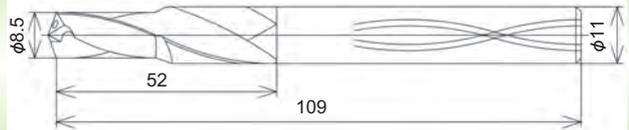
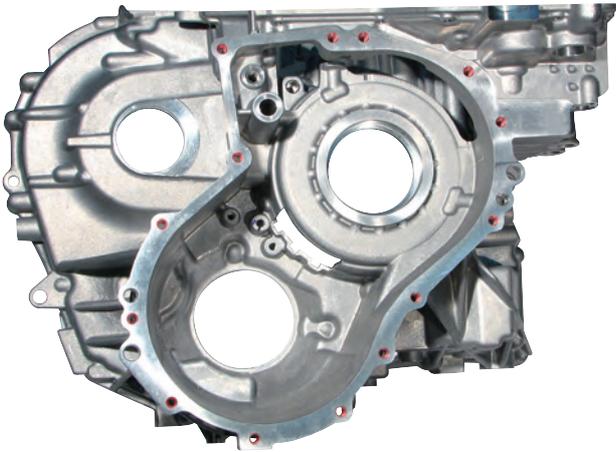


Tool features

$vc=150\text{m/min}$ $n=5,028\text{min}^{-1}$ $fz=0.1\text{mm/rev}$
 $vf=503\text{mm/min}$ Wet

Tooling Sheet 9

OP.10 (Side cover mounting holes) For machining centres



MZE/MZS drill (Special)
HTi10

Tool features

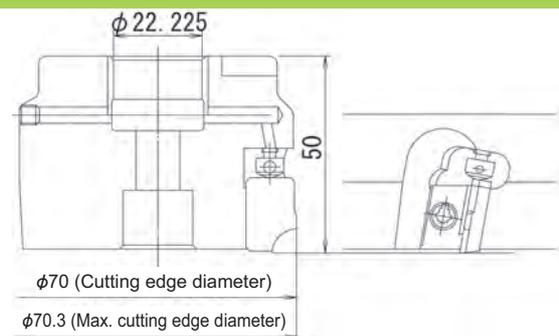
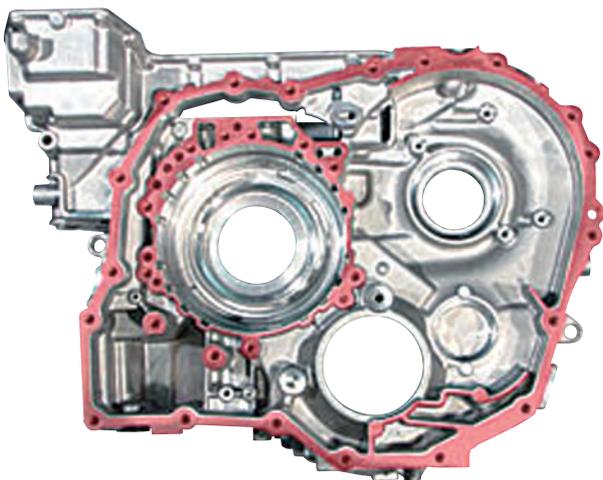
Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)

Cutting conditions

$vc=160\text{m/min}$ $n=5,995\text{min}^{-1}$ $fr=0.13\text{mm/rev}$
 $vf=779\text{mm/min}$ Wet

Tooling Sheet 10

OP.11 (Rough machining of mounting faces) For machining centres



AF5000 (Special)
LDCN190412R MD220

Tool features

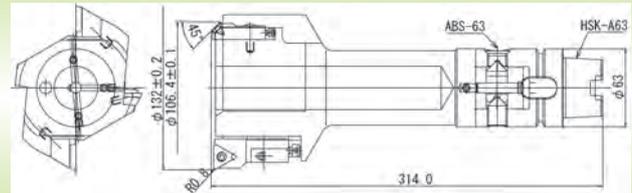
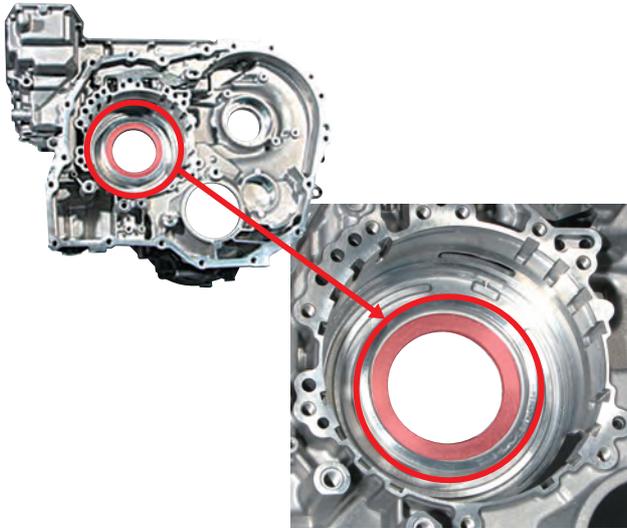
Special AF5000 type cutter with MD220 inserts. Possible to finely adjust the axial run-out of the inserts.

Cutting conditions

$vc=1,540\text{m/min}$ $fz=0.13\text{mm/tooth}$ $vf=500\text{mm/min}$ Wet

Tooling Sheet 11

OP.12 (Roughing of shaft hole) For machining centres



Tool features

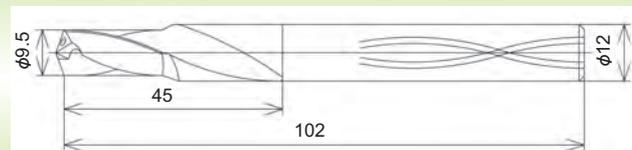
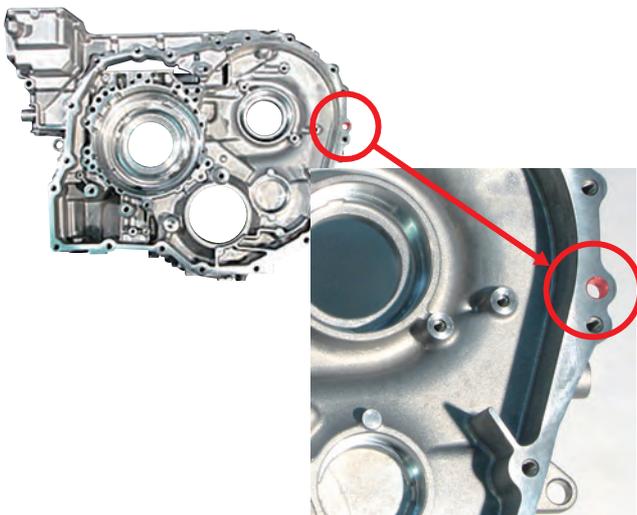
Special combination boring cutter with special MD220 inserts. Combination cutter for facing and chamfering. Cartridge type for high precision machining. Use of an ABS clamping system on the head enables high installation repeatability accuracy and convenient head exchange.

Cutting conditions

$vc=405\text{m/min}$ $fr=0.05\text{mm/rev}$ $vf=50\text{mm/min}$ Wet

Tooling Sheet 12

OP.13 (Housing dowel location holes) For machining centres



MZE/MZS drill (Special)
HTi10

Tool features

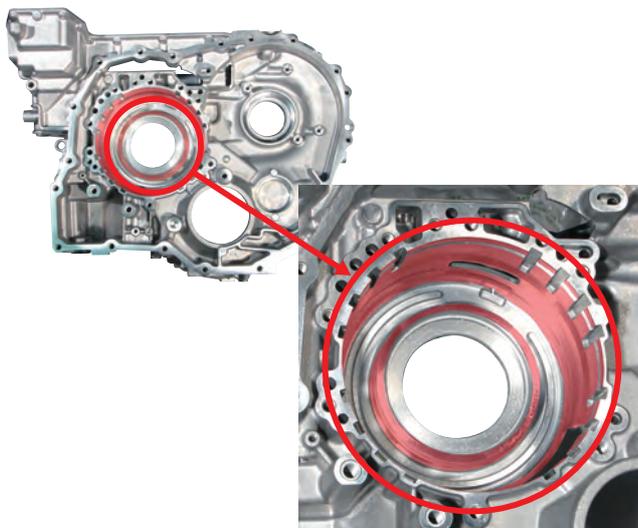
Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)

Cutting conditions

$vc=100\text{m/min}$ $n=3,352\text{min}^{-1}$ $fr=0.1\text{mm/rev}$
 $vf=335\text{mm/min}$ Wet

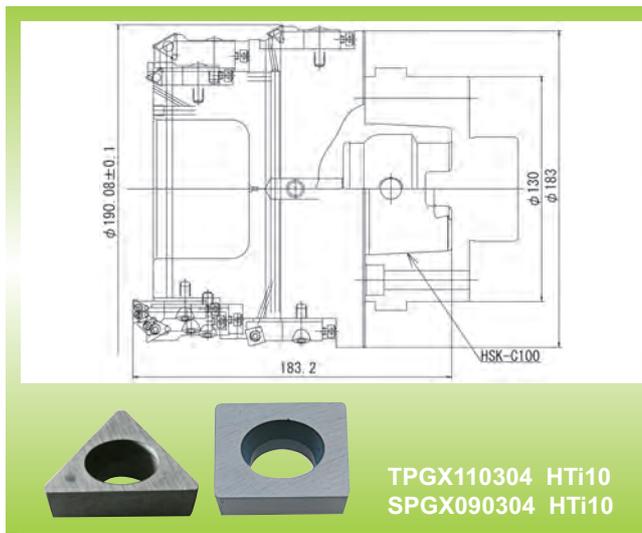
Tooling Sheet 13

OP.14 (Roughing of shaft hole) For machining centres



Tool features

Special combination boring cutter with HTi10 inserts. Facing and chamfering can be performed in one process, allowing drastic process consolidation and higher production efficiency. Cartridge type for high precision machining.

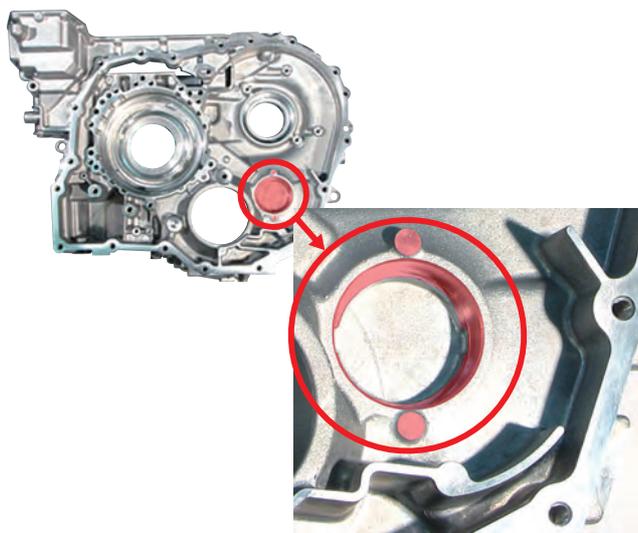


Cutting conditions

$vc=600\text{m/min}$ $fr=0.2\text{mm/rev}$ $vf=382\text{mm/min}$ Wet

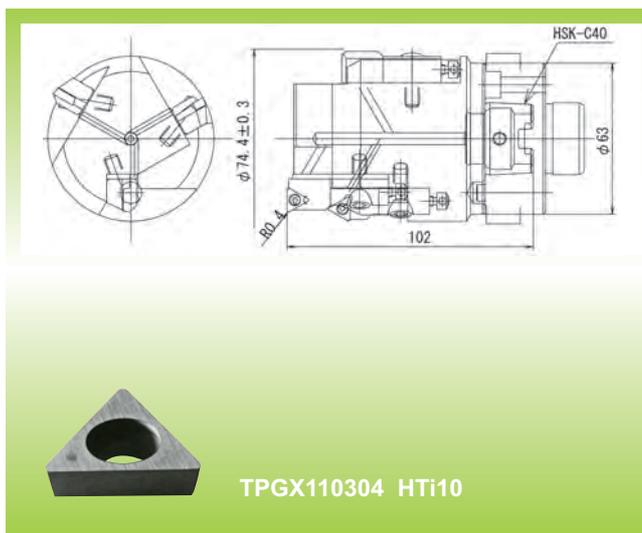
Tooling Sheet 14

OP.15 (Roughing of reduction hole) For machining centres



Tool features

Special combination boring cutter with HTi10 inserts. Combination cutter for facing and chamfering.

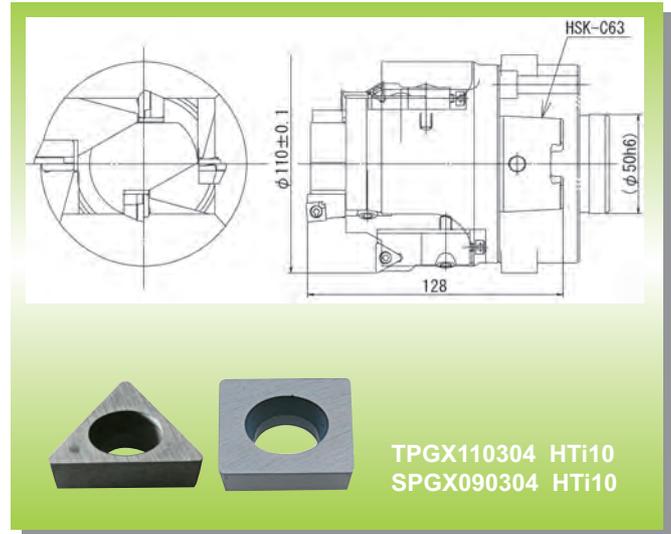
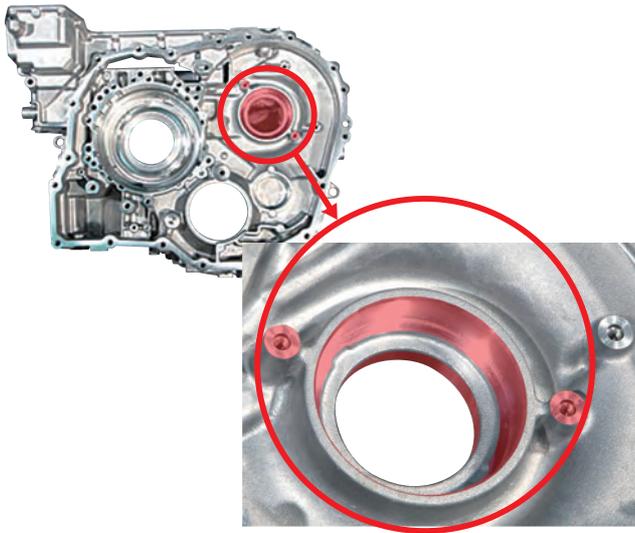


Cutting conditions

$vc=580\text{m/min}$ $fr=0.03\text{mm/rev}$ $vf=80\text{mm/min}$ Wet

Tooling Sheet 15

OP.16 (Roughing of differential hole) For machining centres



Tool features

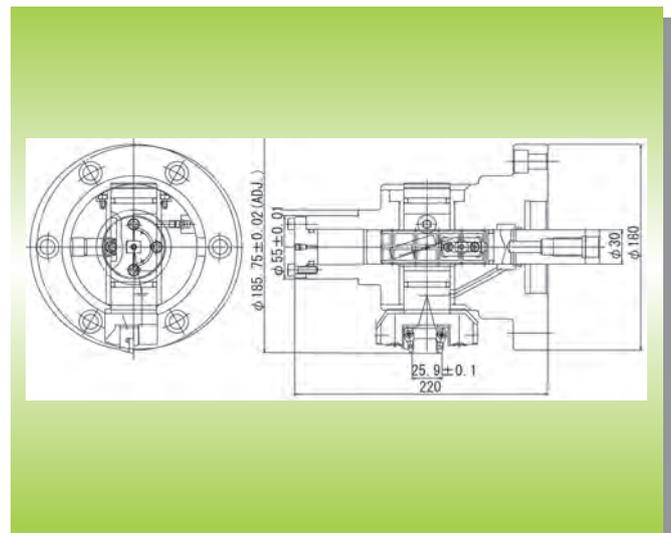
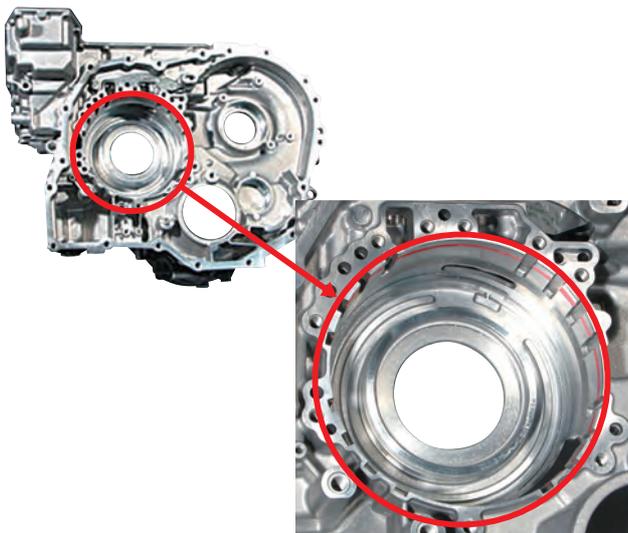
Special combination boring cutter with HTi10 inserts.
Combination cutter for facing and chamfering.

Cutting conditions

$vc=580\text{m/min}$ $fr=0.1\text{mm/rev}$ $vf=264\text{mm/min}$ Wet

Tooling Sheet 16

OP.17 (Grooving of shaft hole) For machining centres



Tool features

Special grooving cutter with special HTi10 inserts.
Simultaneous grooving is possible. Insert position can be adjusted by adjusting the machine's drawbar.

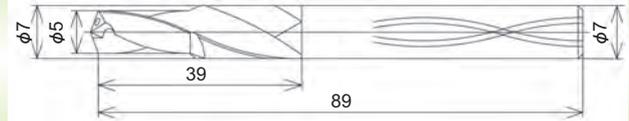
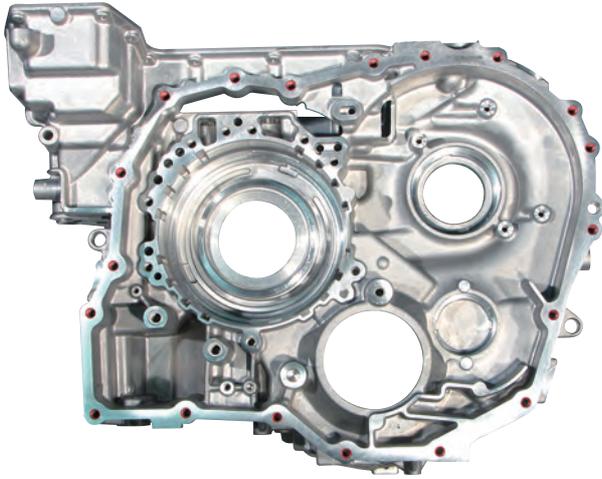
Cutting conditions

$vc=400\text{m/min}$ $fr=0.1\text{mm/rev}$ $ap=1.2\text{mm}$ $W=2\text{mm}$ Wet

Tooling Sheet 17

OP.18 (Mounting holes)

For machining centres



MZE/MZS drill (Special)
HTi10

Tool features

Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)

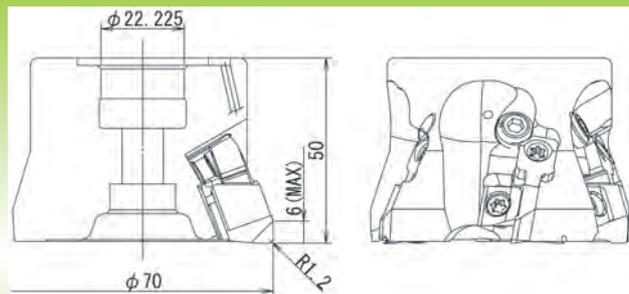
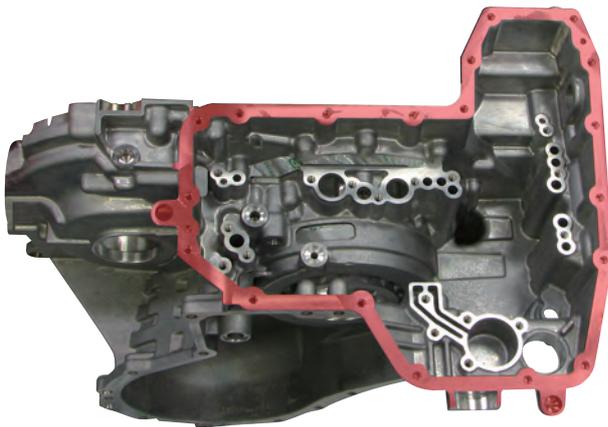
Cutting conditions

$vc=125\text{m/min}$ $n=7,962\text{min}^{-1}$ $fr=0.13\text{mm/rev}$
 $vf=1,035\text{mm/min}$ Wet

Tooling Sheet 18

OP.19 (Oil pan mounting face)

For machining centres



NF10000 (Special)
GDCN2004PDR3 MD220

Tool features

Special NF10000 type cutter with MD220 inserts. Finish milling cutter with high wear and weld resistant MD220 inserts for high speed machining. Radius minor edge for high surface finishes.

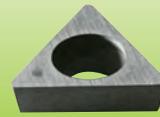
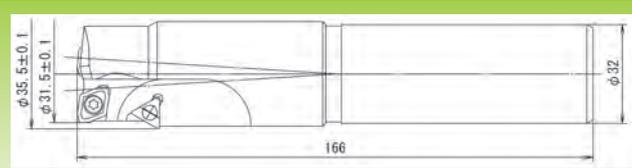
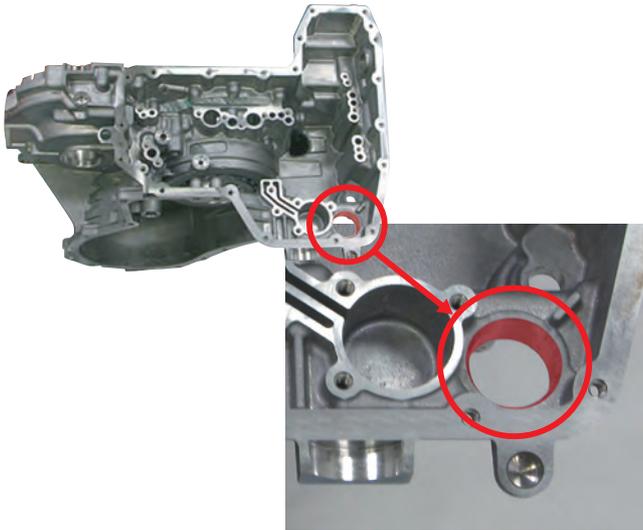
Cutting conditions

$vc=1,759\text{m/min}$ $fz=0.1\text{mm/tooth}$ $vf=4,000\text{mm/min}$ Wet

Tooling Sheet 19

OP.20 (Roughing of harness hole)

For machining centres



TPGX110304 HTi10

Tool features

Special combination boring cutter with special HTi10 inserts. For the boring operation, inserts with the same geometry as the standard TAF drill can be used. Economical 4 corner use.

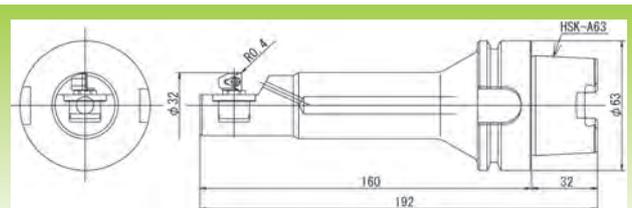
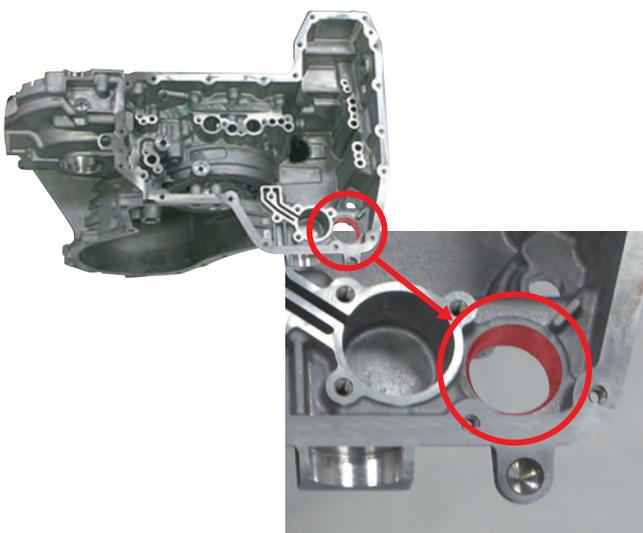
Cutting conditions

vc=446m/min fr=0.15mm/rev vf=676mm/min Wet

Tooling Sheet 20

OP.21 (Finishing of harness hole)

For machining centres



TPGV090204L-F MD220

Tool features

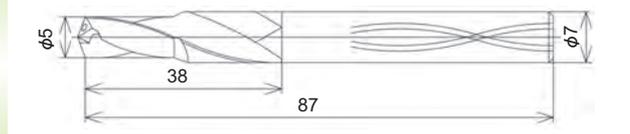
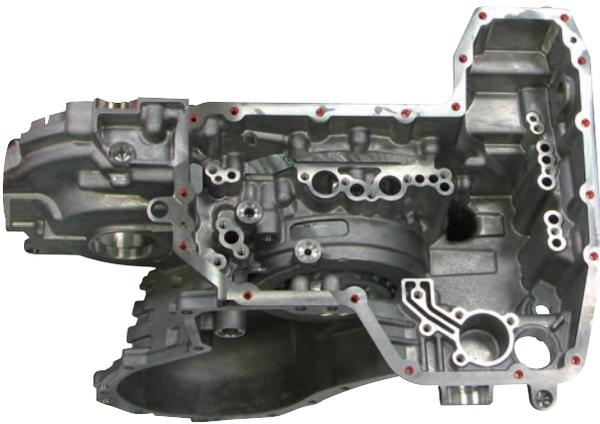
Special boring bar with MD220 inserts. To prevent return marks, back boring is performed. The clamping face is tapered to increase overall rigidity for high machining accuracy.

Cutting conditions

vc=351m/min fr=0.08mm/rev vf=280mm/min Wet

Tooling Sheet 21

OP.22 (Oil pan mounting holes) For machining centres



MZE/MZS drill (Special)
HTi10

Tool features

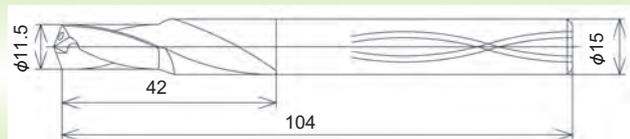
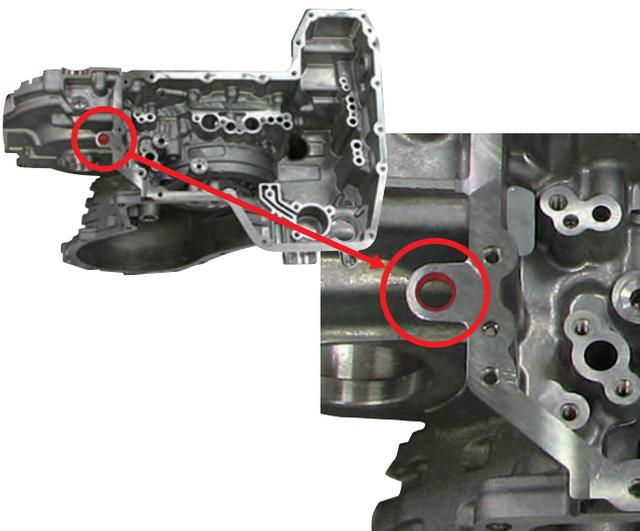
Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS drill cutting edge geometry, sharp edge)

Cutting conditions

$vc=125\text{m/min}$ $n=7,962\text{min}^{-1}$ $fr=0.08\text{mm/rev}$
 $vf=637\text{mm/min}$ Wet

Tooling Sheet 22

OP.23 (Conveyor seat face) For machining centres



MZE/MZS drill (Special)
HTi10

Tool features

Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)

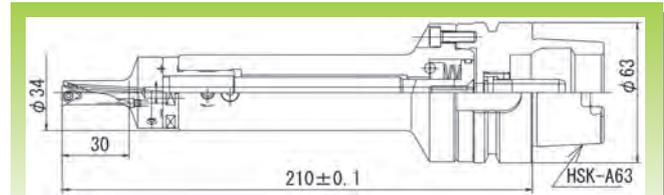
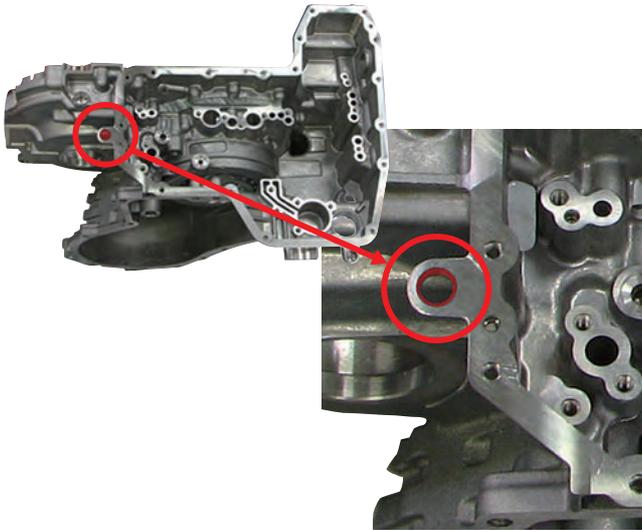
Cutting conditions

$vc=150\text{m/min}$ $n=4,154\text{min}^{-1}$ $fr=0.1\text{mm/rev}$
 $vf=415\text{mm/min}$ Wet

Tooling Sheet 23

OP.24 (Conveyor seat face)

For machining centres



TPGV090204L-F MD220

Tool features

Special boring bar with a diameter adjustment function with MD220 inserts. Use of an adjustable unit makes it possible to change an adjustment amount to the desired value. Easy diameter adjustment.

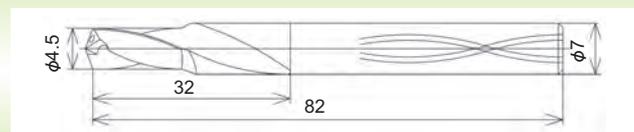
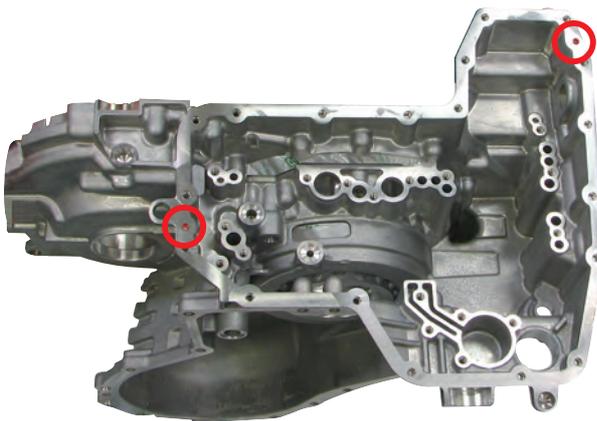
Cutting conditions

vc=301m/min fr=0.06mm/rev vf=500mm/min Wet

Tooling Sheet 24

OP.25 (Dowel location holes)

For machining centres



MZE/MZS drill (Special)
HTi10

Tool features

Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)

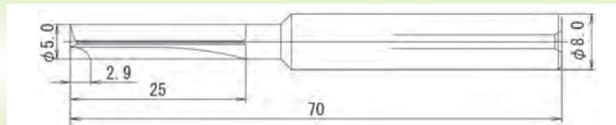
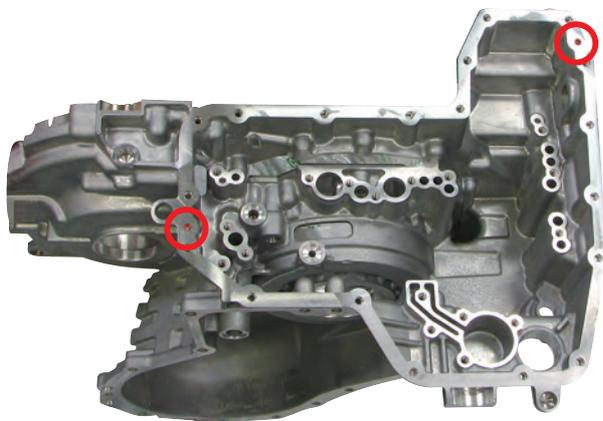
Cutting conditions

vc=100m/min n=7,077min⁻¹ fr=0.08 mm/rev
vf=566mm/min Wet

Tooling Sheet 25

OP.26 (Dowel location holes)

For machining centres



Diamond reamer
MD220

Tool features

Special PCD reamer.
Use of MD220 cutting edge with high welding resistance.
Straight flute for high precision machining.

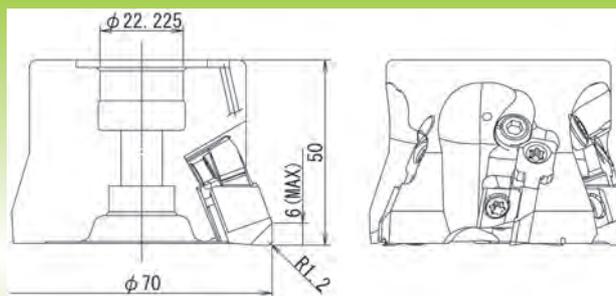
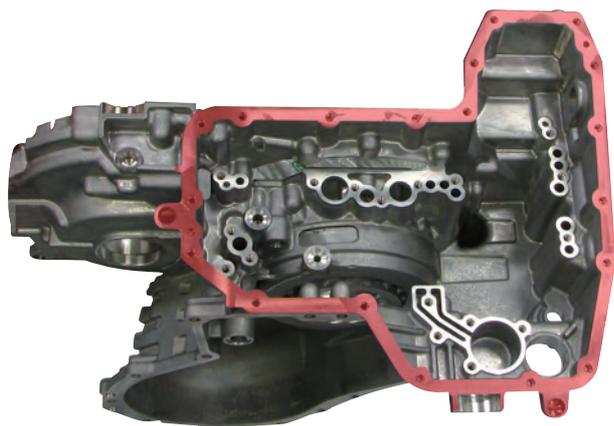
Cutting conditions

$vc=78\text{m/min}$ $fr=0.04\text{mm/rev}$ $vf=400\text{mm/min}$ Wet

Tooling Sheet 26

OP.27 (Finishing oil pan mounting surface)

For machining centres



NF10000 (Special)
GDCN2004PDR3 MD220

Tool features

Special NF10000 type cutter with MD220 inserts.
Finish milling cutter with high wear and weld resistant MD220 inserts for high speed machining.
Radius minor edge for high surface finishes.

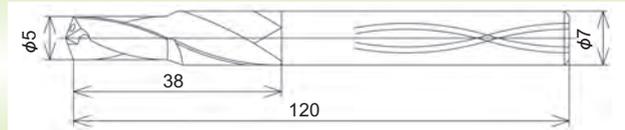
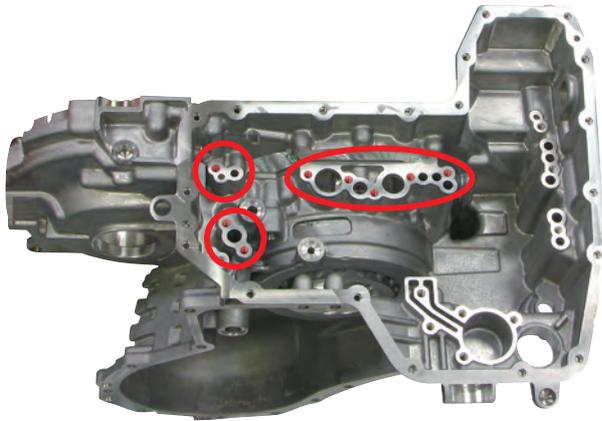
Cutting conditions

$vc=1,539\text{m/min}$ $fz=0.11\text{mm/tooth}$ $vf=4,000\text{mm/min}$ Wet

Tooling Sheet 27

OP.28 (Pre-drilling valve mounting holes)

For machining centres



MZE/MZS drill (Special)
HTi10

Tool features

Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)

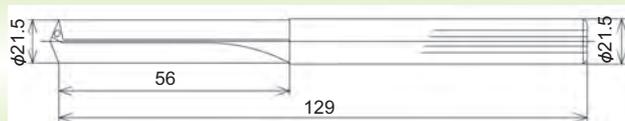
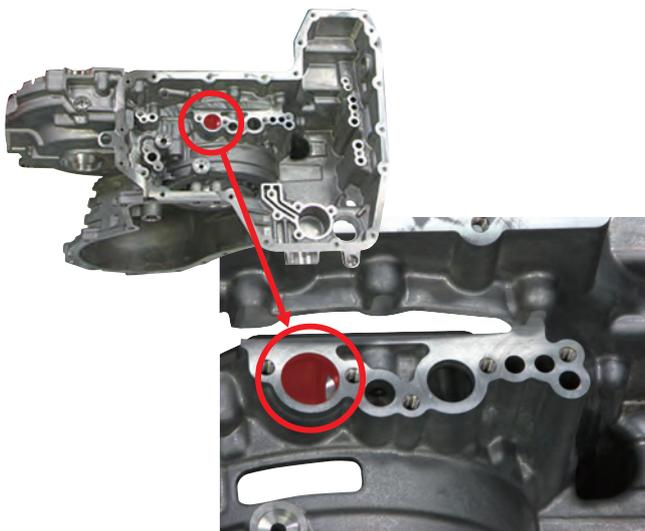
Cutting conditions

vc=125m/min n=7,962min⁻¹ fr=0.08mm/rev
vf=637mm/min Wet

Tooling Sheet 28

OP.29 (Oil pan inlet holes)

For machining centres



Burnishing drill
HTi10

Tool features

Special burnish drill in HTi10 grade. Straight flute for easy re-grinding. (Solid carbide, straight flute)

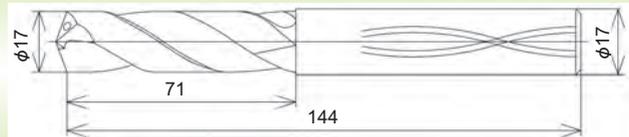
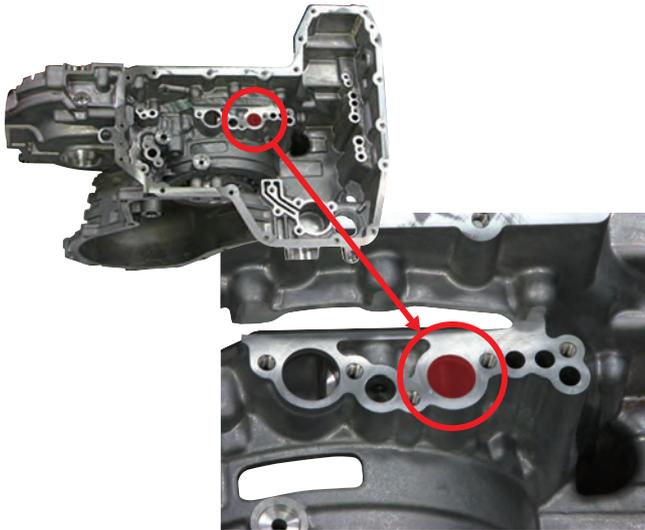
Cutting conditions

vc=337m/min fr=0.1mm/rev vf=1,000mm/min Wet

Tooling Sheet 29

OP.30 (Oil pan outlet holes)

For machining centres



MZE/MZS drill (Special)
HTi10

Tool features

Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)

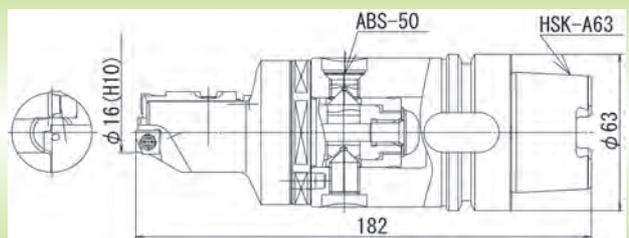
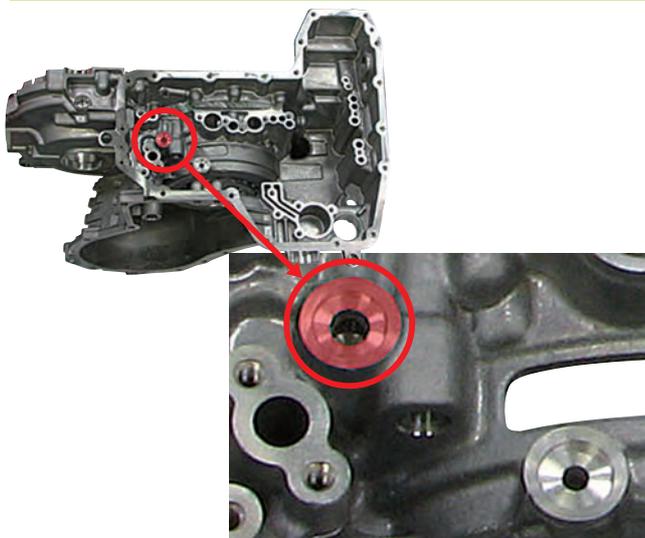
Cutting conditions

$vc=170\text{m/min}$ $n=3,185\text{min}^{-1}$ $fr=0.2\text{mm/rev}$
 $vf=637\text{mm/min}$ Wet

Tooling Sheet 30

OP.31 (Lubrication circuit face)

For machining centres



Tool features

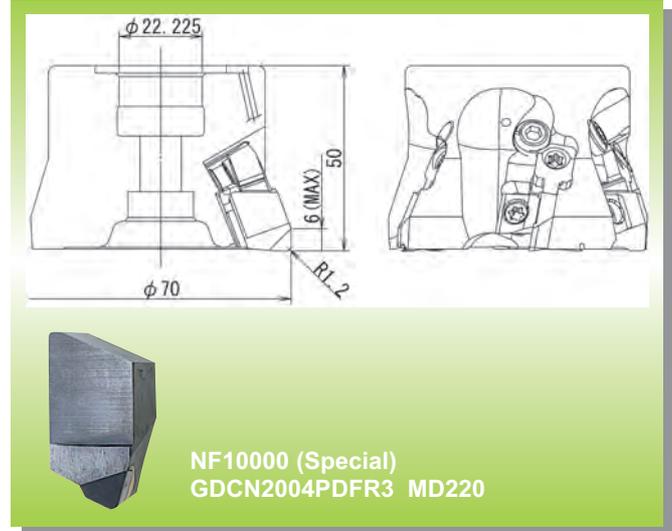
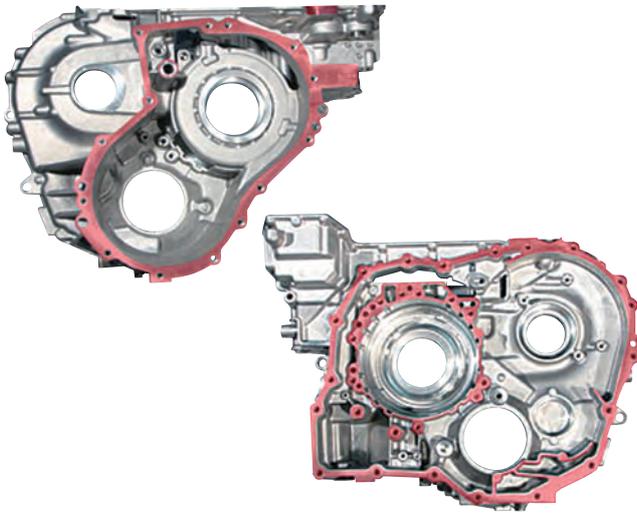
Special boring cutter with special HTi10 and MD220 inserts. Combined machining of facing and chamfering. Use of ABS clamping system on the head enables high installation repeatability accuracy and convenient head exchange.

Cutting conditions

$vc=188\text{m/min}$ $fr=0.1\text{mm/rev}$ $vf=300\text{mm/min}$ Wet

Tooling Sheet 31

OP.32 (Various mounting faces) For machining centres



Tool features

Special NF10000 type cutter with MD220 inserts.
Finish milling cutter with high wear and weld resistant MD220 inserts for high speed machining.
Radius minor edge for high surface finishes.

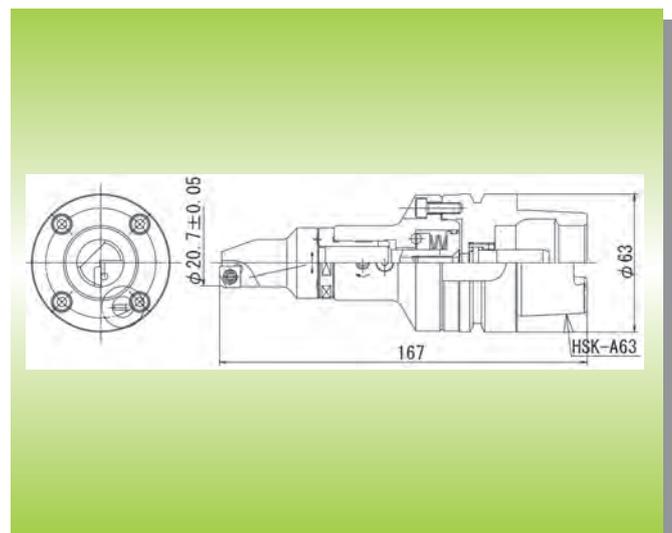
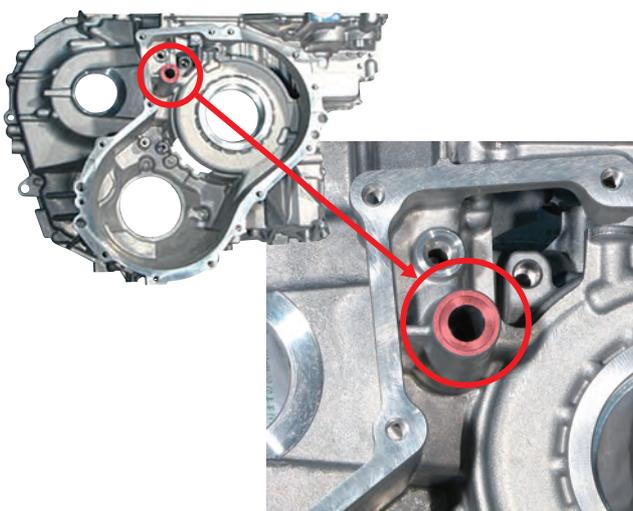
Cutting conditions

$vc=1,539\text{m/min}$ $fz=0.11\text{mm/rev}$ $vf=4,000\text{mm/min}$ Wet

Tooling Sheet 32

OP.33 (Circuit holes) For machining centres

For machining centres



Tool features

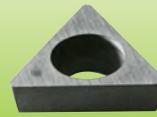
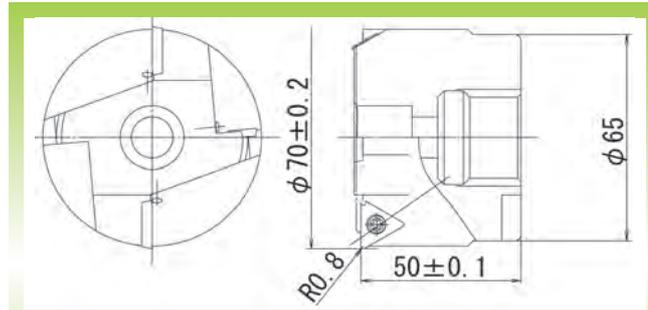
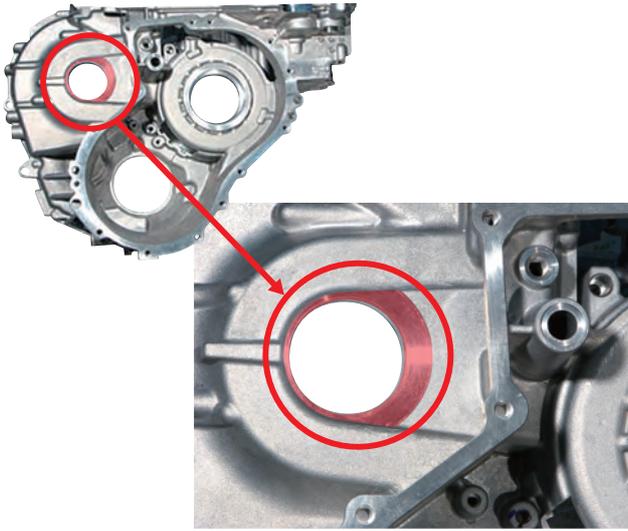
Special boring bar with a diameter adjustment function with MD220 inserts. Use of an adjustable unit makes it possible to change an adjustment amount to the desired value.
Easy diameter adjustment.

Cutting conditions

$vc=195\text{m/min}$ $fr=0.1\text{mm/rev}$ $vf=300\text{mm/min}$ Wet

Tooling Sheet 33

OP.34 (End face of differential oil seal) For machining centres



TPGX090204 HTi10
TPGX160308 HTi10

Tool features

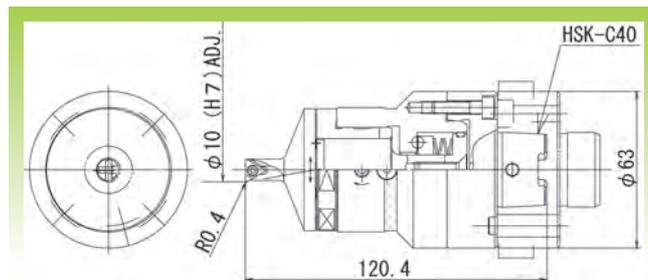
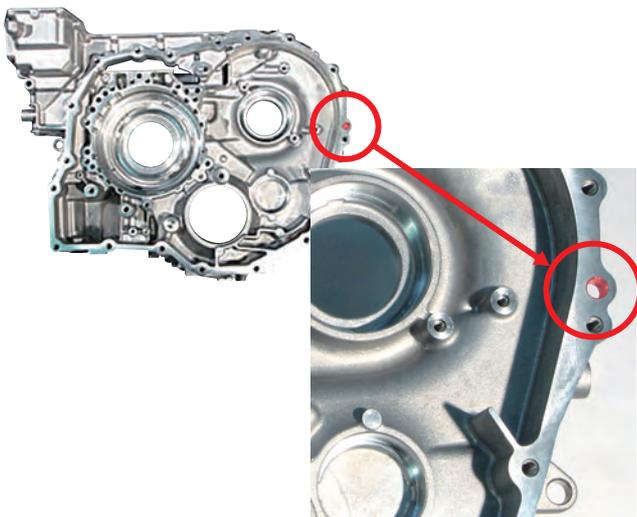
Special milling cutter with HTi10 grade.
Combination cutter for facing and chamfering.

Cutting conditions

$vc=659\text{m/min}$ $fz=0.2\text{mm/rev}$ $vf=300\text{mm/min}$ Wet

Tooling Sheet 34

OP.35 (Housing dowel location holes) For machining centres



TPGV090204L-F MD220

Tool features

Special boring bar with a diameter adjustment function with MD220 inserts. Use of an adjustable unit makes it possible to change the amount of adjustment to the desired value. Easy diameter adjustment.

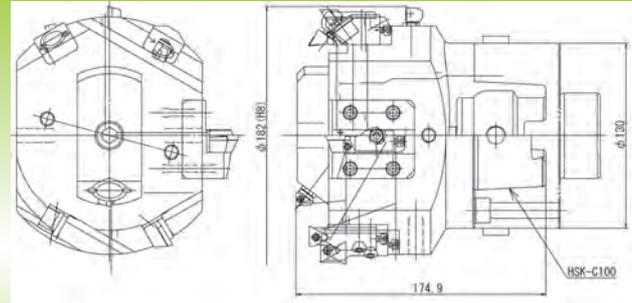
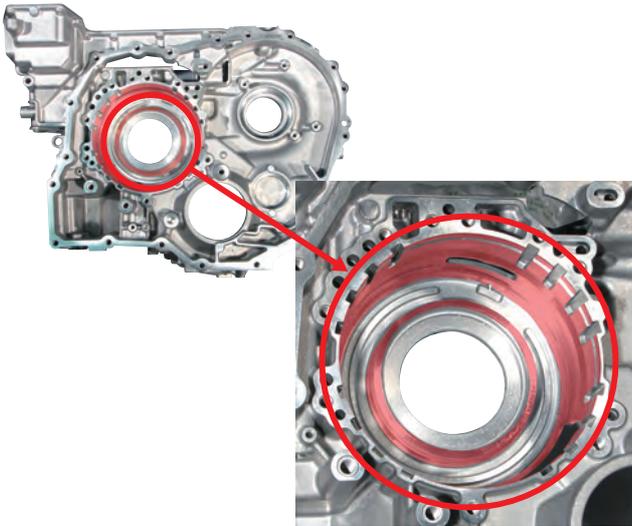
Cutting conditions

$vc=125\text{m/min}$ $fr=0.05\text{mm/rev}$ $vf=200\text{mm/min}$ Wet

Tooling Sheet 35

OP.36 (Shaft hole)

For machining centres



Tool features

Special boring cutter with MD220 inserts.
Numerous cartridges are used to perform facing and chamfering in one process. Enables drastic process consolidation and higher production efficiency.

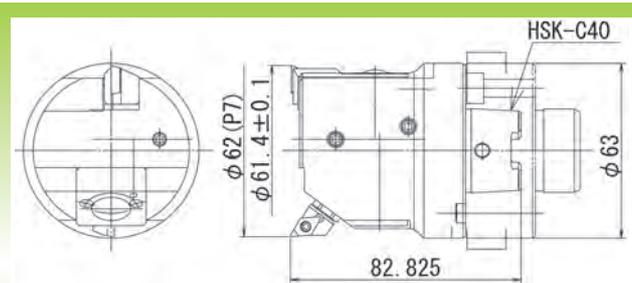
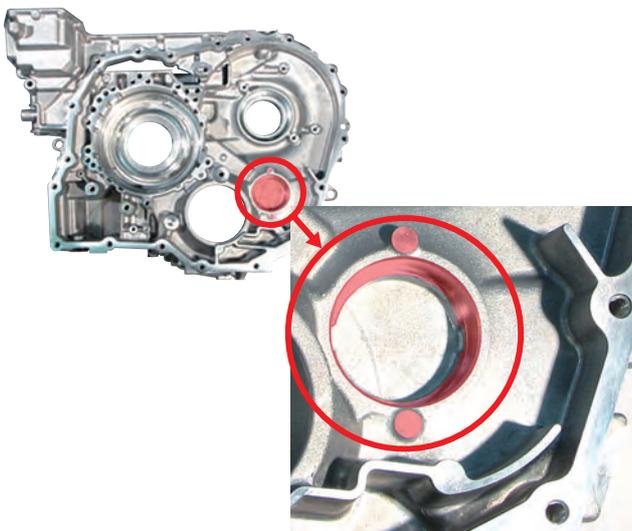
Cutting conditions

$vc=130\text{m/min}$ $fr=0.2\text{mm/rev}$ $vf=51\text{mm/min}$ Wet

Tooling Sheet 36

OP.37 (Finishing of reduction holes)

For machining centres



Tool features

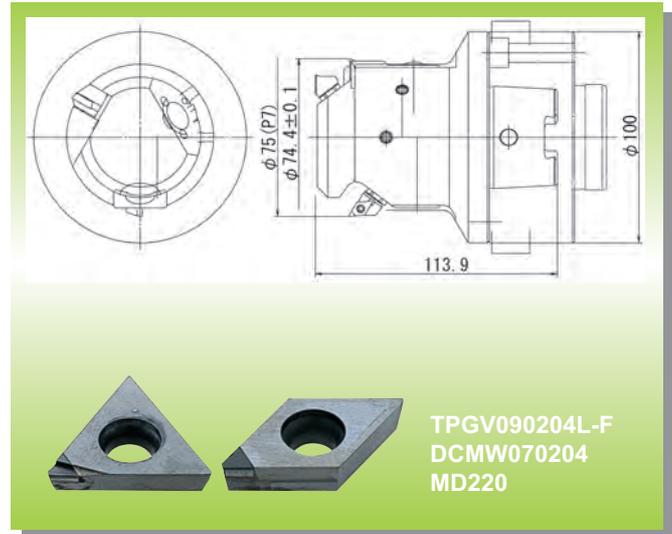
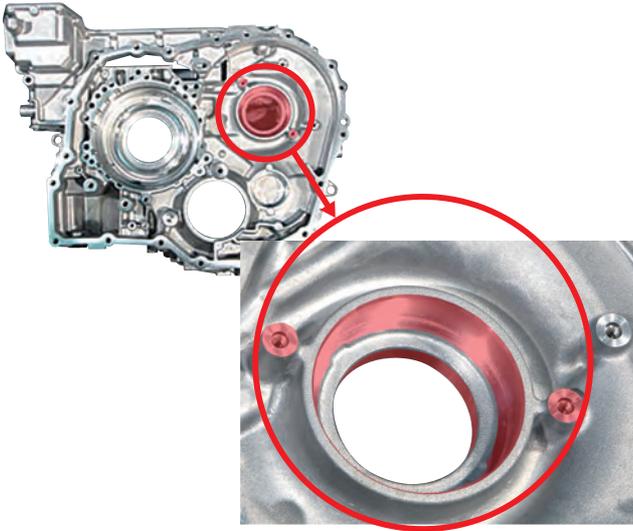
Special boring cutter with special MD220 inserts.
Use of a finishing type, high precision boring unit.
Fine adjustment of inserts can be carried out with ease.

Cutting conditions

$vc=600\text{m/min}$ $fr=0.08\text{mm/rev}$ $vf=247\text{mm/min}$ Wet

Tooling Sheet 37

OP.38 (Finishing of differential gear holes) For machining centres



Tool features

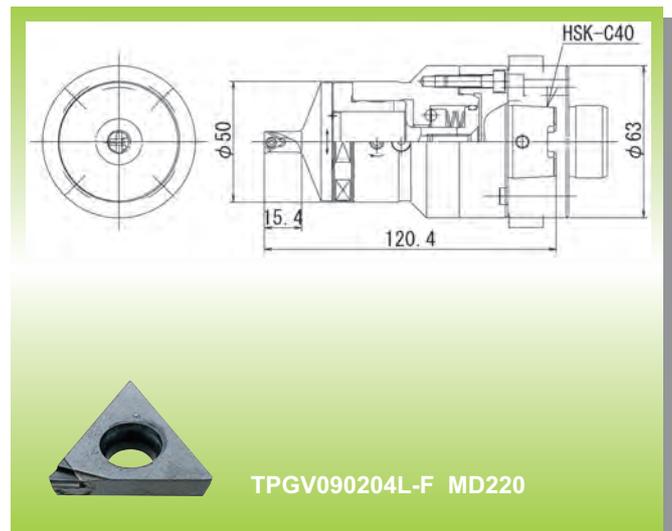
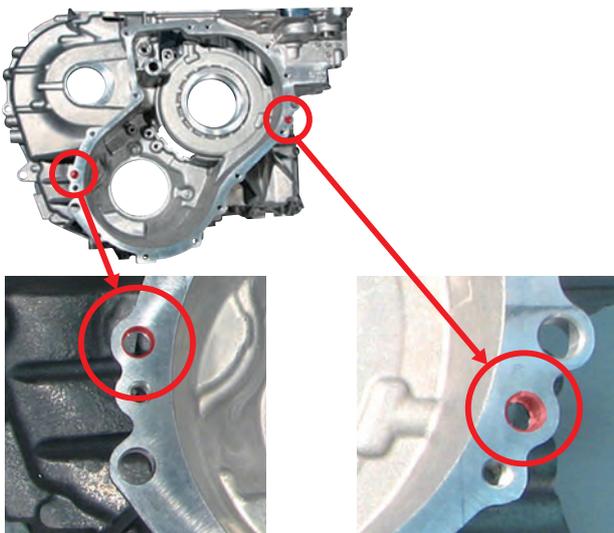
Special combination boring cutter with MD220 inserts. Combination cutter for facing and chamfering. Use of cartridge enables high precision machining.

Cutting conditions

$vc=650\text{m/min}$ $fr=0.05\text{mm/rev}$ $vf=148\text{mm/min}$ Wet

Tooling Sheet 38

OP.39 (Side cover dowel location holes) For machining centres



Tool features

Special boring bar with a diameter adjustment function with MD220 inserts. Use of an adjustable unit makes it possible to change an adjustment amount to the desired value. Easy diameter adjustment.

Cutting conditions

$vc=125\text{m/min}$ $fr=0.04\text{mm/rev}$ $vf=150\text{mm/min}$ Wet

Tooling Sheet 39

Clutch housings



Main machining

- ① Mounting face
- ② Various locating holes
- ③ Various locating faces
- ④ Various bores



Machining methods

- Milling**
- Drilling**
- Boring**
- Reaming**

Work material : ADC10

OP.1 (Machining of mounting face)

For machining centres



NF10000R0306C
GDCN2004PDFR3 MD220

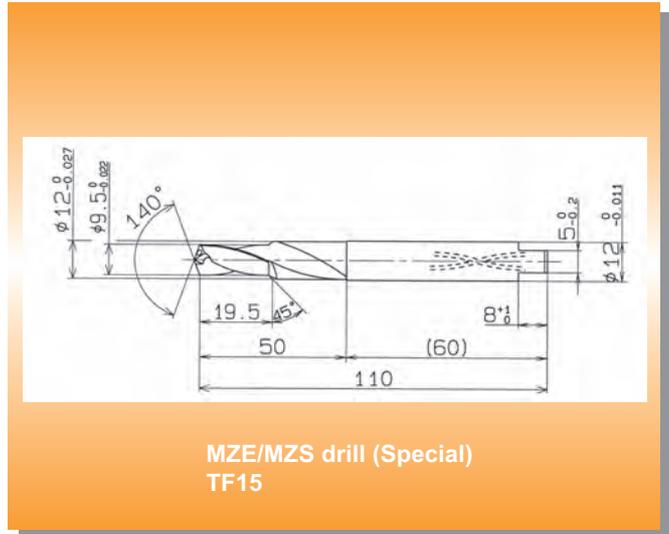
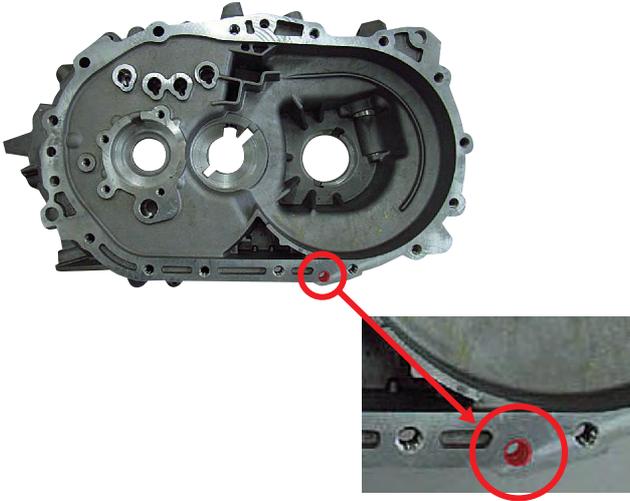
Tool features

Special NF10000 type cutter with MD220 inserts.
Finish milling cutter with high wear and weld resistant MD220 inserts for high speed machining.
Radius minor edge for high surface finishes.

Cutting conditions

vc=1,507m/min fz=0.15mm/tooth vf=5,400mm/min
ap=2mm Wet

OP.2 (Pre-drilling of $\phi 10$ reference hole) For machining centres



MZE/MZS drill (Special)
TF15

Tool features

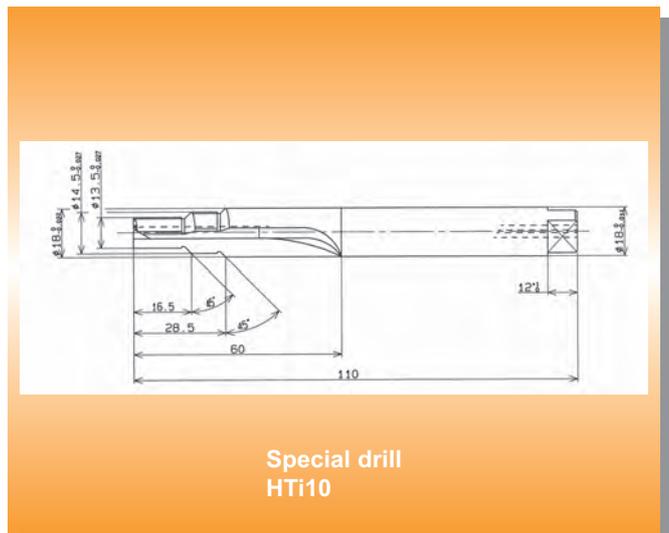
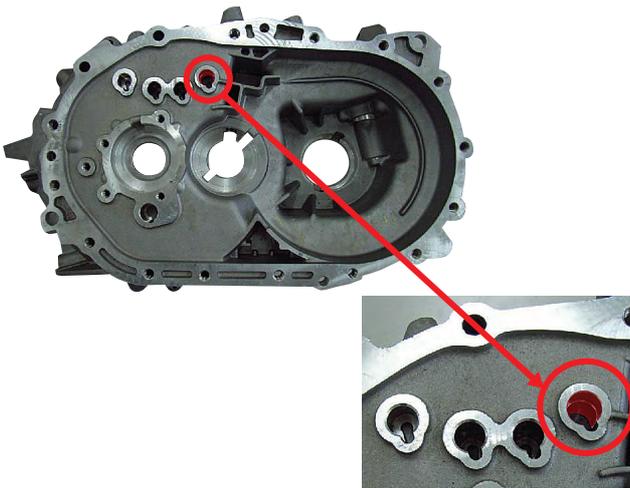
Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)

Cutting conditions

$vc=150\text{m/min}$ $fr=0.20\text{mm/rev}$ $vf=1,005\text{mm/min}$ Wet

Tooling Sheet 2

OP.3 (Pre-drilling of $\phi 13.5 \times \phi 15$) For machining centres



Special drill
HTi10

Tool features

Special drill with through coolant holes in HTi10 grade. Multi-step drill consolidates processes and reduces machining costs. Straight flute for easy re-grinding.

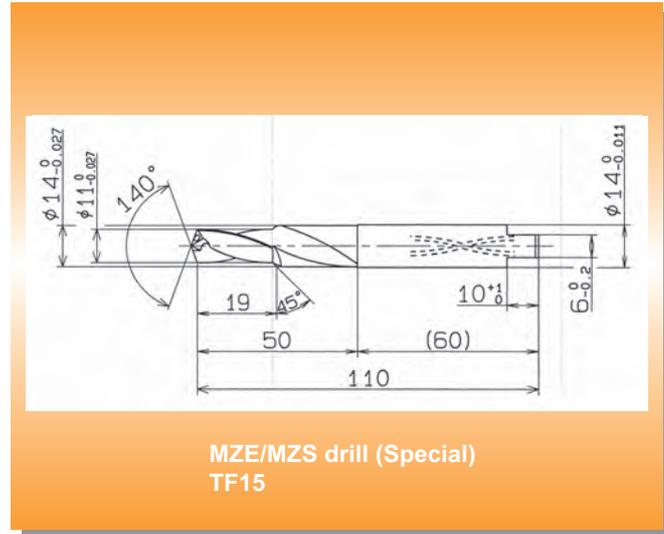
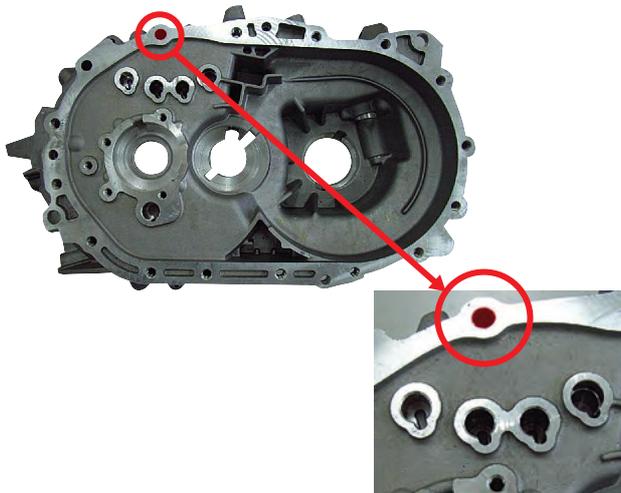
Cutting conditions

$vc=200\text{m/min}$ $fr=0.20\text{mm/rev}$ $vf=944\text{mm/min}$ Wet

Tooling Sheet 3

OP.4 ($\phi 11$ reference hole)

For machining centres



MZE/MZS drill (Special)
TF15

Tool features

Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)

Cutting conditions

$vc=150\text{m/min}$ $fr=0.10\text{mm/rev}$ $vf=434\text{mm/min}$ Wet

Tooling Sheet 4

OP.5 (Machining of mounting face)

For machining centres



NF10000R0306C
GDCN2004PDFR3 MD220

Tool features

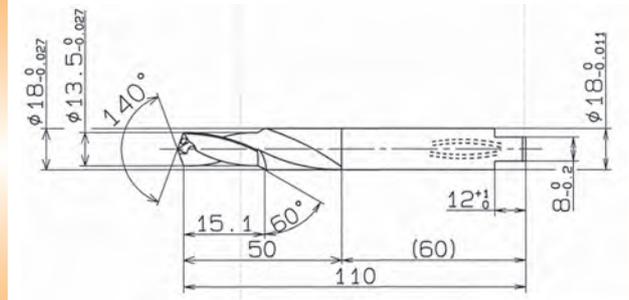
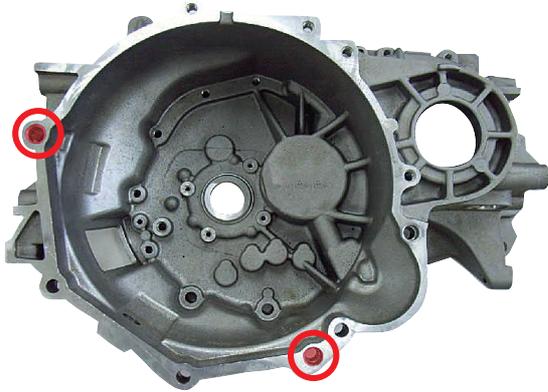
Special NF10000 type cutter with MD220 inserts. Finish milling cutter with high wear and weld resistant MD220 inserts for high speed machining. Radius minor edge for high surface finishes.

Cutting conditions

$vc=1,507\text{m/min}$ $fz=0.15\text{mm/tooth}$ $vf=5,400\text{mm/min}$
 $ap=2\text{mm}$ Wet

Tooling Sheet 5

OP.6 (Pre-drilling of $\phi 14$ dowel location holes) For machining centres



MZE/MZS drill (Special)
TF15

Tool features

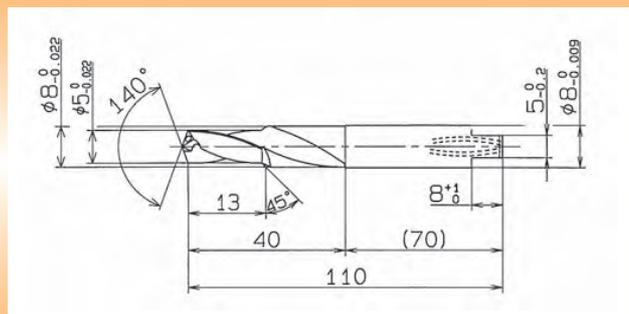
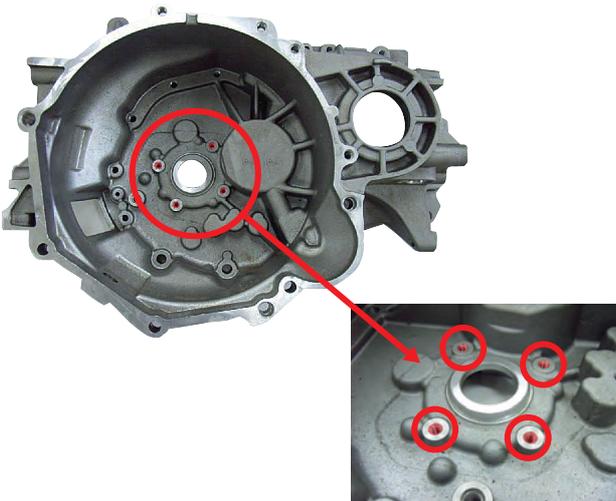
Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)

Cutting conditions

$vc=150\text{m/min}$ $fr=0.2\text{mm/rev}$ $vf=707\text{mm/min}$ Wet

Tooling Sheet 6

OP.7 (Pre-drilling of M6 tap hole) For machining centres



MZE/MZS drill (Special)
TF15

Tool features

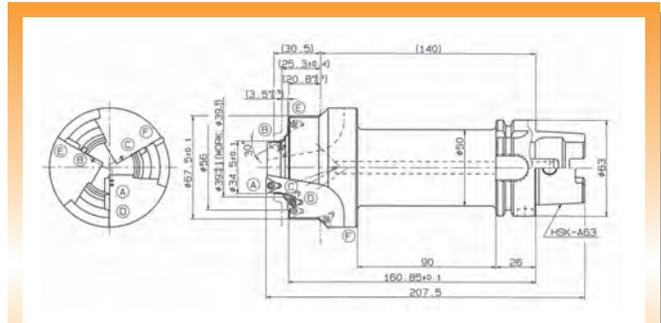
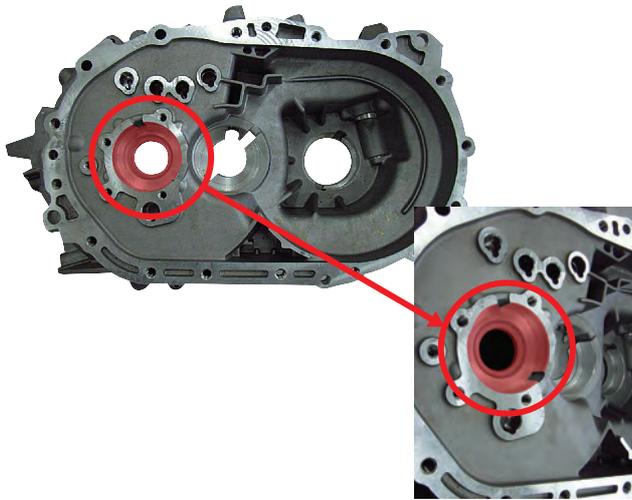
Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)

Cutting conditions

$vc=120\text{m/min}$ $fr=0.2\text{mm/rev}$ $vf=1,529\text{mm/min}$ Wet

Tooling Sheet 7

OP.8 (Back boring the main shaft hole_1) For machining centres



TPGX110304 HTi10

Tool features

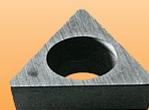
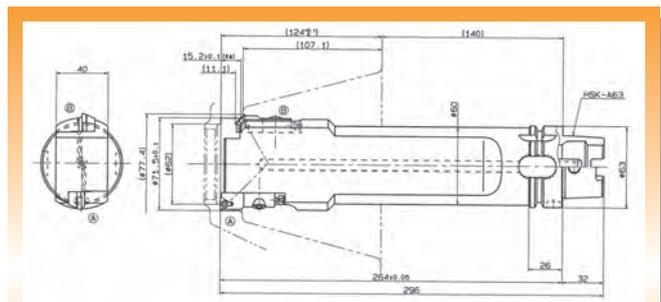
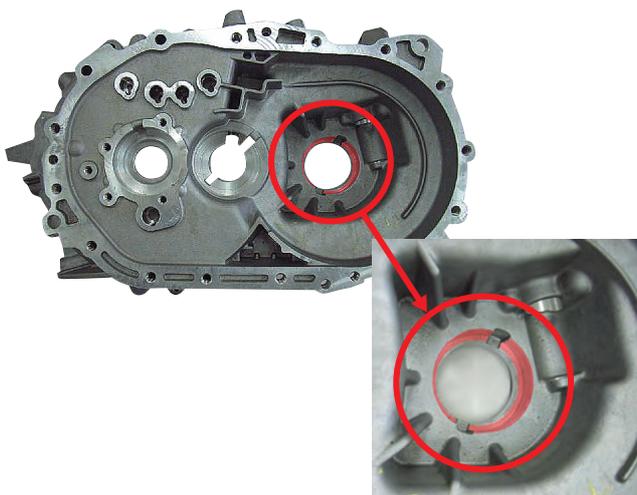
Special combination boring cutter with HTi10 inserts. Possible to perform 6 processes boring, facing and chamfering in one process for drastic process consolidation and higher production efficiency.

Cutting conditions

vc=357~700m/min fr=0.2mm/rev vf=660mm/min ap=1.5mm Wet

Tooling Sheet 8

OP.9 (Back boring the output shaft hole_1) For machining centres



TPGX110304 HTi10

Tool features

Special combination boring cutter with HTi10 inserts. Possible to perform facing and chamfering in one process for drastic process consolidation and higher production efficiency. Cartridge type for high precision machining.

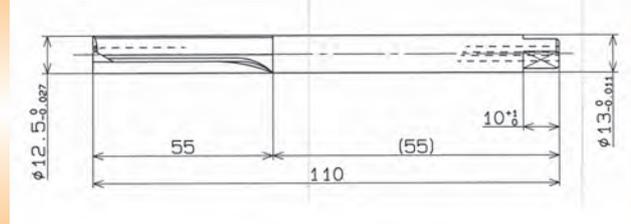
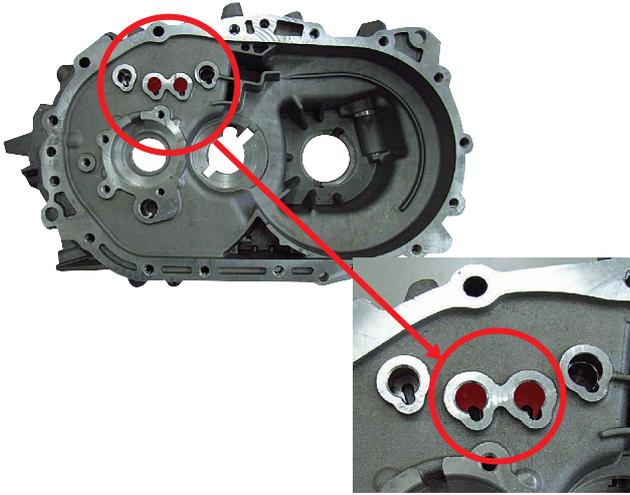
Cutting conditions

vc=700m/min fr=0.2mm/rev vf=620mm/min Wet

Tooling Sheet 9

OP.10 (Pre-drilling $\phi 13$)

For machining centres



Burnishing drill
HTi10

Tool features

Special burnish drill with through coolant holes.
Straight flute for easy re-grinding.

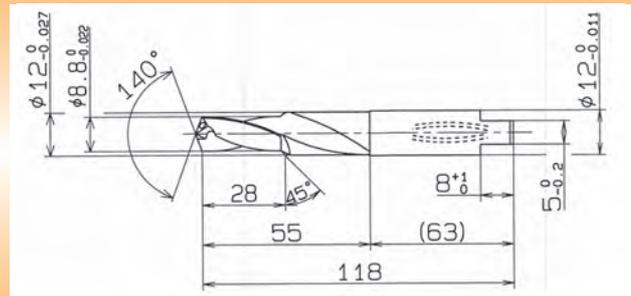
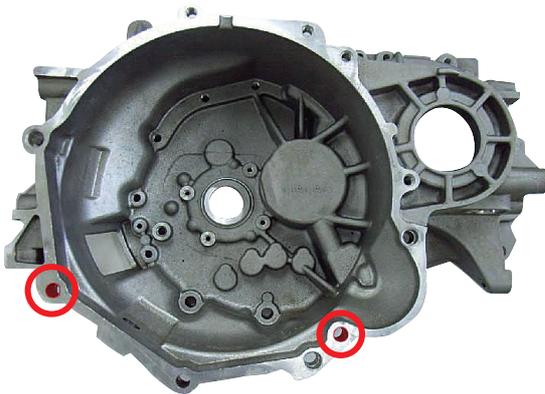
Cutting conditions

$vc=200\text{m/min}$ $fr=0.2\text{mm/rev}$ $vf=1,019\text{mm/min}$ Wet

Tooling Sheet 10

OP.11 (Pre-drilling of M10 tap hole)

For machining centres



MWE/MWS drill (Special)
HTi10

Tool features

Special MWE / MWS drill with through coolant holes. Step drill consolidates processes and reduces machining costs. Wave cutting edge gives a balance of edge strength and sharpness. High precision, stable machining.

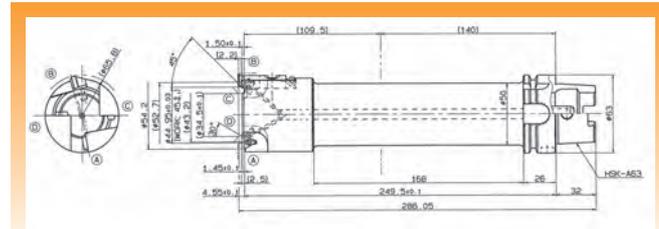
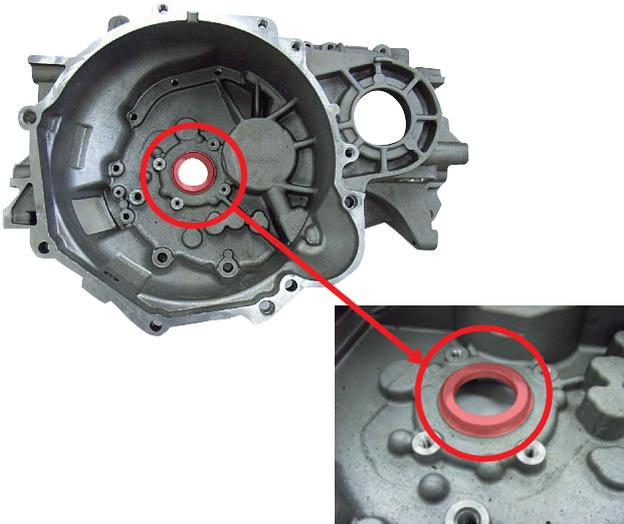
Cutting conditions

$vc=150\text{m/min}$ $fr=0.2\text{mm/rev}$ $vf=1,086\text{mm/min}$ Wet

Tooling Sheet 11

OP.12 (Boring the main shaft hole)

For machining centres



TPGX110304 HTi10

Tool features

Special combination boring cutter with HTi10 inserts. For facing, boring and chamfering. Cartridge type for high precision machining.

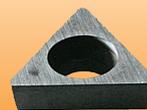
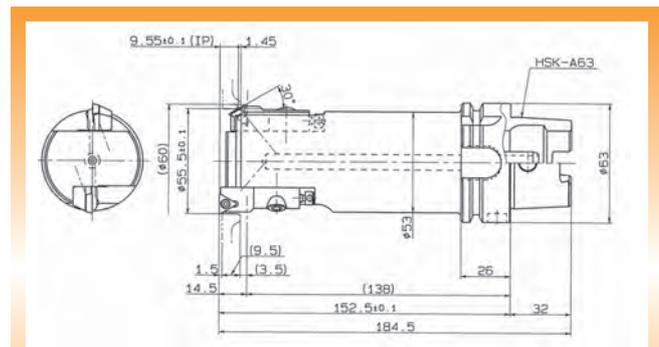
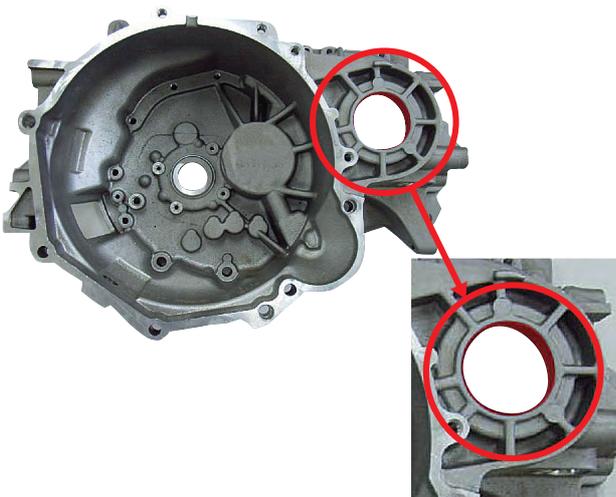
Cutting conditions

vc=600m/min fr=0.1mm/rev vf=420mm/min Wet

Tooling Sheet 12

OP.13 (Boring the output shaft hole)

For machining centres



TPGX110304 HTi10

Tool features

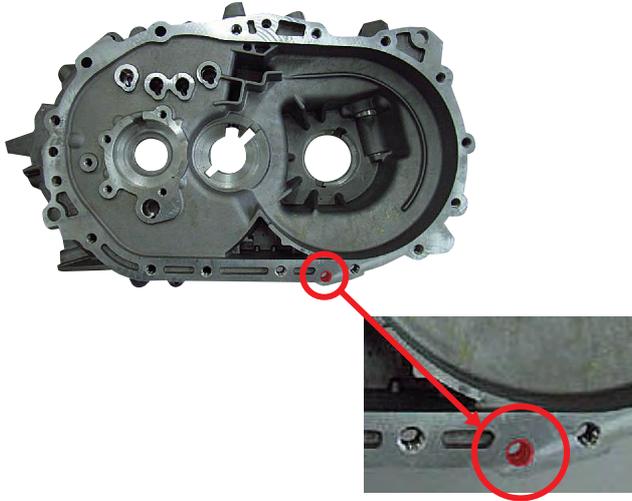
Special combination boring cutter with HTi10 inserts. For boring and chamfering. Cartridge type for high precision machining.

Cutting conditions

vc=600m/min fr=0.2mm/rev vf=688mm/min Wet

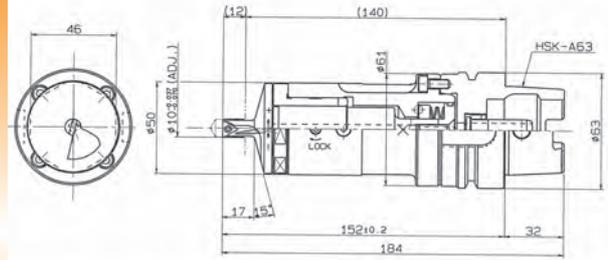
Tooling Sheet 13

OP.14 (Boring of $\phi 10$ datum hole) For machining centres



Tool features

Special boring bar with a diameter adjustment function with MD220 inserts. Use of an adjustable unit makes it possible to change an adjustment amount to the desired value. Easy diameter adjustment.



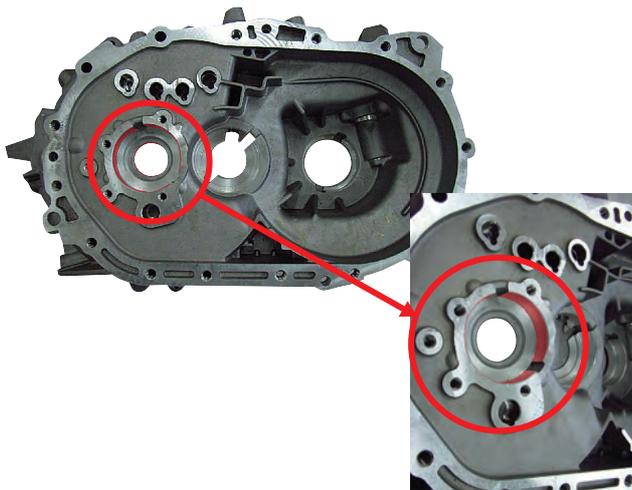
TPGX110304 MD220

Cutting conditions

$vc=251\text{m/min}$ $fr=0.06\text{mm/rev}$ $vf=480\text{mm/min}$ Wet

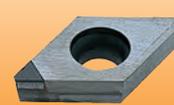
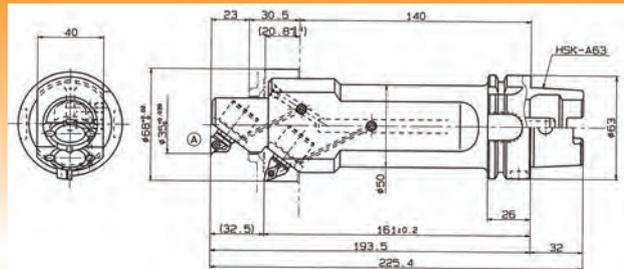
Tooling Sheet 14

OP.15 (Back boring the main shaft hole_2) For machining centres



Tool features

Special combination boring cutter with special MD220 inserts. Use of a finishing type, high precision boring unit. Fine adjustment of inserts can be carried out with ease, enabling high precision machining.



Special DC insert MD220
TPGX110304 MD220

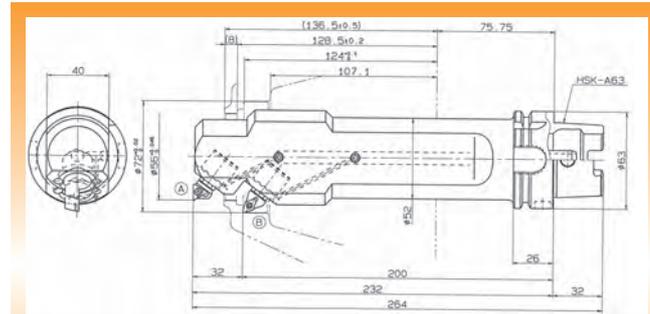
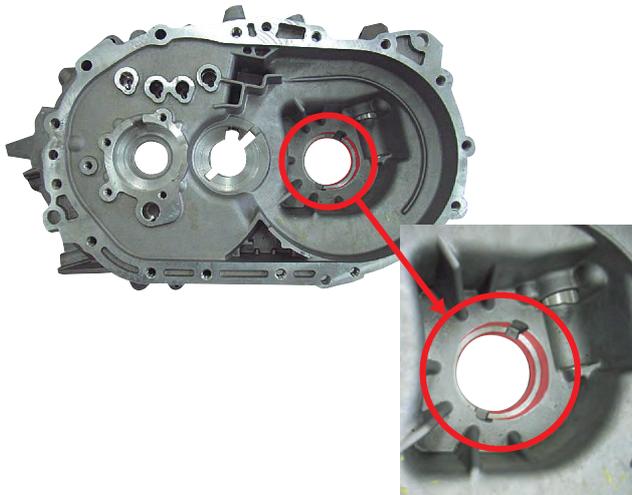
Cutting conditions

$vc=226\sim 427\text{m/min}$ $fr=0.06\text{mm/rev}$ $vf=120\text{mm/min}$ Wet

Tooling Sheet 15

OP.16 (Back boring the output shaft hole_2)

For machining centres



Special DC insert MD220
TPGX110304 MD220

Tool features

Special combination boring cutter with special MD220 inserts. Use of a finishing type, high precision boring unit. Fine adjustment of inserts can be carried out with ease, enabling high precision machining.

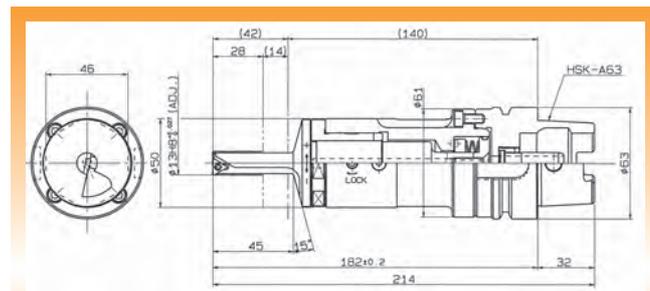
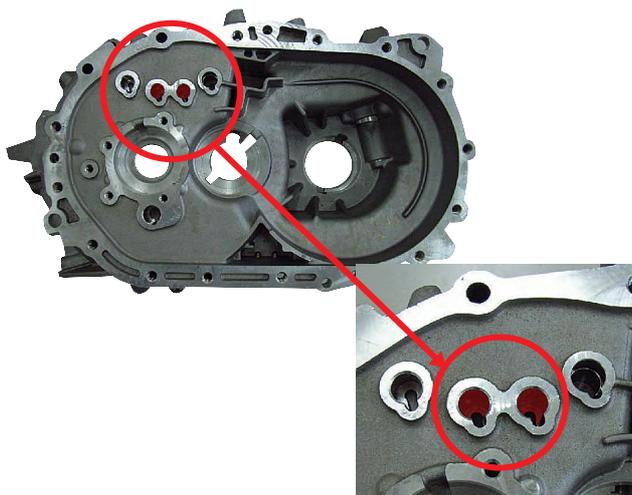
Cutting conditions

vc=345~452m/min fr=0.06mm/rev vf=120mm/min Wet

Tooling Sheet 16

OP.17 (Boring circuit holes A)

For machining centres



TPGX090204 MD220

Tool features

Special boring bar with a diameter adjustment function with MD220 inserts. Use of an adjustable unit makes it possible to change an adjustment amount to the desired value. Easy diameter adjustment.

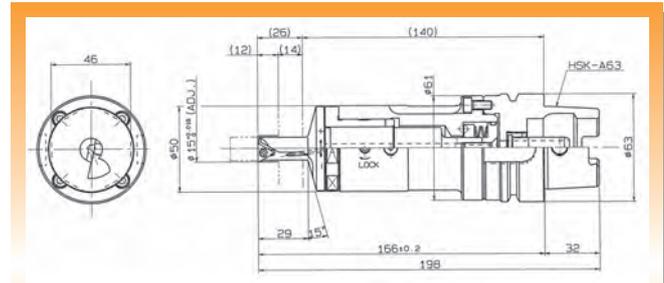
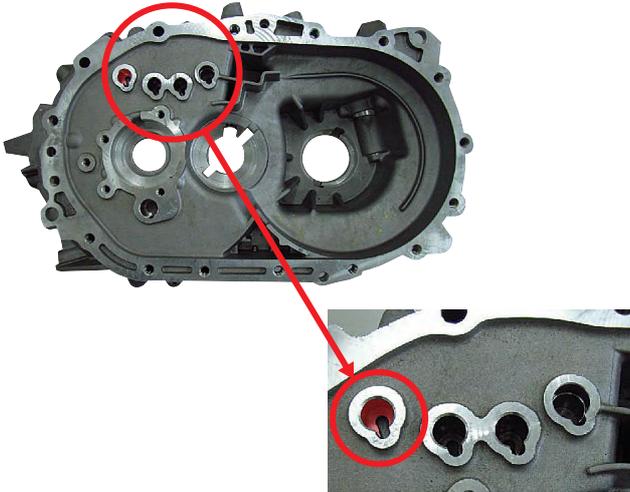
Cutting conditions

vc=327m/min fr=0.06mm/rev vf=480mm/min Wet

Tooling Sheet 17

OP.18 (Boring circuit hole B)

For machining centres



TPGX110304 MD220

Tool features

Special boring bar with a diameter adjustment function with MD220 inserts. Use of an adjustable unit makes it possible to change an adjustment amount to the desired value. Easy diameter adjustment.

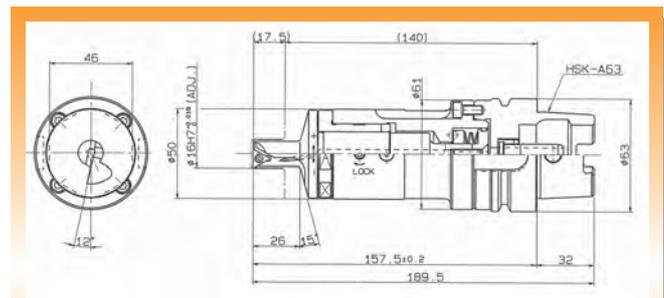
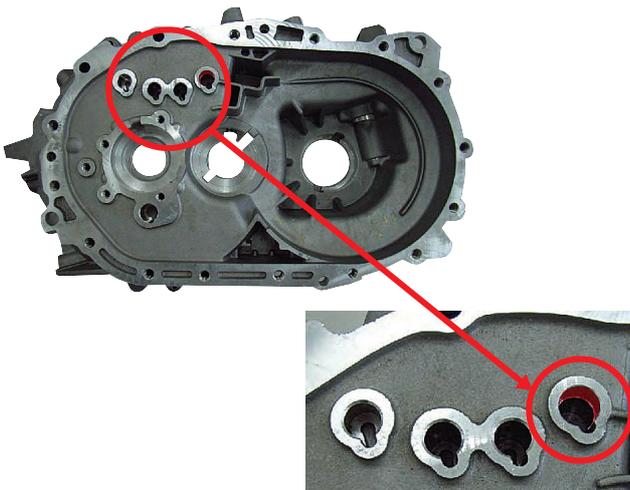
Cutting conditions

$vc=327\text{m/min}$ $fr=0.06\text{mm/rev}$ $vf=480\text{mm/min}$ Wet

Tooling Sheet 18

OP.19 (Boring circuit hole C)

For machining centres



TPGX110304 MD220

Tool features

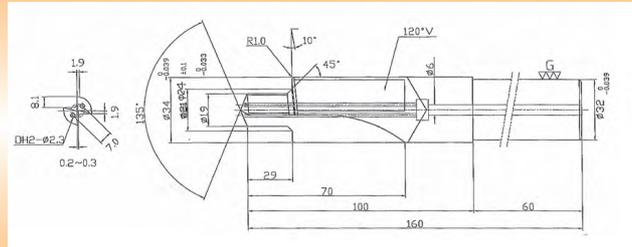
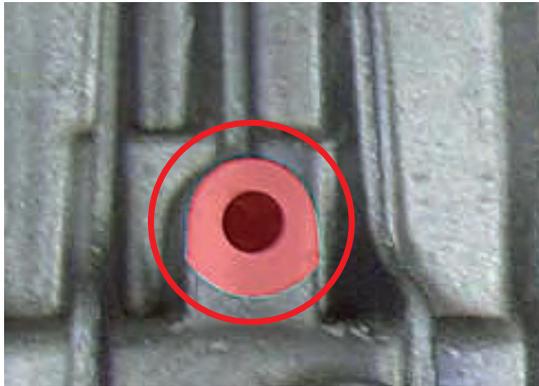
Special boring bar with a diameter adjustment function with MD220 inserts. Use of an adjustable unit makes it possible to change an adjustment amount to the desired value. Easy diameter adjustment.

Cutting conditions

$vc=402\text{m/min}$ $fr=0.06\text{mm/rev}$ $vf=480\text{mm/min}$ Wet

Tooling Sheet 19

OP.20 (Pre-drilling & spot facing of $\phi 22$) For machining centres



Burnishing drill
HTi10

Tool features

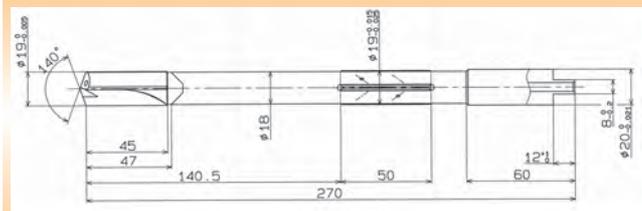
Special burnish drill with through coolant holes in HTi10 grade. Process consolidation by performing pre-drilling and spot facing in one process. Straight flute for easy re-grinding.

Cutting conditions

vc=239 / 427m/min fr=0.2 / 0.1mm/rev vf=800 / 400mm/min
Wet

Tooling Sheet 20

OP.21 (Pre-drilling of $\phi 20$) For machining centres



Burnishing drill
HTi10

Tool features

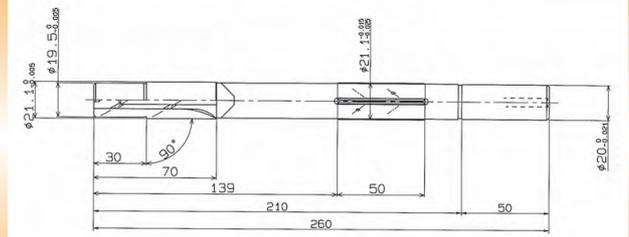
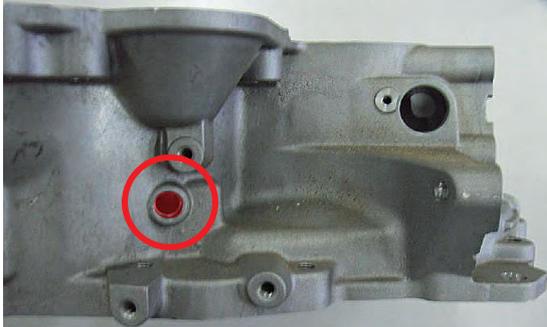
Special burnish drill with through coolant holes in HTi10 grade. Straight flute for easy re-grinding.

Cutting conditions

vc=252m/min fr=0.2mm/rev vf=840mm/min Wet

Tooling Sheet 21

OP.22 (Semi-finishing of $\phi 20 \times \phi 22$) For machining centres



Carbide reamer
HTi10

Tool features

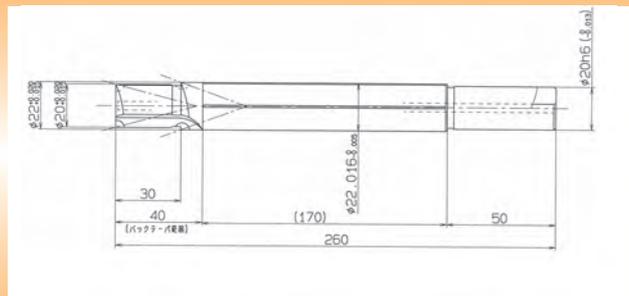
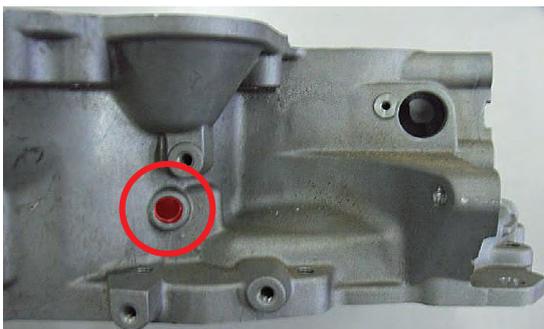
Carbide reamer with guide pads in HTi10 grade. Self-guiding ensures high precision machining.

Cutting conditions

$vc=269 / 297\text{m/min}$ $fr=0.2\text{mm/rev}$ $vf=880\text{mm/min}$ Wet

Tooling Sheet 22

OP.23 (Finishing of $\phi 20 \times \phi 22$) For machining centres



PCD reamer
MD220

Tool features

PCD reamer with guide pads. Self-guiding ensures high precision machining.

Cutting conditions

$vc=200\text{m/min}$ $fr=0.1\text{mm/rev}$ $vf=320\text{mm/min}$ Wet

Tooling Sheet 23

Torque converter cover



Work material : ADC12

- Main machining**
- ① Mounting face
 - ② Various holes

Machining methods

Milling

Drilling

Torque converter cover

OP.1 (Engine mounting face)

For machining centres



NF10000R0408D
GDCN2004PDR3 MD220

Tool features

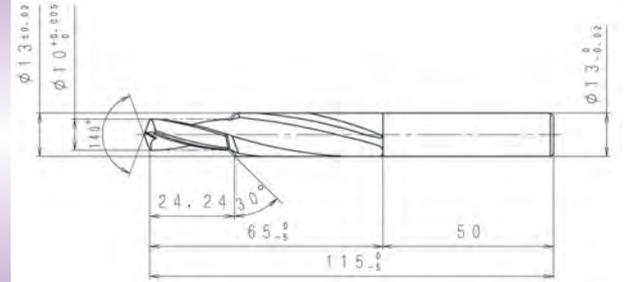
Special NF10000 type cutter with MD220 inserts.
Finish milling cutter with high wear and weld resistant MD220 inserts for high speed machining.
Radius minor edge for high surface finishes.

Cutting conditions

$vc=1,260\text{m/min}$ $n=4,012\text{min}^{-1}$ $fz=0.15\text{mm/tooth}$
 $vf=4,814\text{mm/min}$ $ap=1.5\text{mm}$ Wet

OP.2 (Locating holes)

For machining centres



MZE/MZS drill (Special)
HTi10

Tool features

Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)

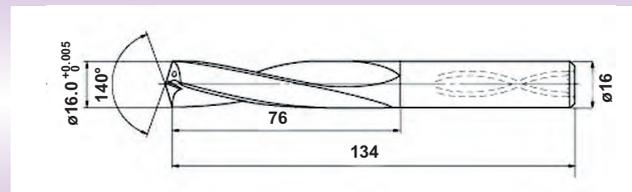
Cutting conditions

$vc=100\text{m/min}$ $n=3,185\text{min}^{-1}$ $fr=0.12\text{mm/rev}$ Wet

Tooling Sheet 2

OP.3 (Engine mounting holes)

For machining centres



MAS1600MB
HTi10

Tool features

Standard super burnish drill.
Use of a double margin enables high precision drilling.

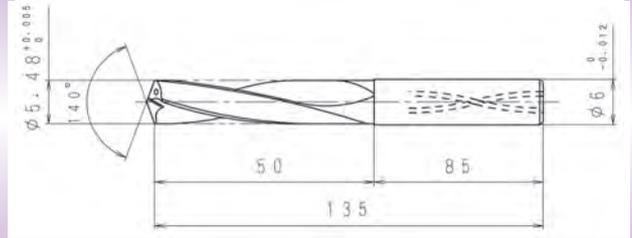
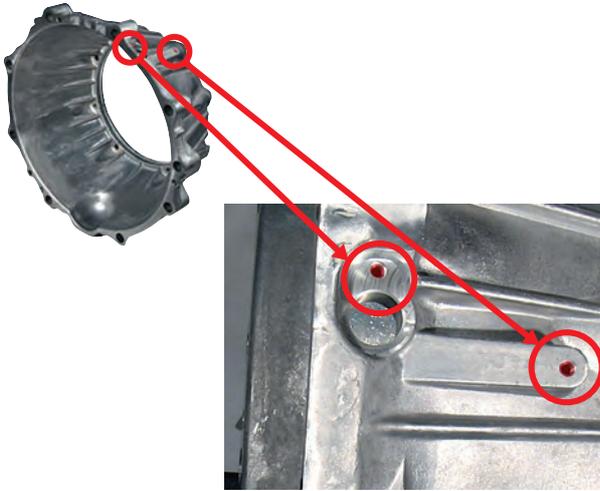
Cutting conditions

$vc=123\text{m/min}$ $n=2,448\text{min}^{-1}$ $fr=0.12\text{mm/rev}$ Wet

Tooling Sheet 3

OP.6 (Pre-drilling of tap holes for cooler bracket installation)

For machining centres



MAS drill (Special)
HTi10

Tool features

Special MAS drill in HTi10 grade.
Use of a double margin enables high precision drilling.

Cutting conditions

$vc=150\text{m/min}$ $n=8,717\text{min}^{-1}$ $fr=0.1\text{mm/rev}$ Wet

Tooling Sheet 6

OP.7 (Case mounting face)

For machining centres



NF10000R0408D
GDCN2004PDFR3 MD220

Tool features

Special NF10000 type cutter with MD220 inserts.
Finish milling cutter with high wear and weld resistant MD220 inserts for high speed machining.
Radius minor edge for high surface finishes.

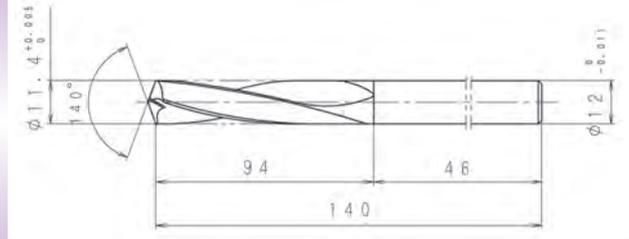
Cutting conditions

$vc=1,000\text{m/min}$ $n=3,184\text{min}^{-1}$ $fz=0.2\text{mm/tooth}$ $vf=5,094\text{mm/min}$ Wet

Tooling Sheet 7

OP.8 (Case mounting holes)

For machining centres



MAS drill (Special)
HTi10

Tool features

Special MAS drill in HTi10 grade.
Use of a double margin enables high precision drilling.

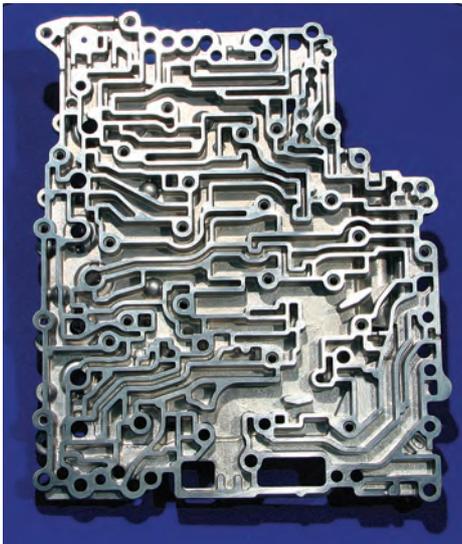
Cutting conditions

$vc=123\text{m/min}$ $n=3,436\text{min}^{-1}$ $fr=0.12\text{mm/rev}$ Wet

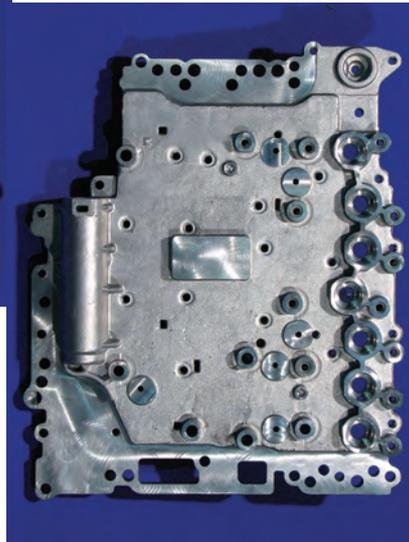
Tooling Sheet 8

Valve body Upper side

Valve body
Upper side



Work material : ADC12



Main machining

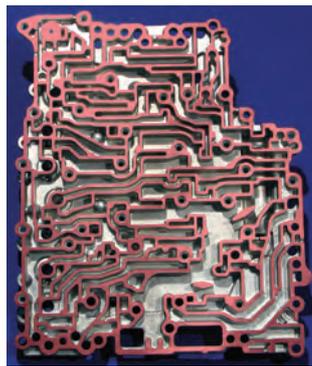
- ① Circuit face
- ② Back face
- ③ Various holes

Machining methods

Milling
Drilling
Boring

OP.1 (Roughing of the circuit surface, back face boss)

For machining centres



Tool features

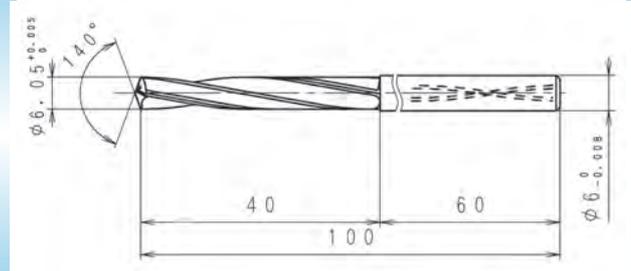
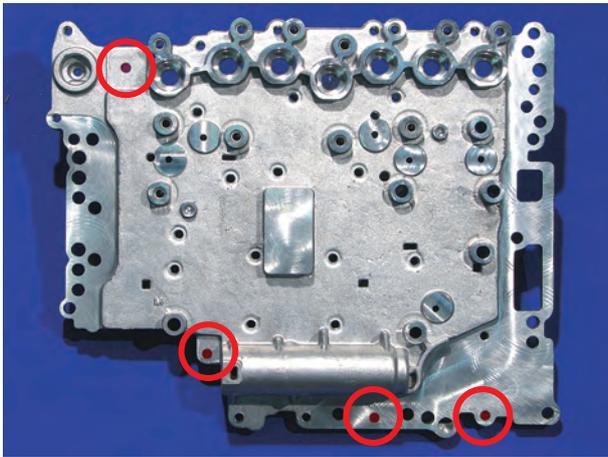
Standard NF10000 type cutter with MD220 inserts. Finish milling cutter with high wear and weld resistant MD220 inserts for high speed machining. Chamfer honed main cutting edges increases cutting edge strength.

Cutting conditions

$vc=3,014m/min$ $n=11,998min^{-1}$ $fz=0.107mm/tooth$ $vf=7,680mm/min$
Wet

OP.2 (Dowel location holes)

For machining centres



MAS drill (Special)
HTi10

Tool features

Special MAS drill in HTi10 grade.
Use of a double margin allows high precision drilling.

Cutting conditions

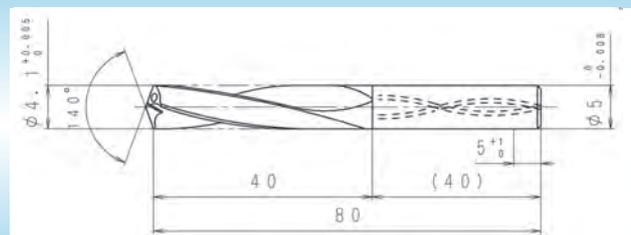
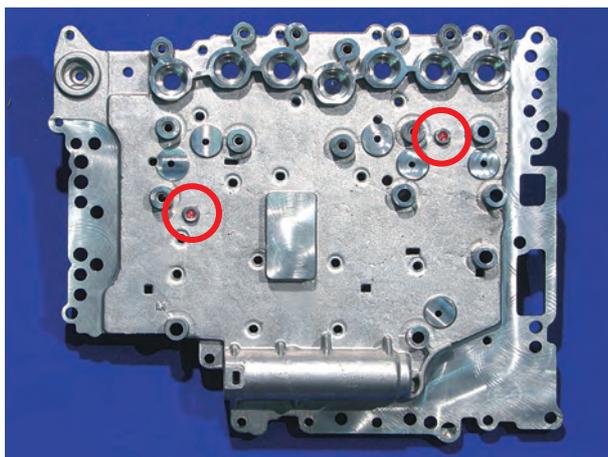
$vc=100\text{m/min}$ $n=5,263\text{min}^{-1}$ $fr=0.07\text{mm/rev}$ $vf=368\text{mm/min}$
Wet

Valve body
Upper side

Tooling Sheet 2

OP.3 (Locating holes)

For machining centres



MAS drill (Special)
HTi10

Tool features

Special MAS drill in HTi10 grade.
Use of a double margin allows high precision drilling.

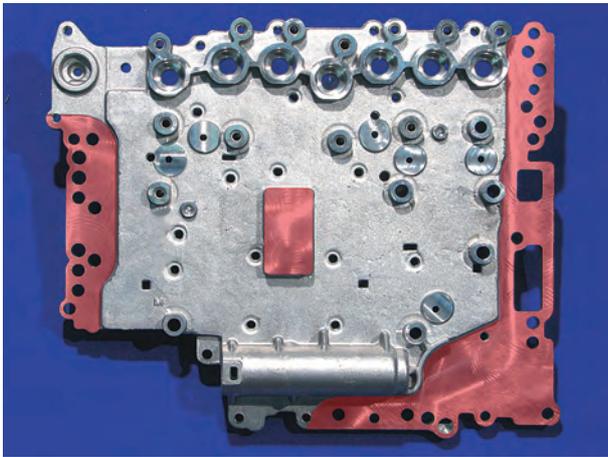
Cutting conditions

$vc=100\text{m/min}$ $n=7,768\text{min}^{-1}$ $fr=0.05\text{mm/rev}$ $vf=388\text{mm/min}$
Wet

Tooling Sheet 3

OP.4 (Rough milling of the case mounting face) For machining centres

Valve body
Upper side



Tool features

Standard BXD type cutter with TF15 inserts.
Specially designed G-class inserts for excellent wall accuracy.

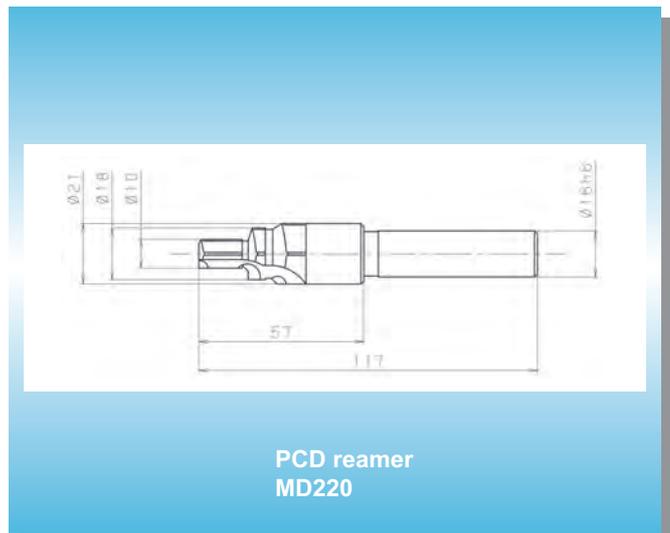
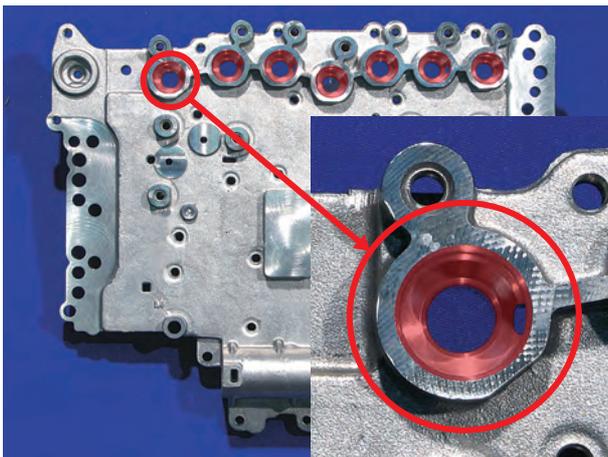
Cutting conditions

$vc=1,507\text{m/min}$ $n=11,998\text{min}^{-1}$ $fz=0.023\text{mm/tooth}$
 $vf=840\text{mm/min}$ $ap=0.3\text{mm}$ Wet

Tooling Sheet 4

OP.5 (Solenoid holes)

For machining centres



Tool features

Special PCD reamer in MD220 grade.
Use of MD220 cutting edge with high welding resistance.

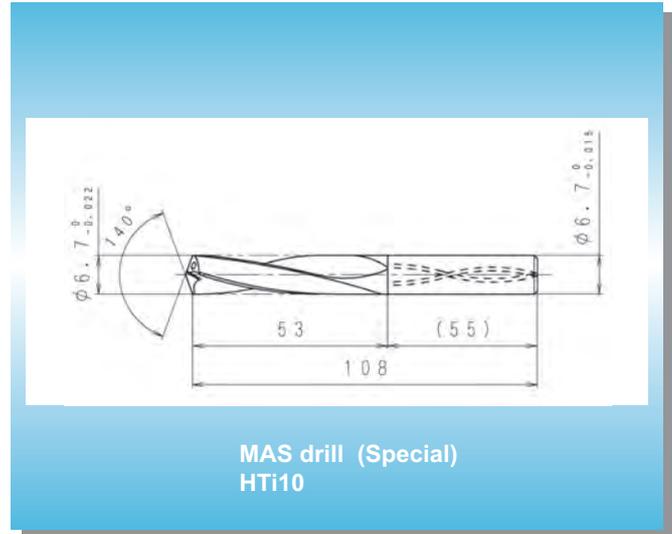
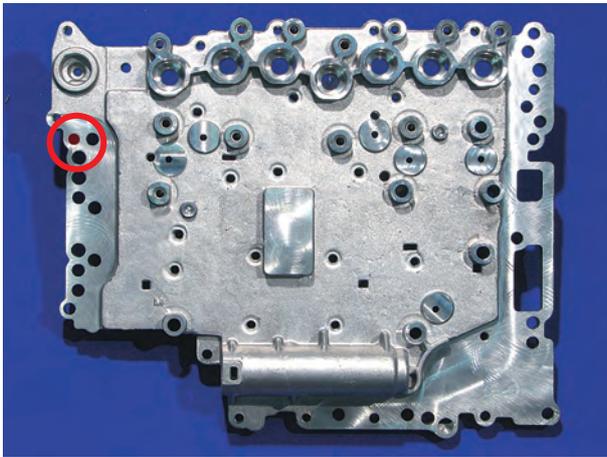
Cutting conditions

$vc=79\text{m/min}$ $n=2,516\text{min}^{-1}$ $fr=0.06\text{mm/rev}$ $vf=150\text{mm/min}$
Wet

Tooling Sheet 5

OP.6 (Dowel location holes)

For machining centres



Valve body
Upper side

Tool features

Special MAS drill in HTi10 grade.
Use of a double margin allows high precision drilling.

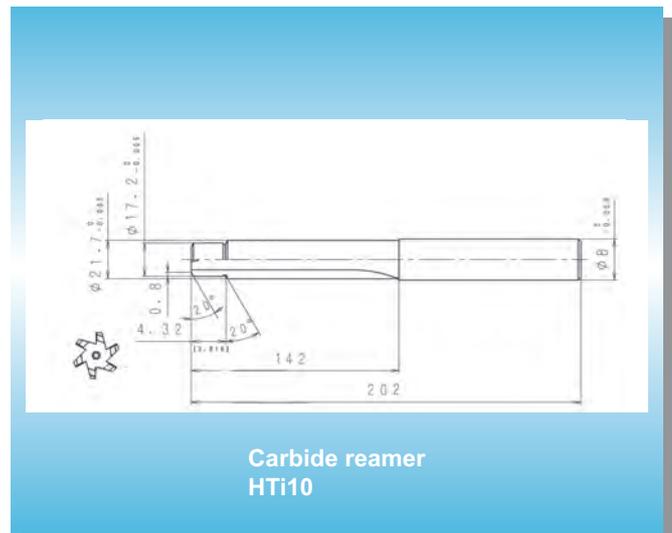
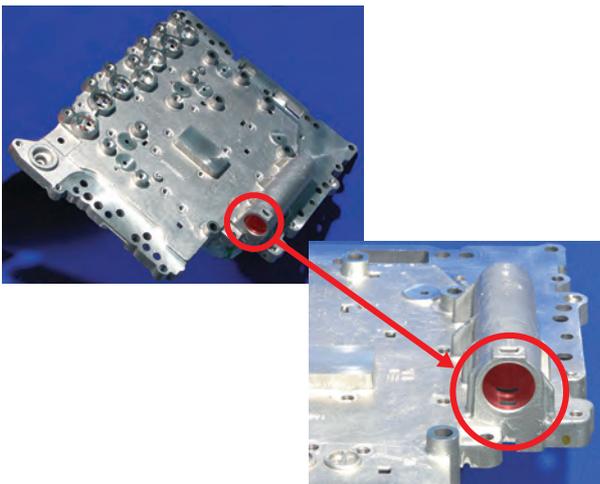
Cutting conditions

$vc=100\text{m/min}$ $n=4,753\text{min}^{-1}$ $fr=0.07\text{mm/rev}$ $vf=332\text{mm/min}$
Wet

Tooling Sheet 6

OP.7 (Roughing of the accumulator bore)

For machining centres



Tool features

Special carbide reamer in HTi10 grade.
The 6-flute cutting edge enables high performance machining. Straight flute for easy re-grinding.

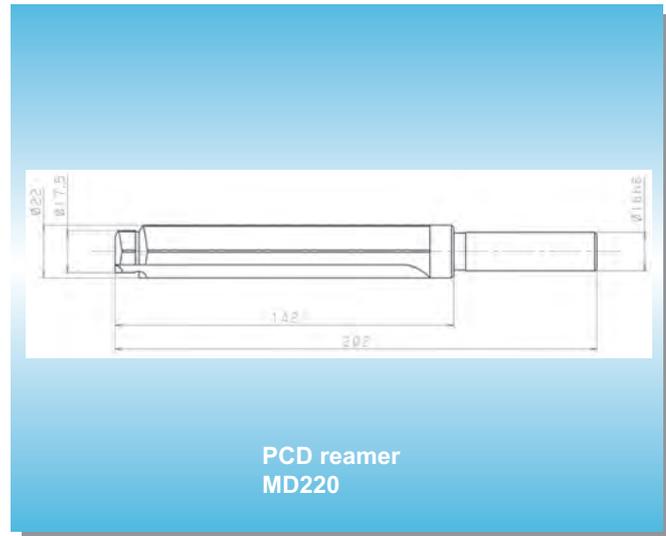
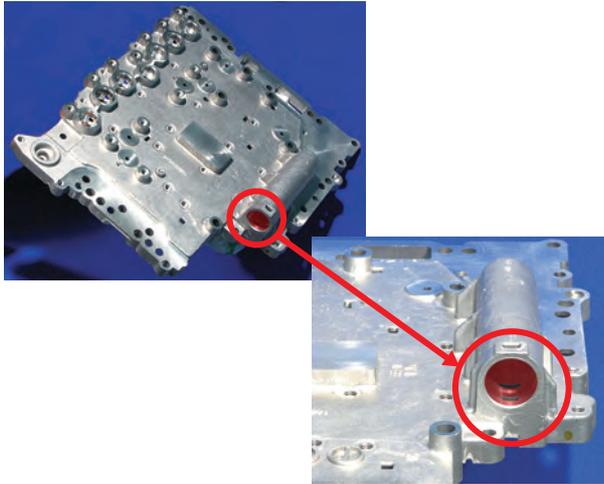
Cutting conditions

$vc=100\text{m/min}$ $n=1,852\text{min}^{-1}$ $fz=0.05\text{mm/tooth}$ $vf=555\text{mm/min}$
Wet

Tooling Sheet 7

OP.8 (Finishing of the accumulator bore)

For machining centres



Tool features

Special PCD reamer in MD220 grade. Use of MD220 (PCD) cutting edge with high welding resistance. The single-flute cutting edge improves run-out accuracy leading to better surface finishes and higher hole roundness accuracy.

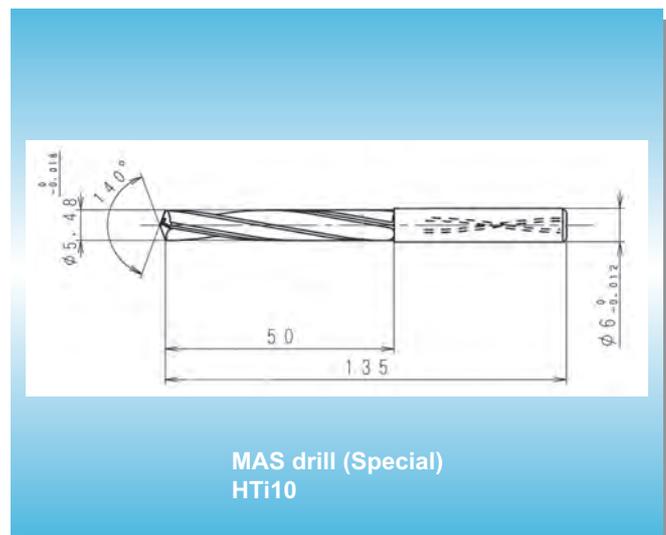
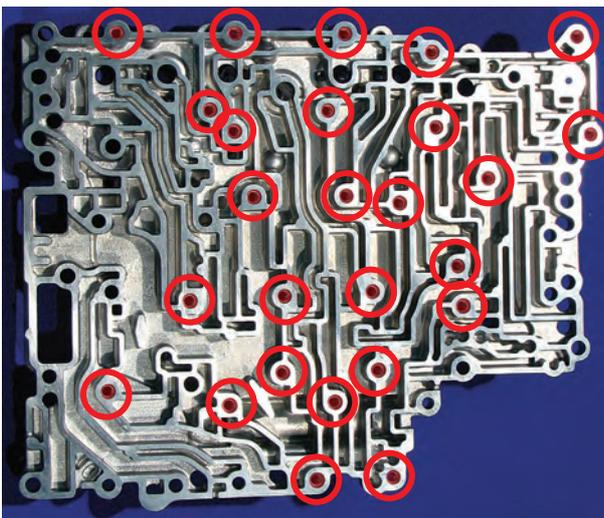
Cutting conditions

$vc=200\text{m/min}$ $n=3,640\text{min}^{-1}$ $fr=0.07\text{mm/rev}$ $vf=255\text{mm/min}$
Wet

Tooling Sheet 8

OP.9 (Pre-drilling of tap holes)

For machining centres



Tool features

Special MAS drill in HTi10 grade. Use of a double margin enables high precision stable pre-hole drilling for rolled tap.

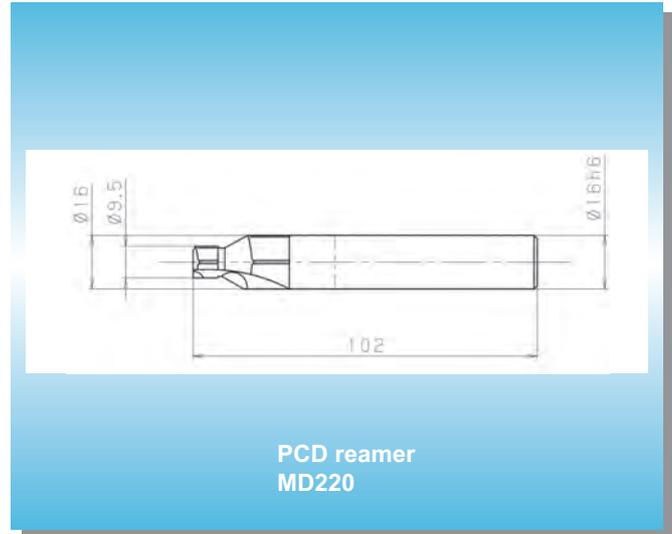
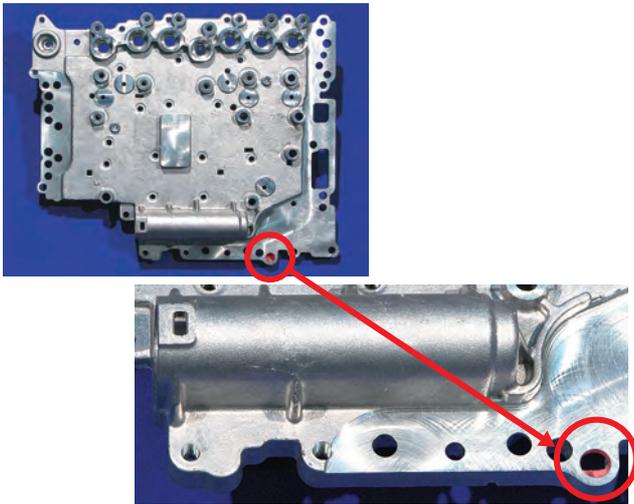
Cutting conditions

$vc=100\text{m/min}$ $n=5,812\text{min}^{-1}$ $fr=0.10\text{mm/rev}$ $vf=581\text{mm/min}$
Wet

Tooling Sheet 9

OP.10 (Drain holes)

For machining centres



Valve body
Upper side

Tool features

Special PCD reamer in MD220 grade.
Use of MD220 cutting edge with high welding resistance.

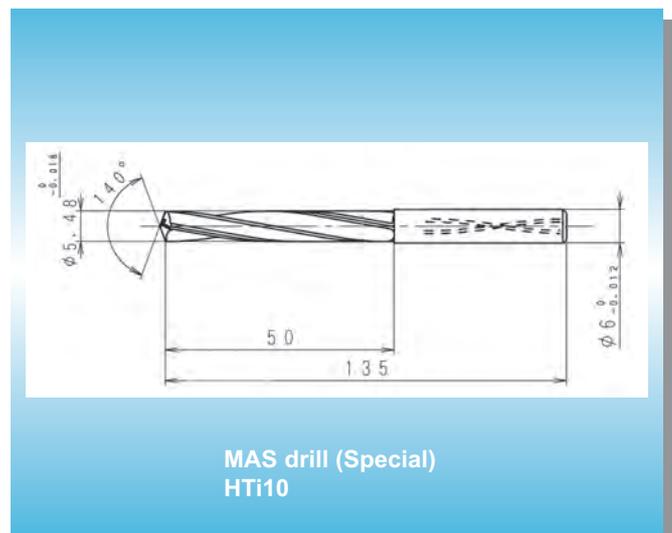
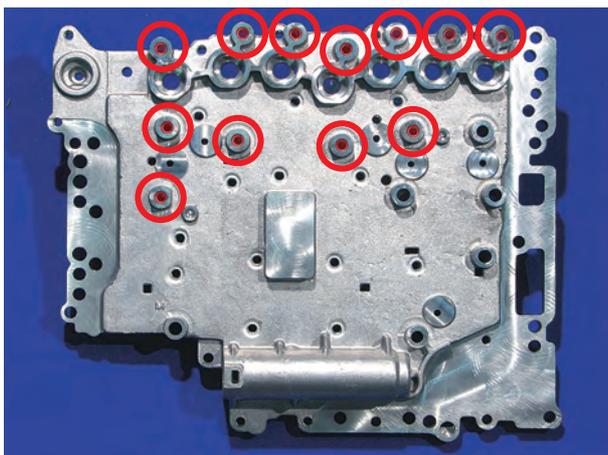
Cutting conditions

$vc=113\text{m/min}$ $n=3,788\text{min}^{-1}$ $fr=0.082\text{mm/rev}$ $vf=310\text{mm/min}$
Wet

Tooling Sheet 10

OP.11 (Pre-drilling of tap holes for the solenoid & oil pressure switch)

For machining centres



Tool features

Special MAS drill in HTi10 grade. Use of a double margin enables high precision stable pre-hole drilling for rolled tap.

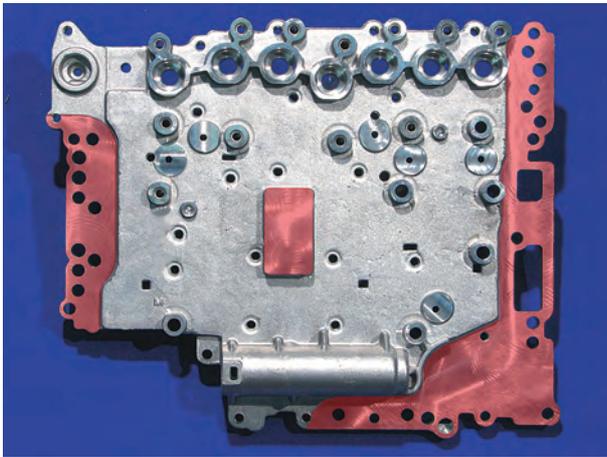
Cutting conditions

$vc=100\text{m/min}$ $n=5,812\text{min}^{-1}$ $fr=0.10\text{mm/rev}$ $vf=581\text{mm/min}$
Wet

Tooling Sheet 11

OP.12 (Finish milling of the case mounting face)

For machining centres



Tool features

Standard BXD type cutter with TF15 inserts. Specially designed G-class inserts for excellent wall accuracy.

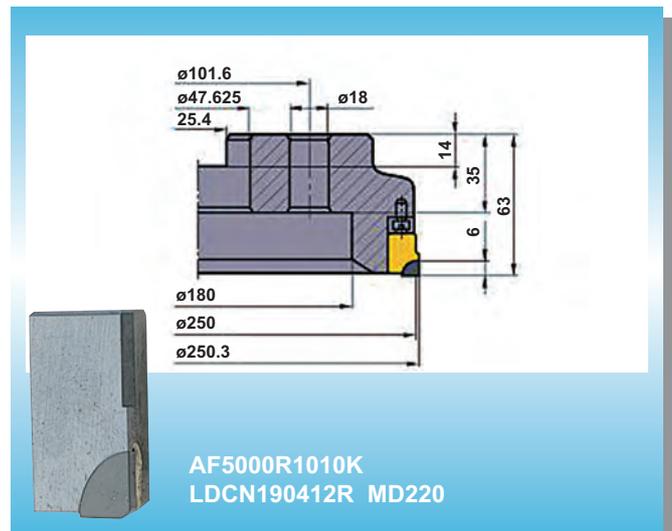
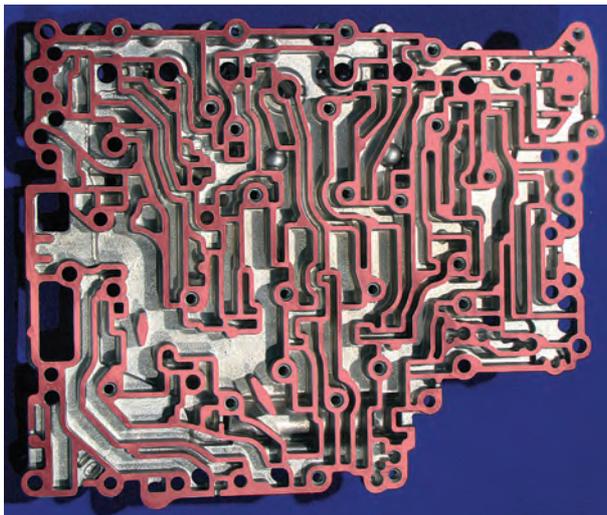
Cutting conditions

$vc=1,507\text{m/min}$ $n=11,998\text{min}^{-1}$ $fz=0.02\text{mm/tooth}$ $vf=720\text{mm/min}$
 $ap=0.3\text{mm}$ Wet

Tooling Sheet 12

OP.13 (Finish milling the circuit surface)

For machining centres



Tool features

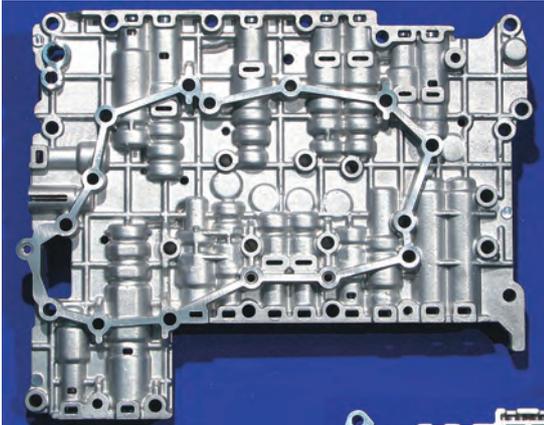
Standard AF5000 type cutter with MD220 inserts. CBN inserts are available for use instead of PCD inserts to machine other materials than aluminum alloy.

Cutting conditions

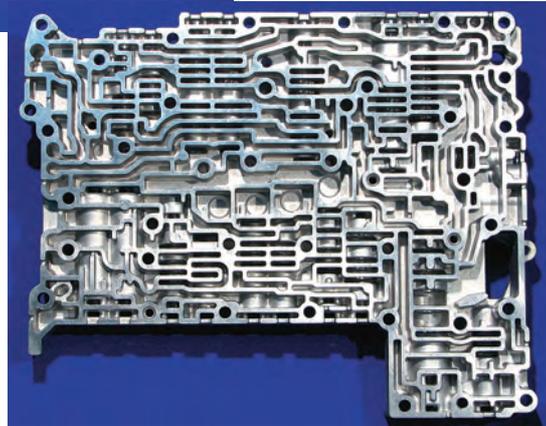
$vc=2,000\text{m/min}$ $n=2,548\text{min}^{-1}$ $fz=0.05\text{mm/tooth}$ $vf=1,274\text{mm/min}$
 $ap=0.4\text{mm}$ Wet

Tooling Sheet 13

Valve body lower side



Work material : ADC12



Main machining

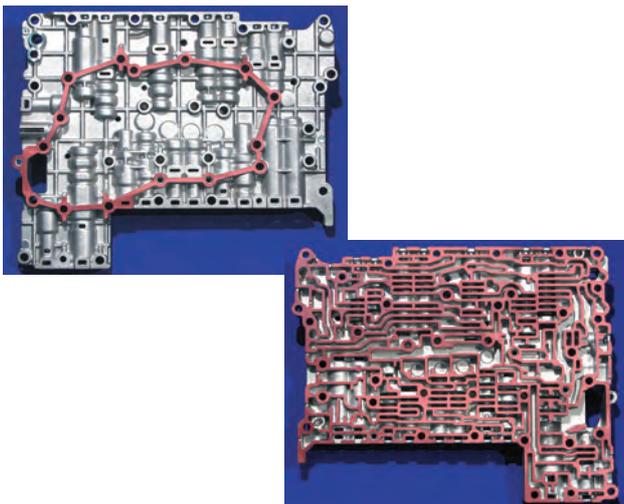
- ① Circuit face
- ② Various holes

Machining methods

Milling
Drilling

Valve body
lower side

OP.1 (Roughing of the circuit & oil strainer surface) For machining centres



NR1000R0306C
GDCN2004ZDTR1 MD220

Tool features

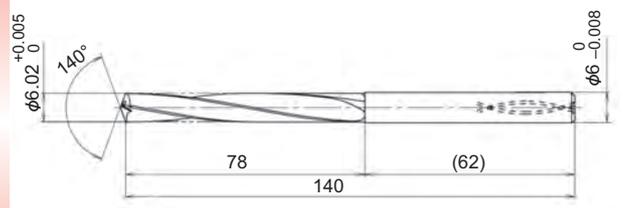
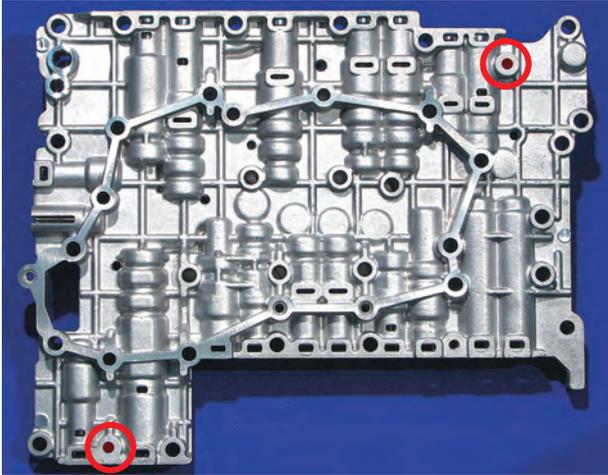
Standard NR10000 type cutter with MD220 inserts.
Roughing cutter with high wear and weld resistant MD220 (PCD) inserts for high speed machining.
Chamfer honed main cutting edges increases cutting edge strength.

Cutting conditions

$vc=3,014\text{m/min}$ $n=11,998\text{min}^{-1}$ $fz=0.067\text{mm/tooth}$
 $vf=4,800\text{mm/min}$ Wet

OP.2 (Locating holes)

For machining centres



MAS drill (Special)
HTi10

Tool features

Special MAS drill in HTi10 grade.
Use of a double margin enables high precision drilling.

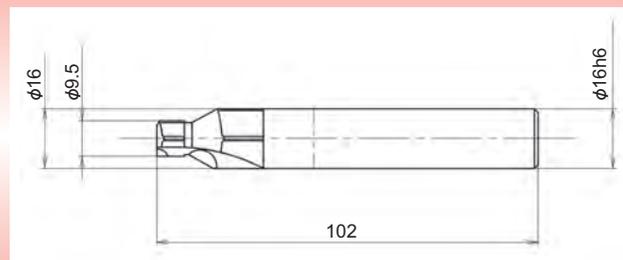
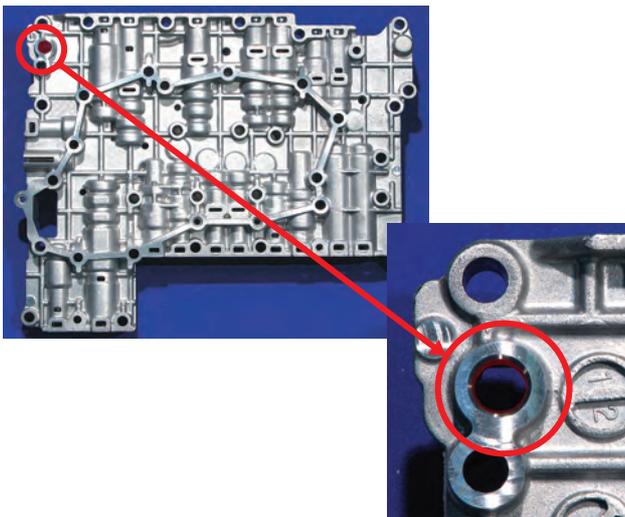
Cutting conditions

$vc=100\text{m/min}$ $n=5,290\text{min}^{-1}$ $fr=0.07\text{mm/rev}$ $vf=370\text{mm/min}$
Wet

Tooling Sheet 2

OP.3 (Sensor hole)

For machining centres



PCD reamer
MD220

Tool features

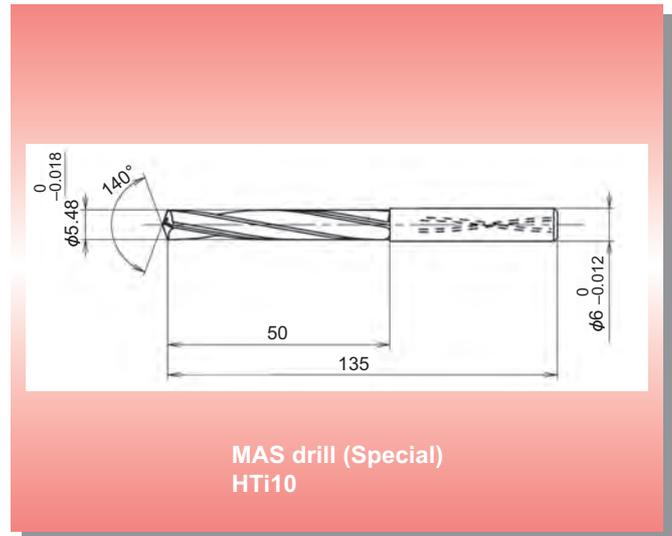
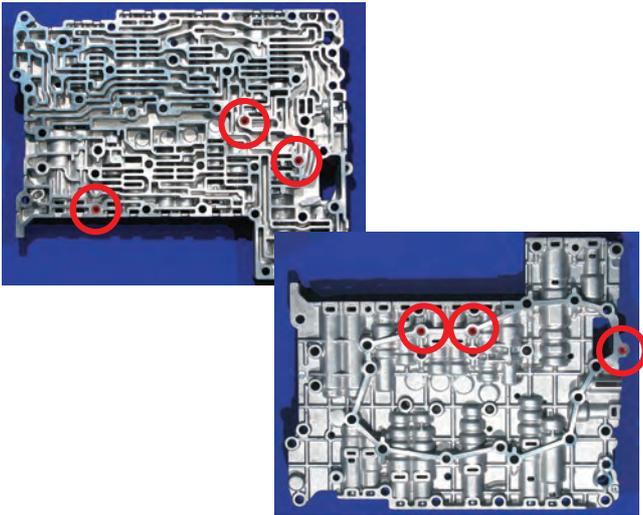
Special PCD reamer in MD220 grade.
Use of MD220 (PCD) cutting edge with high welding resistance. Shortening the tool length as much as possible achieves high runout accuracy.

Cutting conditions

$vc=113\text{m/min}$ $n=3,788\text{min}^{-1}$ $fr=0.1\text{mm/rev}$ $vf=380\text{mm/min}$
Wet

Tooling Sheet 3

OP.4 T1 (Pre-drilling of the tap holes) For machining centres



Tool features

Special MAS drill in HTi10 grade.
Use of a double margin enables high precision stable pre-hole drilling for rolled tap.

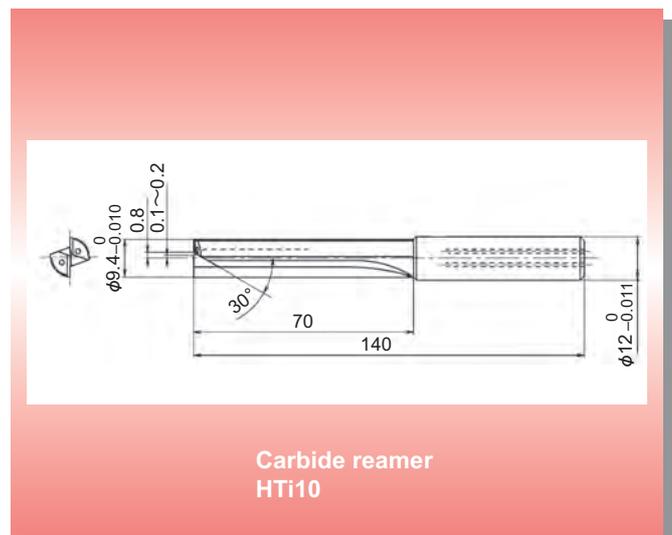
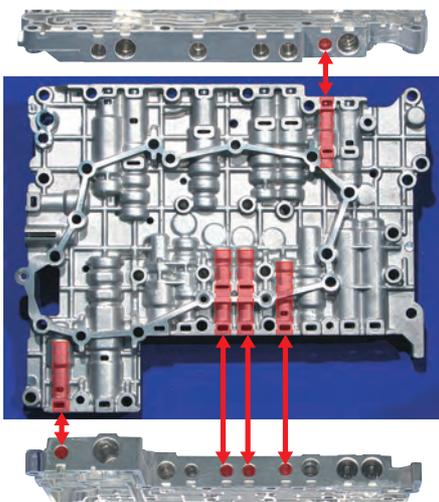
Cutting conditions

$vc=100\text{m/min}$ $n=5,812\text{min}^{-1}$ $fr=0.10\text{mm/rev}$ $vf=581\text{mm/min}$
Wet

Valve body
lower side

Tooling Sheet 4

OP.5 (①Roughing of the spool holes) For machining centres



Tool features

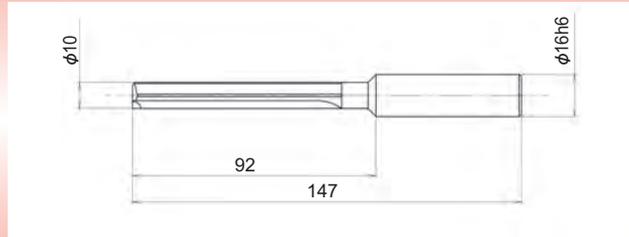
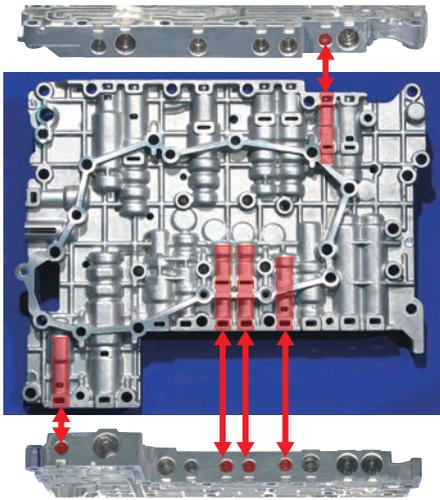
Special carbide reamer in HTi10 grade.
The 2-flute cutting edge allows good chip disposal.
Straight flute for easy re-grinding.

Cutting conditions

$vc=100\text{m/min}$ $n=3,388\text{min}^{-1}$ $fz=0.10\text{mm/tooth}$ $vf=678\text{mm/min}$
Wet

Tooling Sheet 5

OP.6 (① Finishing of the spool holes) For machining centres



PCD reamer
MD220

Tool features

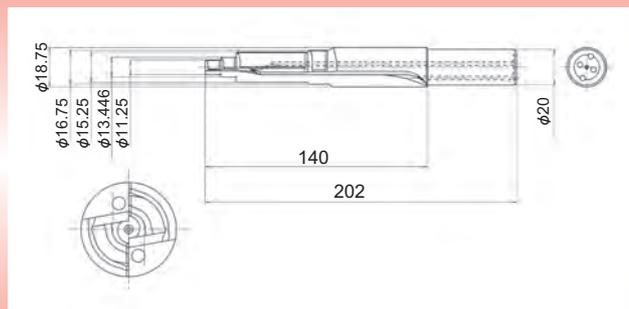
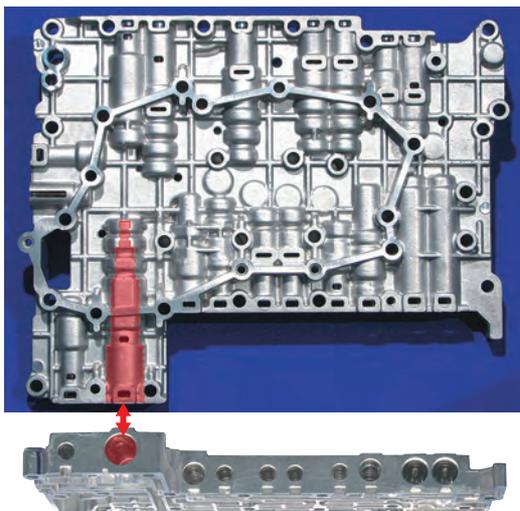
Special PCD reamer in MD220 grade.
Use of MD220 (PCD) cutting edge with high welding resistance.
The 2-flute cutting edge with good chip disposal properties allows highly efficient machining.

Cutting conditions

$vc=184\text{m/min}$ $n=5,860\text{min}^{-1}$ $fr=0.14\text{mm/rev}$ $vf=820\text{mm/min}$
Wet

Tooling Sheet 6

OP.7 (② Roughing of the spool holes) For machining centres



Carbide reamer
HTi10

Tool features

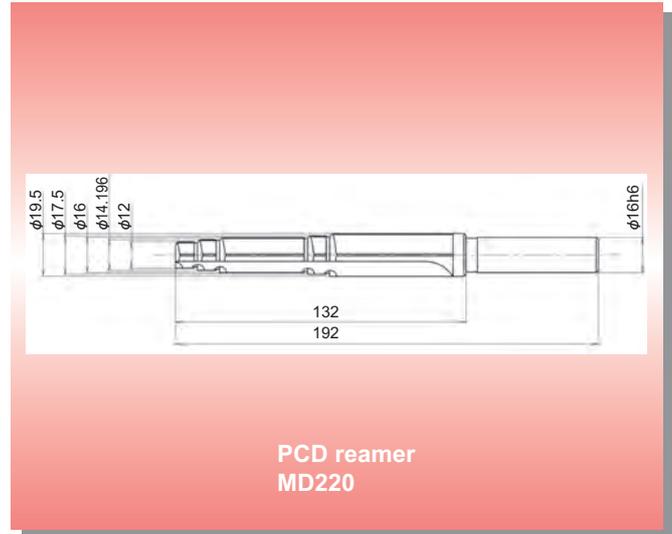
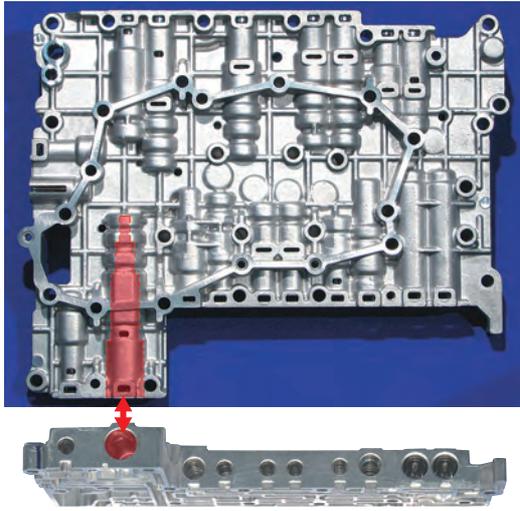
Special solid carbide multi-step reamer in HTi10 grade.
For roughing of 5 stepped holes.
The single-flute cutting edge improves run-out accuracy leading to better surface finishes and higher hole roundness accuracy.

Cutting conditions

$vc=100\text{m/min}$ $n=2,830\text{min}^{-1}$ $fr=0.05\text{mm/rev}$ $vf=142\text{mm/min}$
Wet

Tooling Sheet 7

OP.8 (②Finishing of the spool holes) For machining centres



Tool features

Special PCD multi-step reamer in MD220 grade.
Use of MD220 (PCD) cutting edge with high welding resistance.
The single-flute cutting edge improves run-out accuracy leading to better surface finishes and higher hole roundness accuracy.

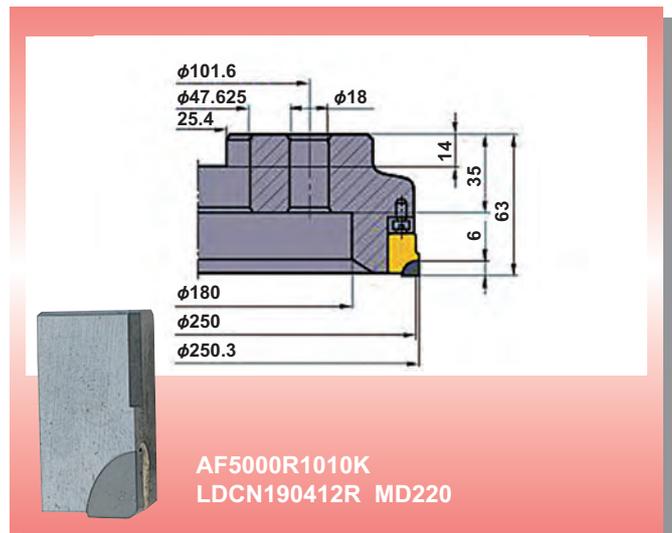
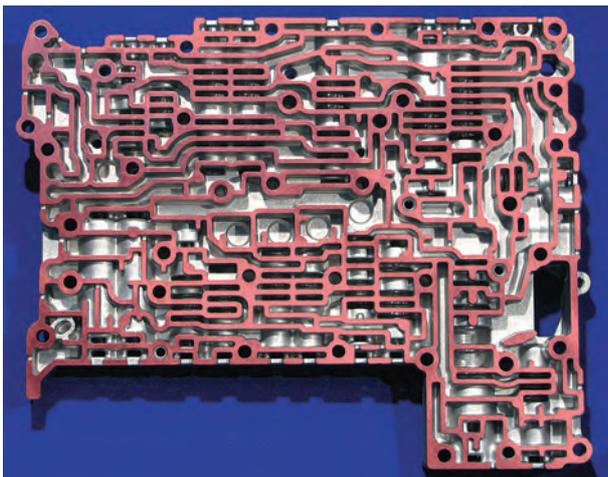
Cutting conditions

$vc=113\text{m/min}$ $n=3,005\text{min}^{-1}$ $fr=0.07\text{mm/rev}$ $vf=210\text{mm/min}$
Wet

Valve body
lower side

Tooling Sheet 8

OP.9 (Finish milling of the circuit surface) For machining centres



Tool features

Standard AF5000 type cutter with MD220 inserts.
CBN inserts are available for use instead of PCD inserts to machine other materials than aluminum alloy.

Cutting conditions

$vc=2,512\text{m/min}$ $n=3,200\text{min}^{-1}$ $fz=0.05\text{mm/tooth}$
 $vf=1,920\text{mm/min}$ $ap=0.4\text{mm}$ Wet

Tooling Sheet 9

CVT pulley Primary FIX

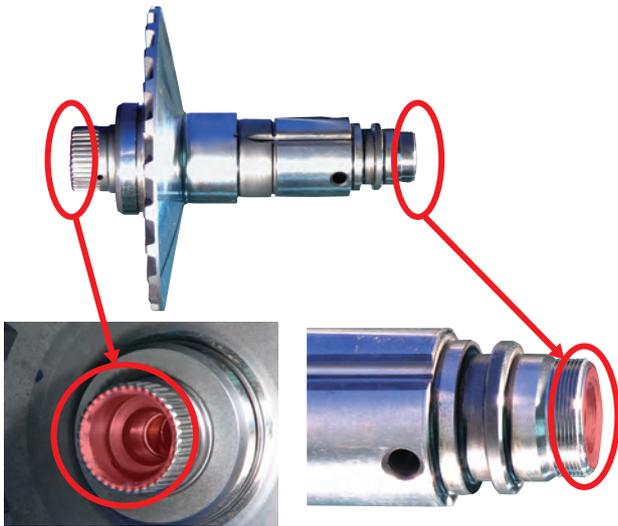


Work material : SCr420H

- Main machining**
- ① External turning
 - ② Sheave surface
 - ③ Boring

- Machining methods**
- Turning
 - Milling
 - Drilling
 - Boring

OP.1 (Milling of both end faces) For machining centres



ASX400R635S32
SOMT12T308PEER-JM VP15TF

Tool features

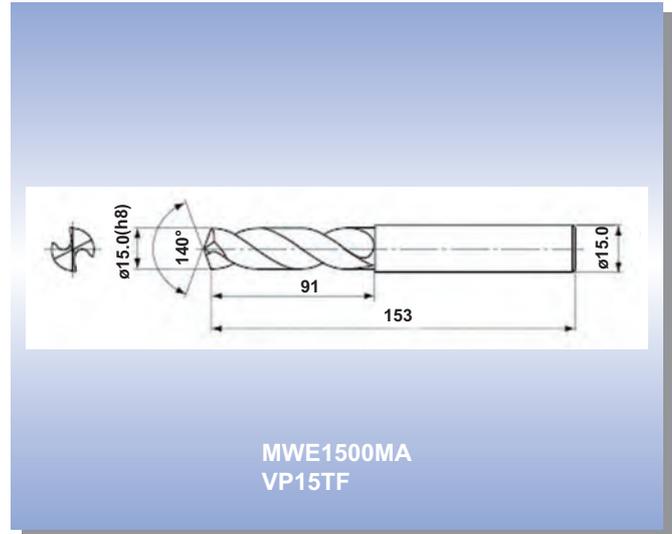
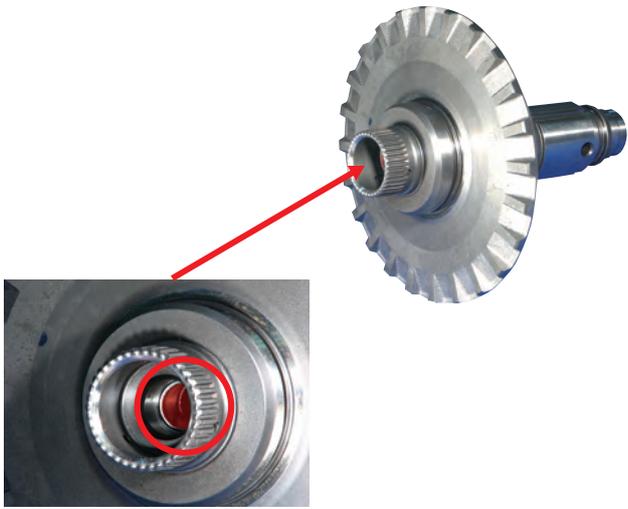
Standard ASX400 type cutter with VP15TF inserts. The body is made from a special alloy steel that provides high heat resistance and excellent durability. Use of screw-on type inserts for easy and high accuracy clamping. Use of a general-purpose JM breaker.

Cutting conditions

$vc=150\text{m/min}$ $n=758\text{min}^{-1}$ $fz=0.20\text{mm/tooth}$
 $vf=606\text{mm/min}$ $ap=1\text{mm}$ Wet

OP.2 (Drilling of the FR hole)

For machining centres



Tool features

Standard WSTAR drill.
Use of a wavy cutting edge and special flute geometry with superior chip disposal properties reduces the cutting resistance. High precision, stable machining.

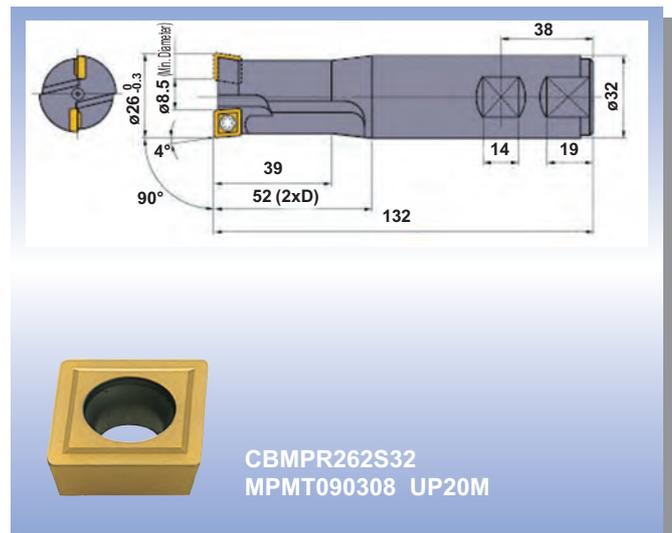
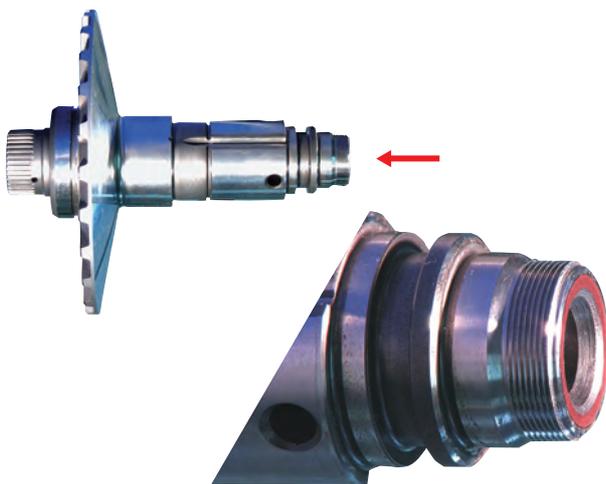
Cutting conditions

$vc=120\text{m/min}$ $n=2,548\text{min}^{-1}$ $fr=0.13\text{mm/rev}$
 $vf=331\text{m/min}$ $ld=34\text{mm}$ Wet

Tooling Sheet 2

OP.3 (Spot facing of the RR side)

For machining centres



Tool features

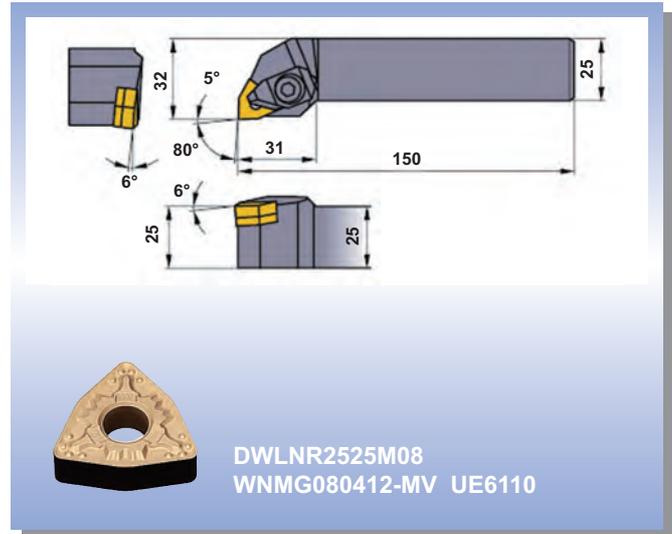
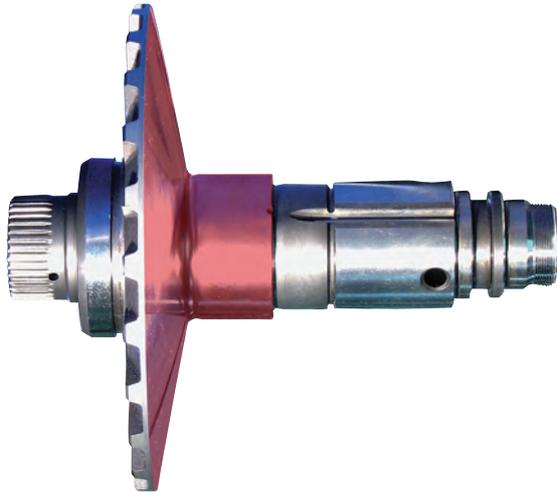
Standard CBMPR type cutter with UP20 inserts.
Good chip control and high cutting edge strength.

Cutting conditions

$vc=100\text{m/min}$ $n=1,224\text{min}^{-1}$ $fr=0.05\text{mm/rev}$
 $vf=122\text{mm/min}$ $ld=3\text{mm}$ Wet

Tooling Sheet 3

OP.4 (Rough turning of the outer diameter and sheave surface) For CNC lathes



Tool features

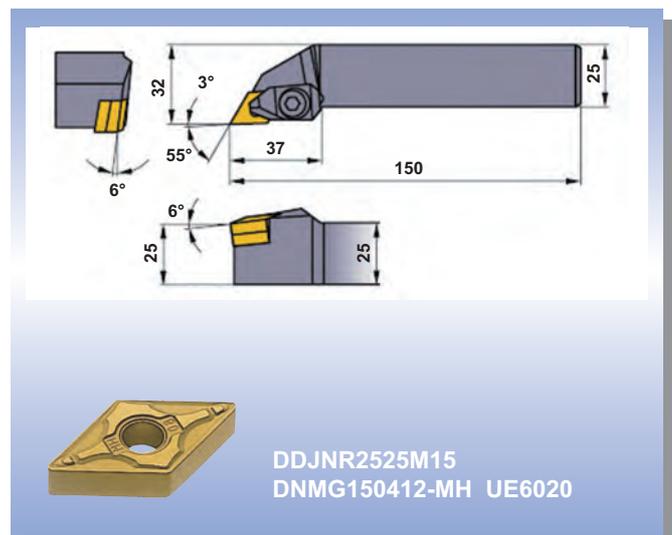
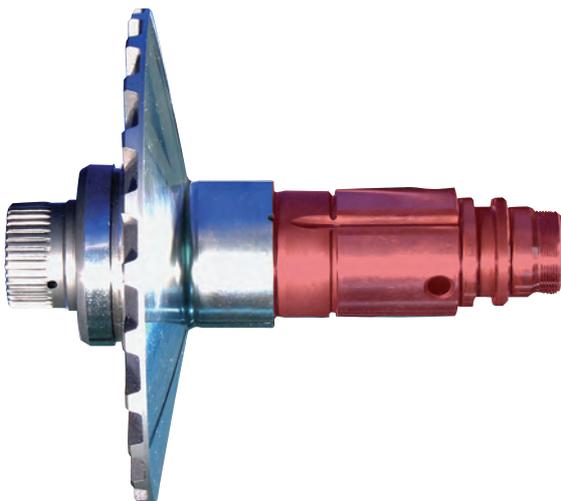
Standard holder with UE6110 inserts.
The UE6110 steel turning grade with a nano-texture coating provides excellent balance of wear and fracture resistance. The MV breaker gives effective chip control in the light to medium cutting application areas.

Cutting conditions

$vc=194\sim 275\text{m/min}$ $n=500\sim 1,000\text{min}^{-1}$ $fr=0.55\text{mm/rev}$
 $ap=1.5\text{mm}$ Wet

Tooling Sheet 4

OP.5 (Rough external turning of the shaft) For CNC lathes



Tool features

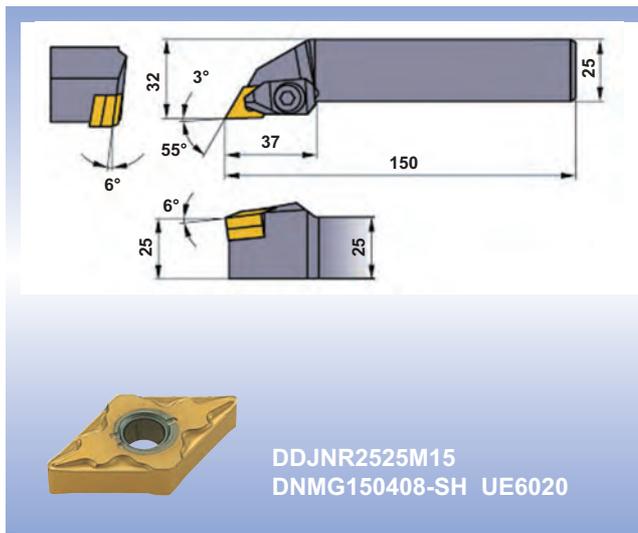
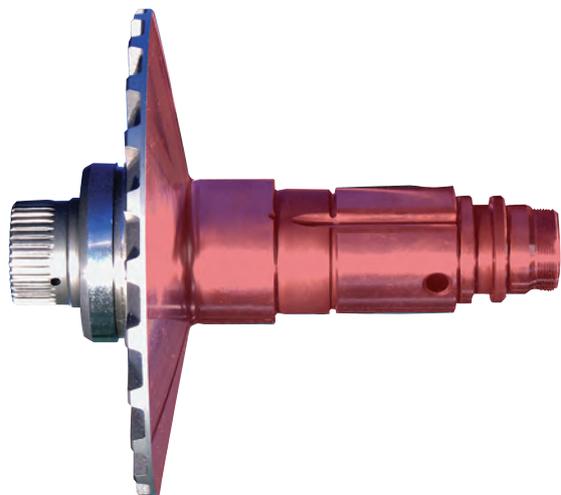
Standard holder with UE6020 inserts.
The highly reliable UE6020 grade employs Even Coating Technology to deliver higher welding and fracture resistance. The MH breaker with a flat land gives high cutting edge strength, ensuring high stability during interrupted machining.

Cutting conditions

$vc=148\sim 240\text{m/min}$ $n=1,450\text{min}^{-1}$ $fr=0.35\text{mm/rev}$
 $ap=1.5\text{mm}$ Wet

Tooling Sheet 5

OP.6 (Semi-finishing the shaft and finishing the sheave surface) For CNC lathes



Tool features

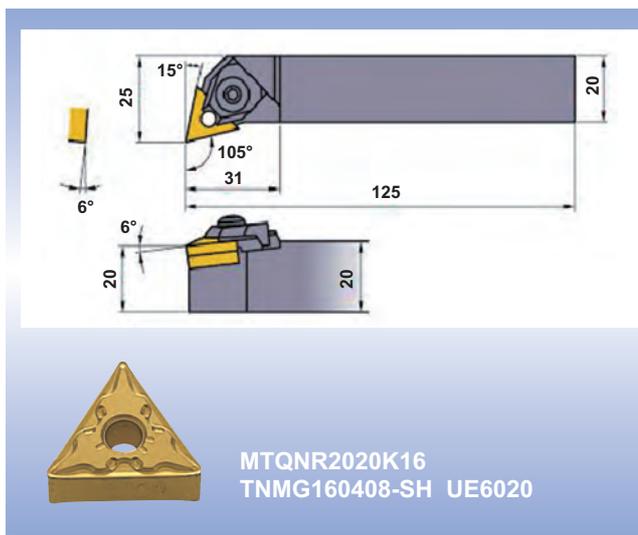
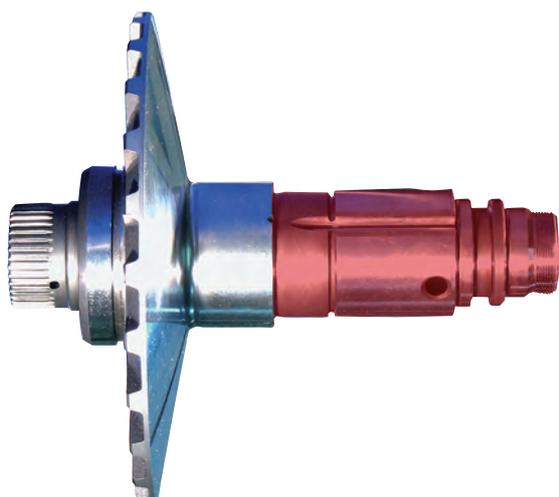
Standard holder with UE6020 inserts. The highly reliable UE6020 grade employs Even Coating Technology to deliver higher welding and fracture resistance. The SH breaker featuring the curved edge gives sharp cutting action.

Cutting conditions

$vc=250\text{m/min}$ $fr=0.35\text{mm/rev}$ $ap=0.4\text{mm}$ Wet

Tooling Sheet 6

OP.7 (Finishing of the shaft outer diameter) For CNC lathes



Tool features

Standard holder with UE6020 inserts. The highly reliable UE6020 grade employs Even Coating Technology to deliver higher welding and fracture resistance. The SH breaker featuring the curved edge gives sharp cutting action.

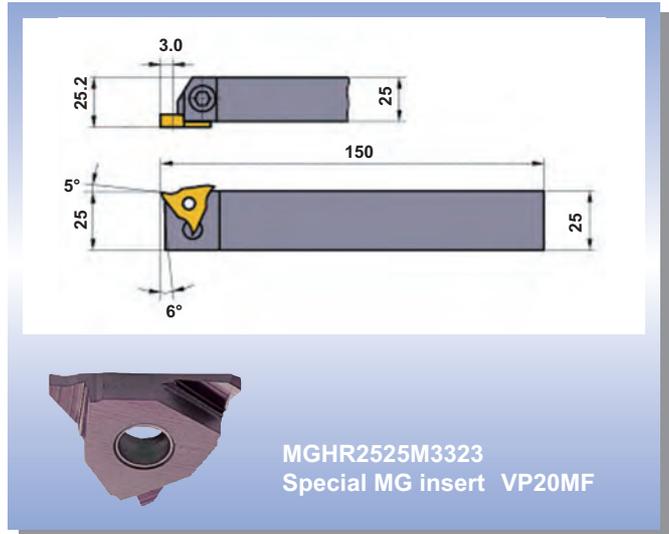
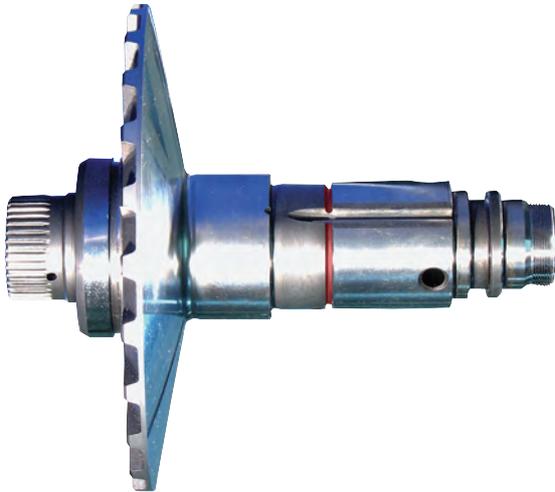
Cutting conditions

$vc=204\sim 332\text{m/min}$ $n=2,000\text{min}^{-1}$ $fr=0.35\text{mm/rev}$ $ap=0.4\text{mm}$ Wet

Tooling Sheet 7

OP.8 (Snap ring groove)

For CNC lathes



Tool features

Standard holder with special VP20MF inserts. The VP20MF grade uses a micro-grain cemented carbide substrate. Superior wear and fracture resistance and long tool life.

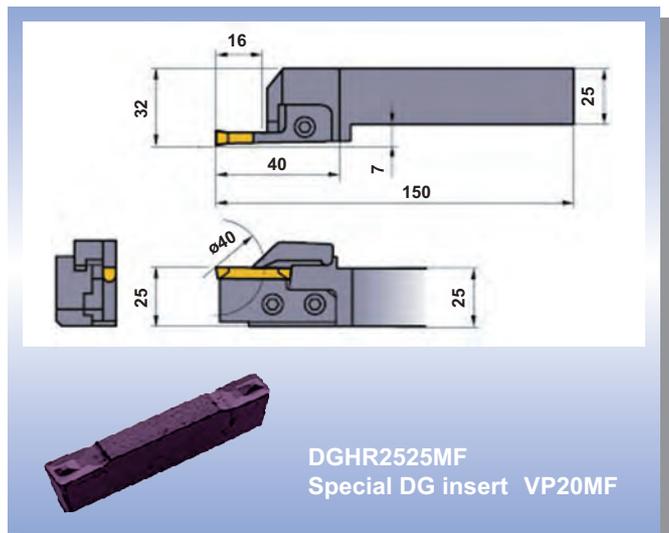
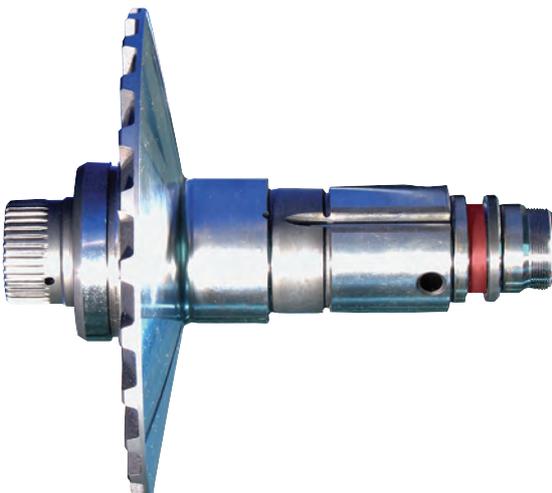
Cutting conditions

vc=145~130m/min fr=0.1mm/rev ap=2.2mm W=1.73mm
Wet

Tooling Sheet 8

OP.9 (C-ring groove)

For CNC lathes



Tool features

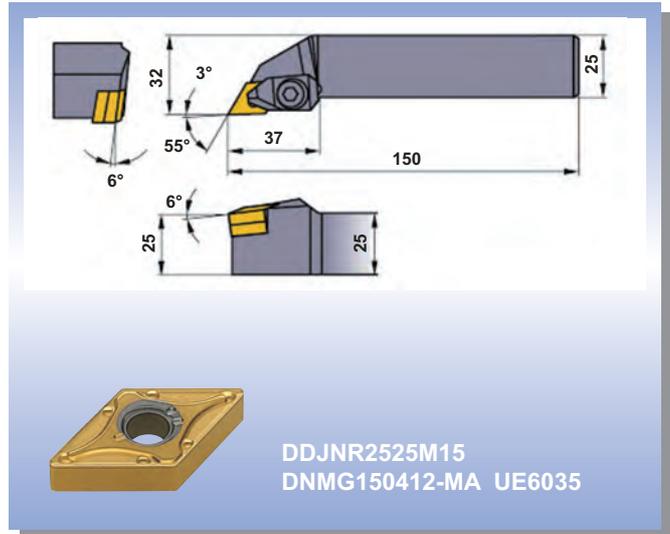
Standard holder with special VP20MF inserts. The VP20MF grade uses a micro-grain cemented carbide substrate. Superior wear and fracture resistance and long tool life.

Cutting conditions

vc=79~65m/min fr=0.13mm/rev ap=3.7mm W=5.27mm
Wet

Tooling Sheet 9

OP.10 (Roughing of the sensor end face) For CNC lathes



Tool features

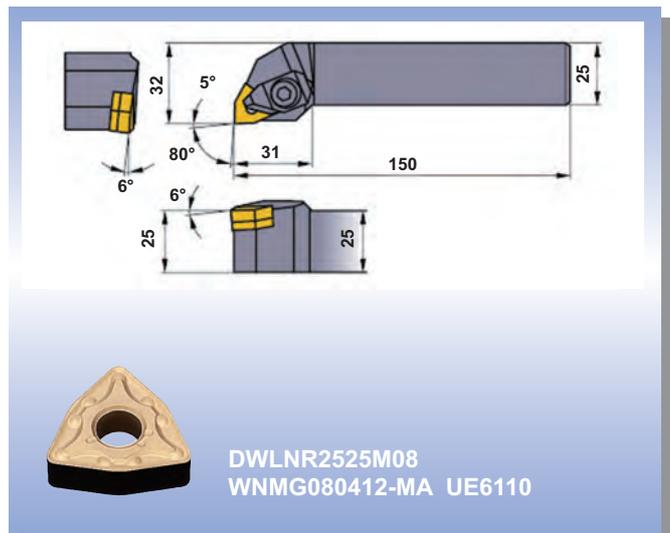
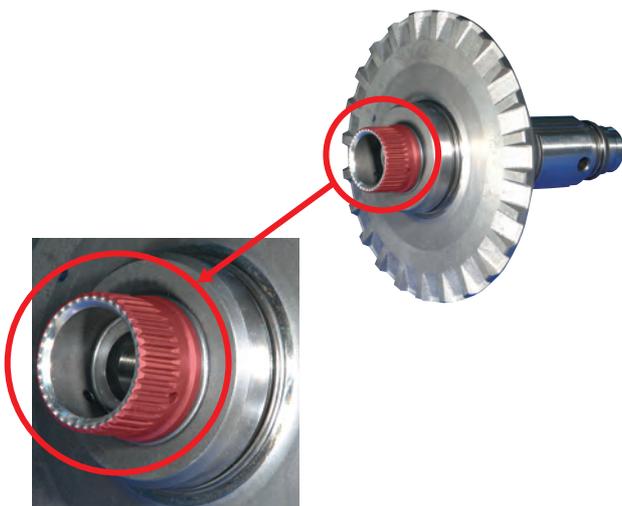
Standard holder with UE6035 inserts.
The UE6035 grade ensures higher fracture resistance during interrupted machining.
General-purpose MA breaker.

Cutting conditions

vc=160m/min fr=0.2mm/rev ap=1.1mm Wet

Tooling Sheet 10

OP.11 (Rough external turning and facing of the spline shaft) For CNC lathes



Tool features

Standard holder with UE6110 inserts.
The UE6110 steel turning grade with a nano-texture coating provides excellent balance of wear and fracture resistance.
General-purpose MA breaker.

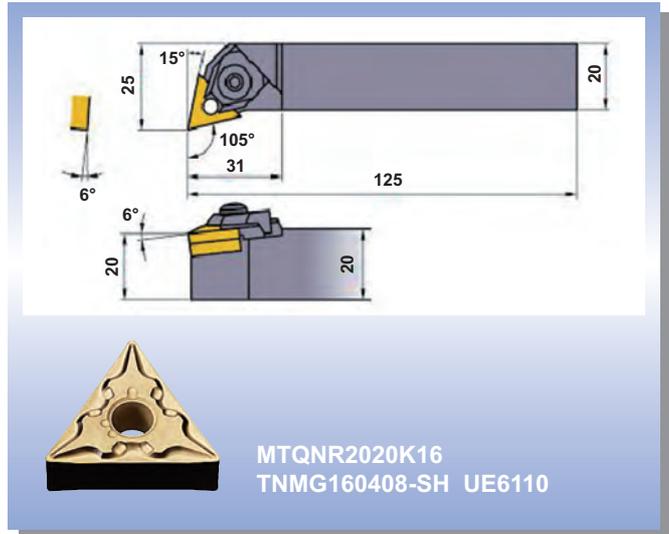
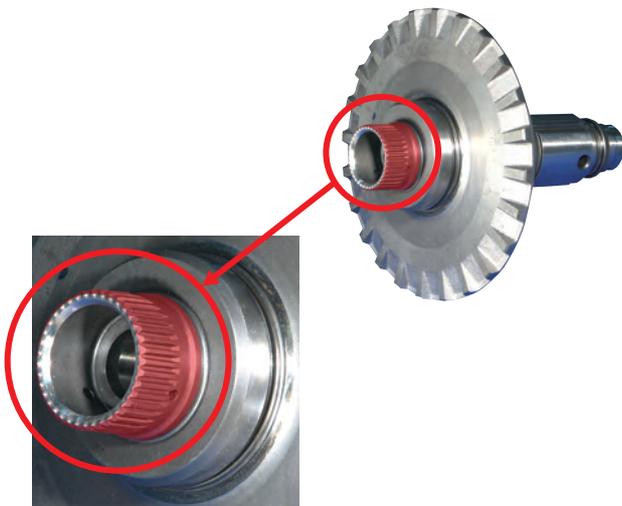
Cutting conditions

vc=140m/min fr=0.55mm/rev ap=0.9mm Wet

Tooling Sheet 11

OP.12 (Finish external turning and facing of the spline shaft)

For CNC lathes



Tool features

Standard holder with UE6110 inserts.
The UE6110 steel turning grade with a nano-texture coating provides excellent balance of wear and fracture resistance. The SH breaker featuring the curved edge gives sharp cutting action.

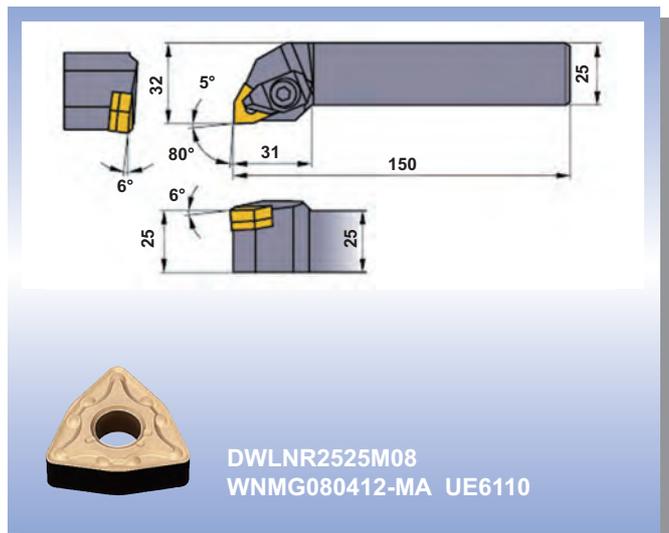
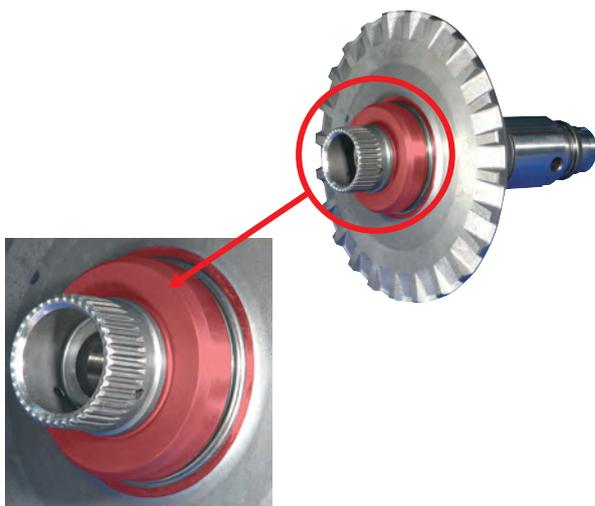
Cutting conditions

$n=2,000\text{m}/\text{min}^{-1}$ $fr=0.2\text{mm}/\text{rev}$ $ap=0.8\text{mm}$ Wet

Tooling Sheet 12

OP.13 (Rough external turning and facing)

For CNC lathes



Tool features

Standard holder with UE6110 inserts.
The UE6110 steel turning grade with a nano-texture coating provides excellent balance of wear and fracture resistance. General-purpose MA breaker.

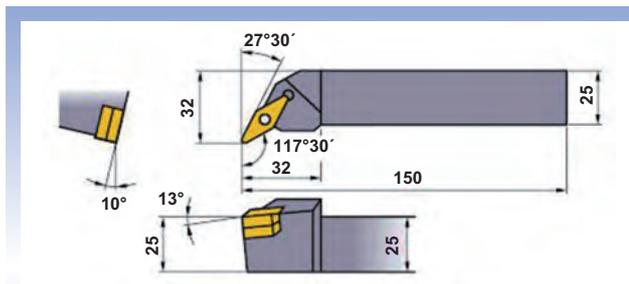
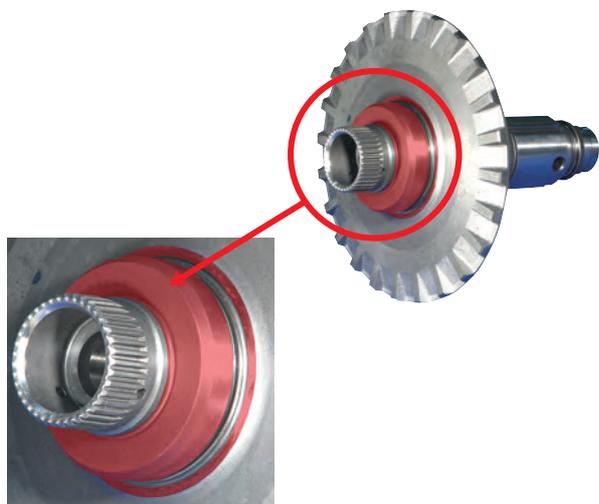
Cutting conditions

$vc=300\text{m}/\text{min}$ $fr=0.26\text{mm}/\text{rev}$ $ap=2.2\text{mm}$ Wet

Tooling Sheet 13

OP.14 (Finish external turning and facing)

For CNC lathes



PVPCR2525M16
VNMG160408-MA UE6110

Tool features

Standard holder with UE6110 inserts.
The UE6110 steel turning grade with a nano-texture coating provides excellent balance of wear and fracture resistance. General-purpose MA breaker.

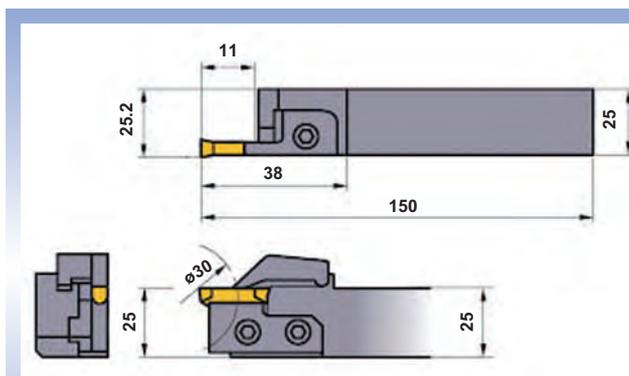
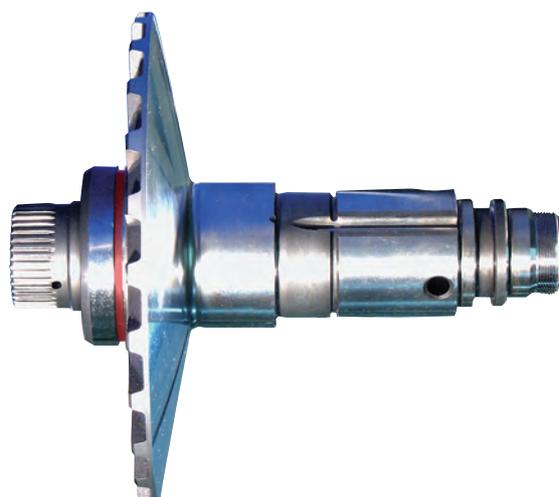
Cutting conditions

$n=2,000\text{min}^{-1}$ $fr=0.2\text{mm/rev}$ $ap=0.25\text{mm}$ Wet

Tooling Sheet 14

OP.15 (Circlip groove)

For CNC lathes



DGHR2525M (B3307R)
Special DG insert VP20MF

Tool features

Standard holder with special VP20MF inserts. The VP20MF grade uses a micro-grain cemented carbide substrate. Superior wear and fracture resistance and long tool life.

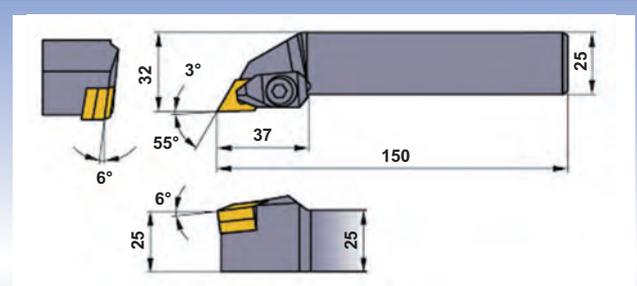
Cutting conditions

$vc=205\sim 191\text{m/min}$ $n=1,000\text{min}^{-1}$ $fr=0.1\text{mm/rev}$
 $ap=1.9\text{mm}$ Wet

Tooling Sheet 15

OP.16 (Finish facing of the sensor)

For CNC lathes



DDJNR2525M15
DNMG150412-MV UE6110

Tool features

Standard holder with UE6110 inserts.
The UE6110 steel turning grade with a nano-texture coating provides excellent balance of wear and fracture resistance. The MV breaker gives effective chip control in the light to medium cutting application areas.

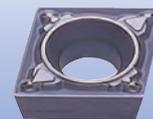
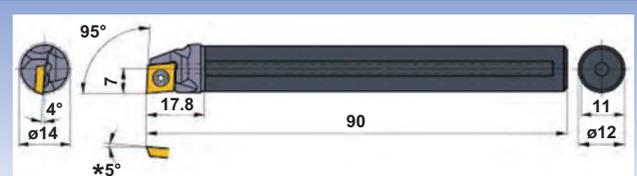
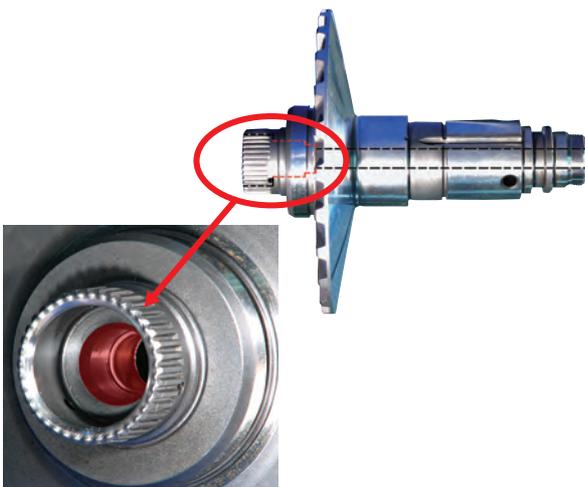
Cutting conditions

$vc=280\text{m/min}$ $fr=0.15\text{mm/rev}$ $ap=0.4\text{mm}$ Wet

Tooling Sheet 16

OP.17 (Semi-finishing of the bush press-fit diameter)

For CNC lathes



FSCLP1412R-08E-1/2
CPMH080204-MV VP15TF

Tool features

Standard boring bar with VP15TF inserts.
The VP15TF uses a micro-grain cemented carbide substrate. Excellent balance of wear and fracture resistance. The MV breaker gives effective chip control in the light to medium cutting application areas.

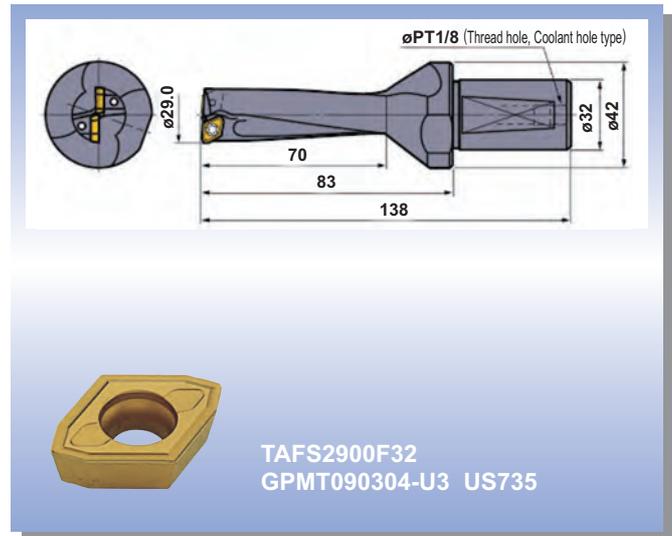
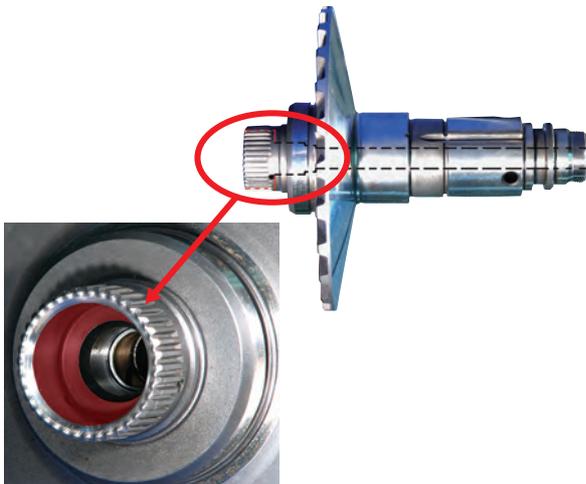
Cutting conditions

$n=2,000\text{min}^{-1}$ $fr=0.24\text{mm/rev}$ $ap=0.6\text{mm}$ Wet

Tooling Sheet 17

OP.18 (Rough boring)

For CNC lathes



Tool features

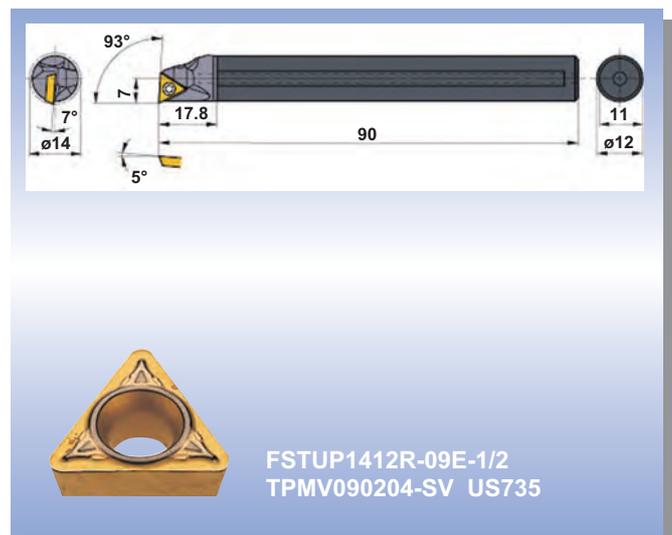
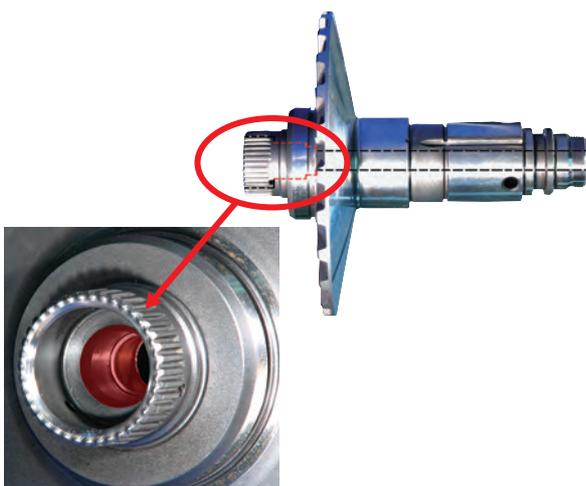
Standard TAF drill with US735 inserts.
Highly durable body with high insert seat rigidity.
Economical 4 cutting edge type inserts.

Cutting conditions

$vc=123\text{m/min}$ $n=1,350\text{min}^{-1}$ $fr=0.15\text{mm/rev}$ $ld=19.5\text{mm}$
Wet

Tooling Sheet 18

OP.19 (Finishing of the bush press-fit diameter) For CNC lathes



Tool features

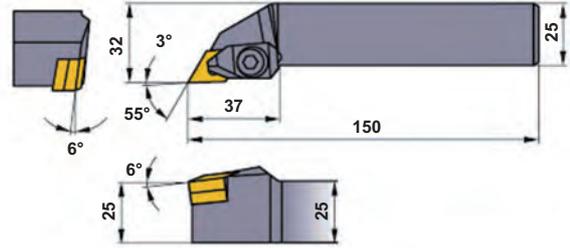
Standard boring bar with US735 inserts.
US735 with high welding resistance helps prevent abnormal wear at medium to low speed, interrupted cutting.
Use of the finishing type SV breaker.

Cutting conditions

$vc=155\text{m/min}$ $fr=0.3\text{mm/rev}$ $ap=0.17\text{mm}$
Wet

Tooling Sheet 19

OP.20 (Finishing of the sensor surface) For CNC lathes



DDJNR2525M15
DNMG150412-MH UE6020

Tool features

Standard holder with UE6020 inserts.
The highly reliable UE6020 grade employs Even Coating Technology to deliver higher welding and fracture resistance.
Use of the MH breaker with a tougher cutting edge.

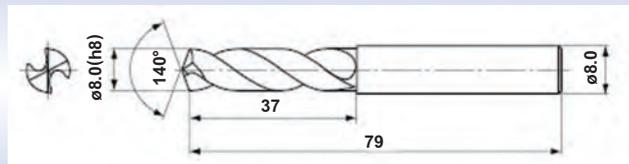
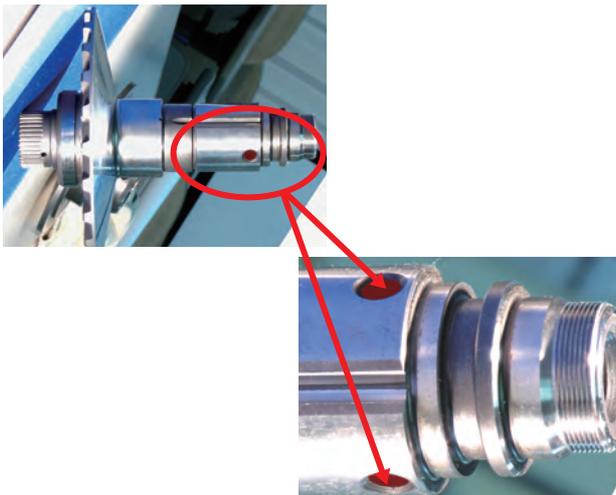
Cutting conditions

$vc=280\text{m/min}$ $fr=0.15\text{mm/rev}$ $ap=0.4\text{mm}$ Wet

Tooling Sheet 20

OP.21 (Slide circuit holes)

For machining centres



MWE0800SA
VP15TF

Tool features

Standard WSTAR drill.
The use of a wavy cutting edge and special flute geometry with superior chip disposal reduces the cutting resistance.
High precision, stable machining.

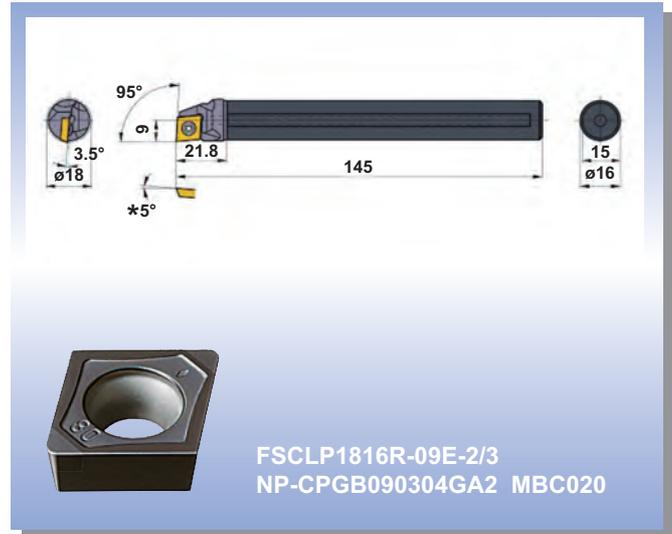
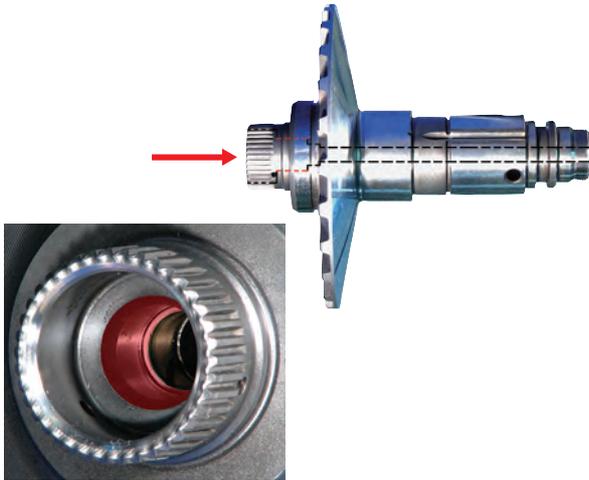
Cutting conditions

$vc=150\text{m/min}$ $n=6,000\text{min}^{-1}$ $fr=0.24\text{mm/rev}$ $vf=1440\text{mm/min}$ Wet

Tooling Sheet 21

OP.22 (Boring).....After heat treating

For CNC lathes



Tool features

Standard boring bar with MBC020 inserts. MBC020 is a MIRACLE coated CBN grade. The combination of a high rigidity CBN substrate with a coating for higher wear resistance allows MBC020 to cover a wide range of machining applications.

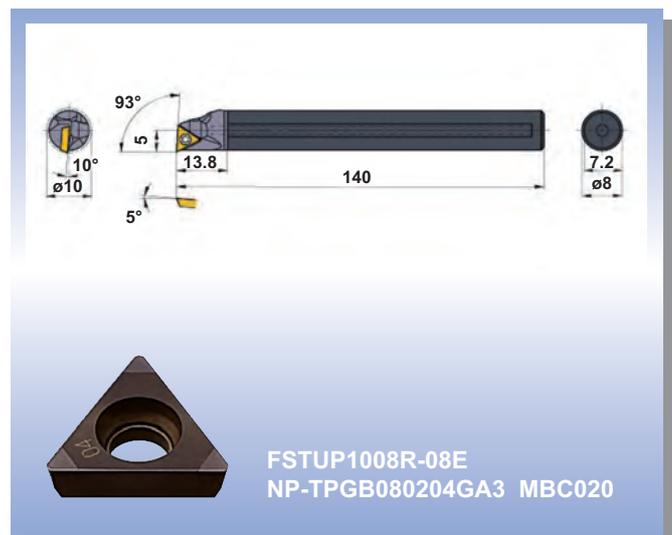
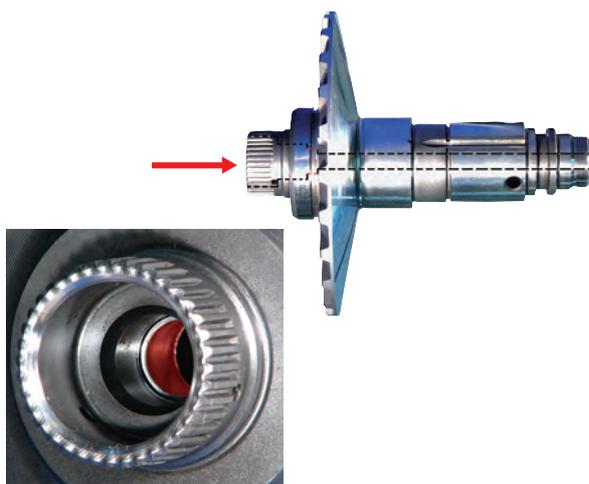
Cutting conditions

vc=150m/min fr=0.08mm/rev ap=0.1mm Wet

Tooling Sheet 22

OP.23 (Boring of the bush).....After heat treating

For CNC lathes



Tool features

Standard boring bar with MBC020 inserts. MBC020 is a MIRACLE coated CBN grade. The combination of a high rigidity CBN substrate with a coating for higher wear resistance allows MBC020 to cover a wide range of machining applications. Use of the optimum GA type honing.

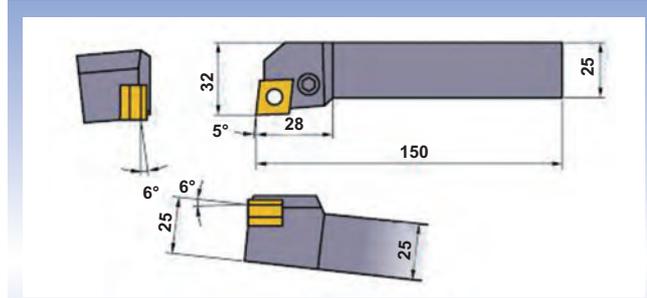
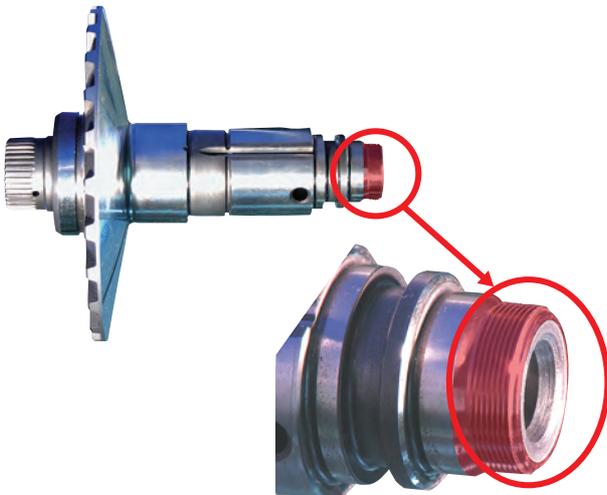
Cutting conditions

vc=120m/min fr=0.06mm/rev ap=0.25mm Wet

Tooling Sheet 23

OP.24 (Removal of excess material for the thread)After heat treatment

For CNC lathes



PCLNR2525M12
NP-CNGA120408GA4 MBC020

Tool features

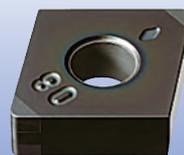
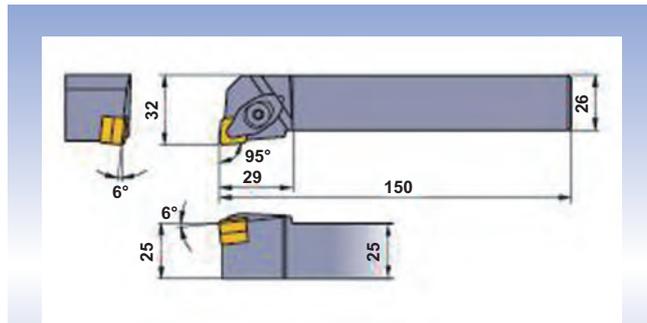
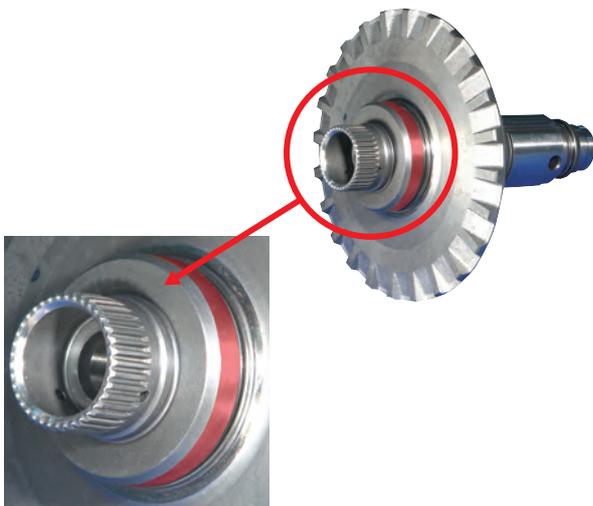
Standard holder with MBC020 inserts. MBC020 is a MIRACLE coated CBN grade. The combination of a high rigidity CBN substrate with a coating for higher wear resistance allows MBC020 to cover a wide range of machining applications. Use of cost effective, double sided, multi-corner type inserts.

Cutting conditions

vc=120m/min f=0.15mm/rev ap=1.0mm Wet

Tooling Sheet 24

OP.25 (Finishing the press-fit diameter).....After heat treatment **For CNC lathes**



DCLNR2525M12
NP-CNGA120404GAW4 MBC020

Tool features

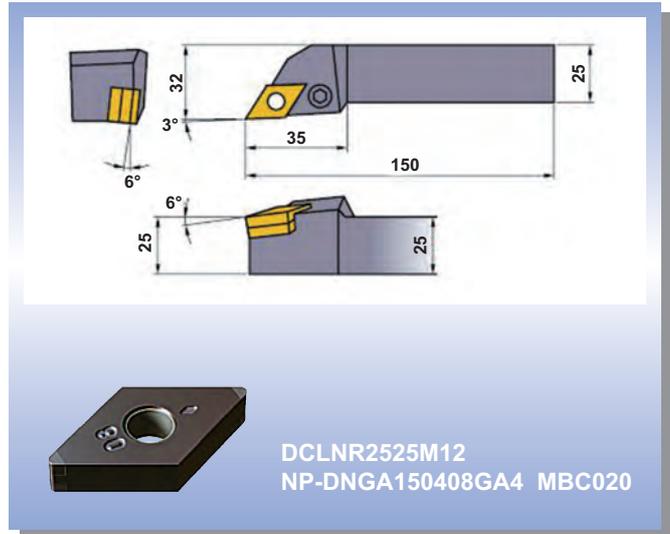
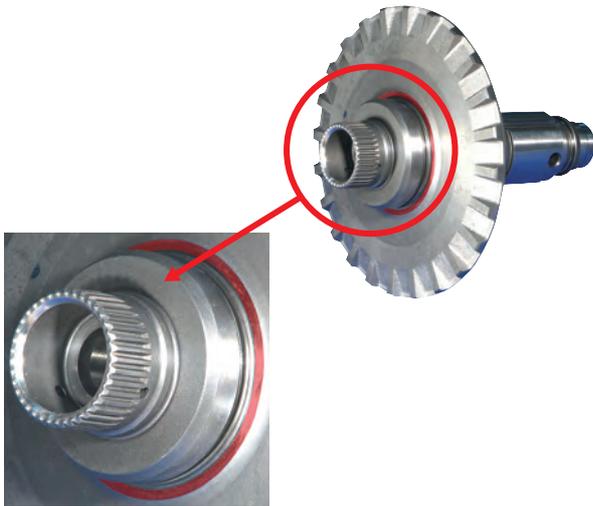
Standard holder with MBC020 inserts. MBC020 is a MIRACLE coated CBN grade. The combination of a high rigidity CBN substrate with a coating for higher wear resistance allows MBC020 to cover a wide range of machining applications. Use of wiper inserts balances high machining efficiency and good surface finishes.

Cutting conditions

vc=150m/min fr=0.25mm/rev ap=0.04mm Wet

Tooling Sheet 25

OP.26 (Finishing the press-fit diameter).....After heat treatment For CNC lathes



Tool features

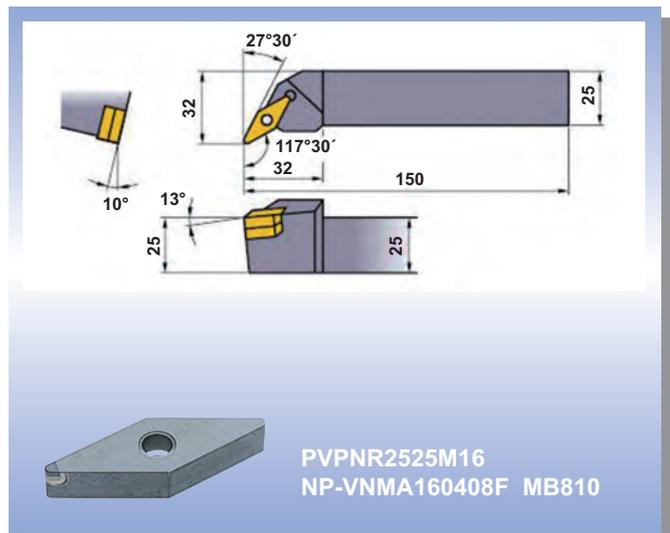
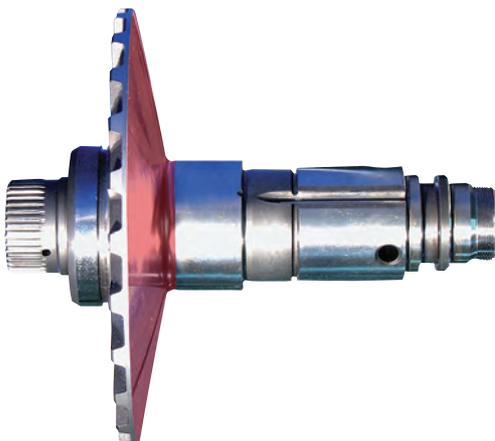
Standard holder with MBC020 inserts.
MBC020 is a MIRACLE coated CBN grade. The combination of a high rigidity CBN substrate with a coating for higher wear resistance allows MBC020 to cover a wide range of machining applications. Use of cost effective, double sided, multi-corner type inserts.

Cutting conditions

vc=130m/min f=0.1mm/rev ap=0.1mm Wet

Tooling Sheet 26

OP.27 (Sheave surface).....After heat treatment For CNC lathes



Tool features

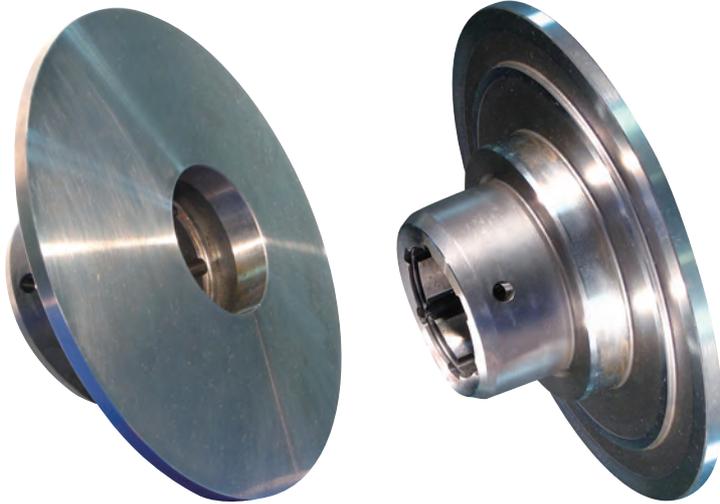
Standard holder with MB810 inserts.
MB810 is a non-coated CBN grade.
High performance grade for high speed continuous machining. Use of the optimum GA type honing.

Cutting conditions

vc=100m/min fr=0.22mm/rev ap=0.05mm Wet

Tooling Sheet 27

CVT pulley Primary SLID

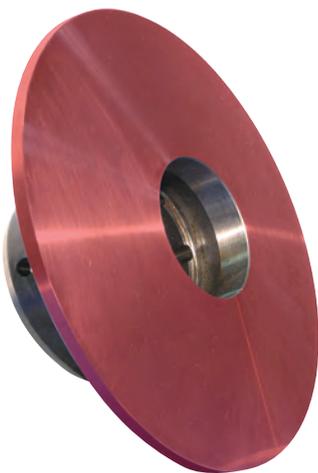


- Main machining**
- ① External turning
 - ② Sheave surface
 - ③ Boring

Machining methods
Turning
Boring

Work material : SCr420H

OP.1 (Rough external turning and facing) For CNC lathes



DWLNR2525M08
WNMG080408-MA UE6110

Tool features

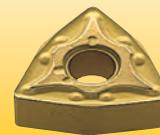
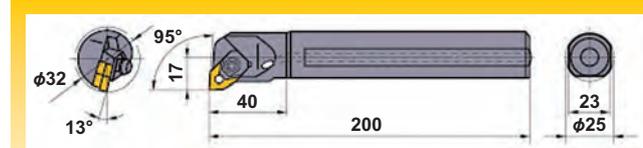
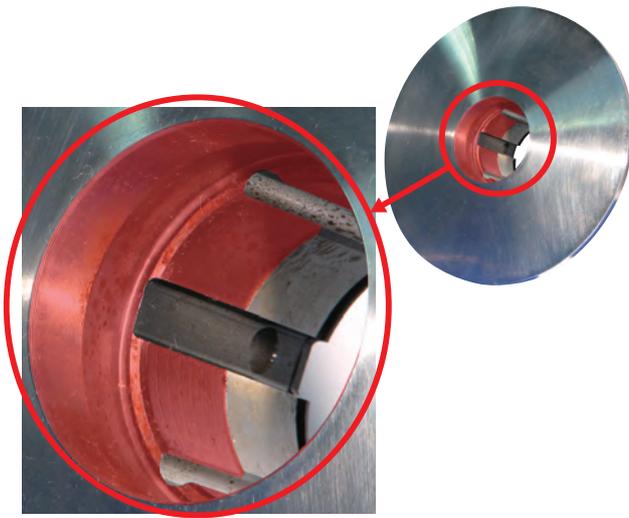
Standard holder with UE6110 inserts.
The UE6110 grade for steel turning uses a nano-texture coating to provide excellent balance of wear and fracture resistance.
General-purpose MA breaker.

Cutting conditions

vc=190m/min fr=0.45mm/rev ap=1mm Wet

OP.2 (Rough boring)

For CNC lathes



A25RMWLN08
WNMG080408-MA UE6020

Tool features

Standard holder with UE6020 inserts.
The UE6020 grade uses Even Coating Technology to provide exceptional welding and fracture resistance with a highly reliable cutting edge.
General-purpose MA breaker.

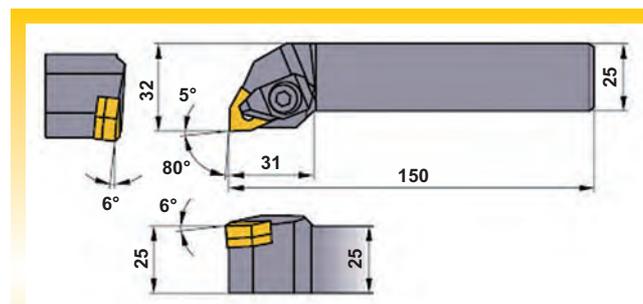
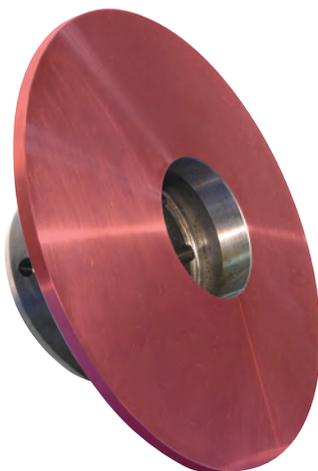
Cutting conditions

vc=180m/min fr=0.45mm/rev ap=1.5mm Wet

Tooling Sheet 2

OP.3 (Finish external turning and facing)

For CNC lathes



DWLNR2525M08
WNMG080408-FY NX3035

Tool features

Standard holder with NX3035 inserts.
NX3035 is a cermet grade with highly improved thermal shock resistance. Offers highly stable cutting edge performance even during wet cutting conditions that usually cause instability in conventional grades.
Finishing type FV breaker.

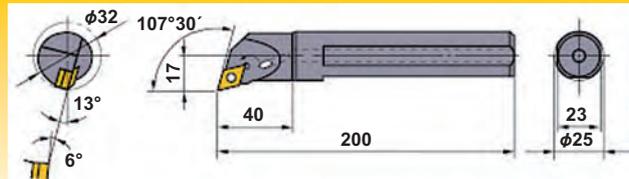
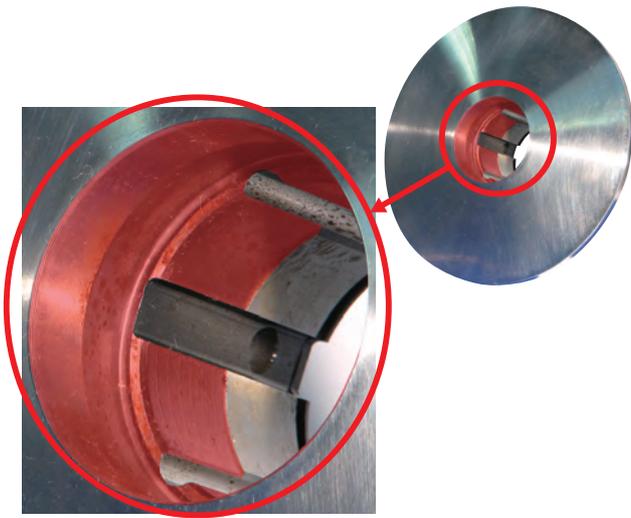
Cutting conditions

vc=280m/min fr=0.45mm/rev ap=0.5mm Wet

Tooling Sheet 3

OP.4 (Finish boring)

For CNC lathes



A25RPDQNR15
DNMG150408-FY NX3035

Tool features

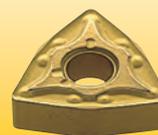
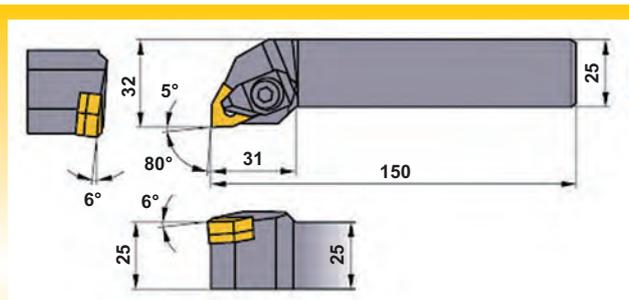
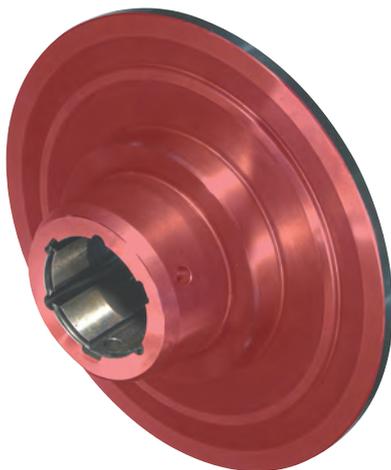
Standard holder with NX3035 inserts.
NX3035 is a cermet grade with highly improved thermal shock resistance. Offers highly stable cutting edge performance even during wet cutting conditions that usually cause instability in conventional grades.
Finishing type FV breaker.

Cutting conditions

vc=220m/min fr=0.35mm/rev ap=0.4mm Wet

Tooling Sheet 4

OP.5 (Rough external turning and facing) For CNC lathes



DWLNR2525M08
WNMG080408-MA UE6020

Tool features

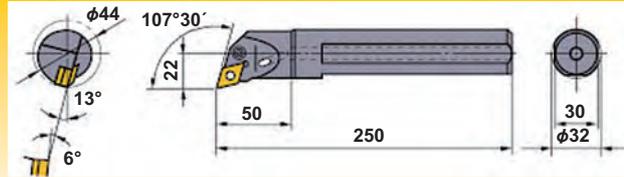
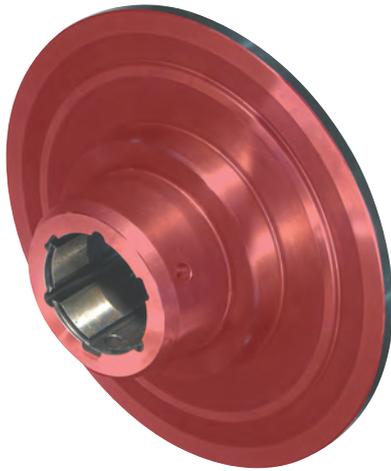
Standard holder with UE6020 inserts.
The UE6020 grade uses Even Coating Technology to provide exceptional welding and fracture resistance with a highly reliable cutting edge.
General-purpose MA breaker.

Cutting conditions

vc=180m/min fr=0.5mm/rev ap=1mm Wet

Tooling Sheet 5

OP.6 (Finish external turning and facing) For CNC lathes



A32SPDUNR15
DNMG150408-MV UE6110

Tool features

Standard holder with UE6110 inserts.
The UE6110 steel turning grade with a nano-texture coating provides excellent balance of wear and fracture resistance. The MV breaker gives effective chip control in the light to medium cutting application areas.

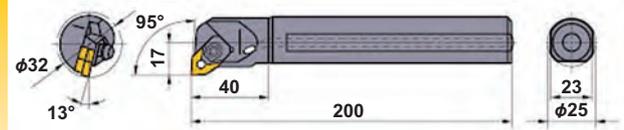
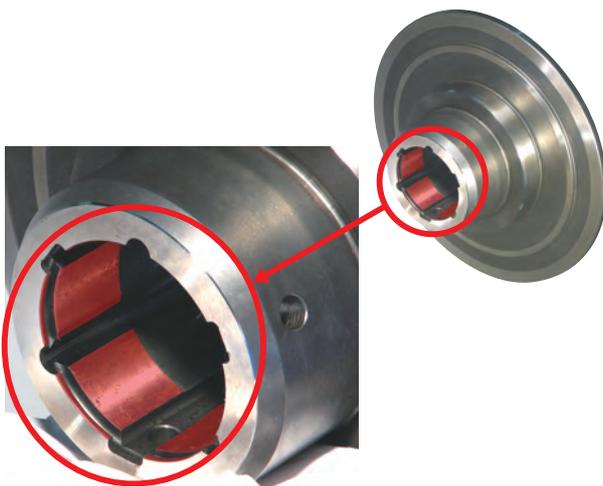
Cutting conditions

vc=320m/min fr=0.35mm/rev ap=0.5mm Wet

Tooling Sheet 6

OP.7 (Finish boring)

For CNC lathes



A25RMWLN R08
WNMG080408-FY NX3035

Tool features

Standard holder with NX3035 inserts.
NX3035 is a cermet grade with highly improved thermal shock resistance. Offers highly stable cutting edge performance even during wet cutting conditions that usually cause instability in conventional grades. Finishing type FV breaker.

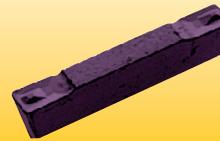
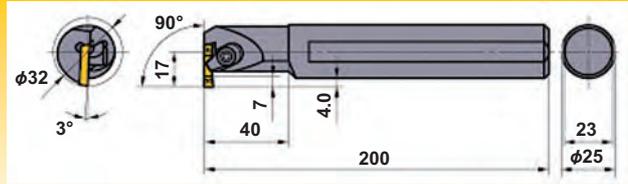
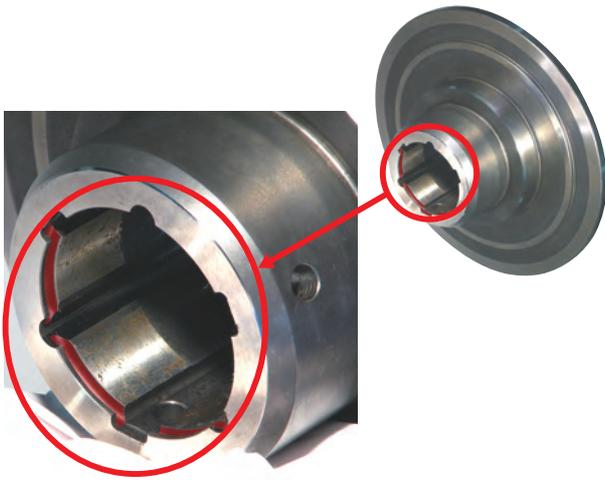
Cutting conditions

vc=250m/min fr=0.2mm/rev ap=0.2mm Wet

Tooling Sheet 7

OP.8 (Internal grooving)

For CNC lathes



FCDG4125R3M
Special DG insert VP20MF

Tool features

Standard holder with special VP20MF inserts.
The VP20MF grade uses a micro-grain cemented carbide substrate. Superior wear and fracture resistance and long tool life.

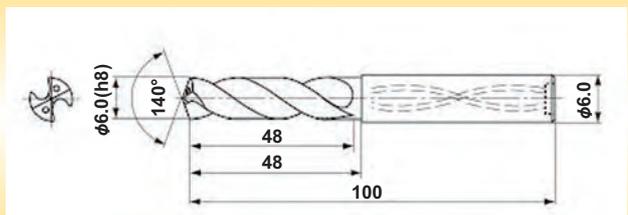
Cutting conditions

vc=150m/min fr=0.1mm/rev ap=1mm W=1.75mm
Wet

Tooling Sheet 8

OP.9 (Oil holes)

For machining centres



MWS0600LB
VP15TF

Tool features

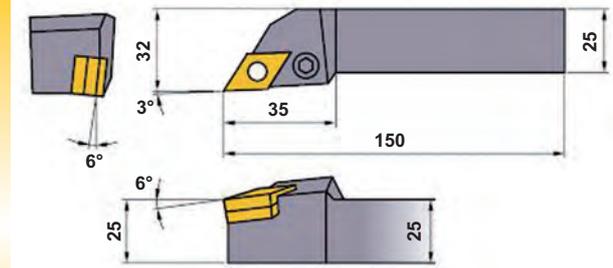
Standard holder with special VP20MF inserts.
The VP20MF grade uses a micro-grain cemented carbide substrate. Superior wear and fracture resistance and long tool life.

Cutting conditions

vc=150m/min n=7,960min⁻¹ fr=0.2mm/rev vf=1,600mm/min
Wet

Tooling Sheet 9

OP.10 (Rough external turning and facing).....After heat treatment For CNC lathes



PDJNR2525M15
NP-DNGA150408GA4 MBC020

Tool features

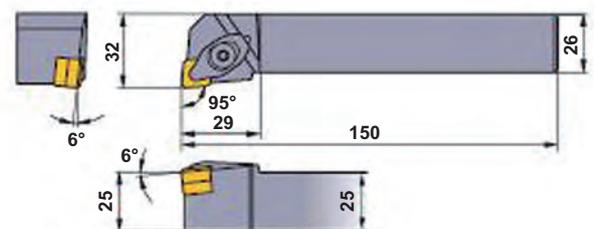
Standard holder with MBC020 inserts.
MBC020 is a MIRACLE coated CBN grade. The combination of a high rigidity CBN substrate with a coating for higher wear resistance allows MBC020 to cover a wide range of machining applications.
Use of cost effective, double sided, multi-corner type inserts.

Cutting conditions

vc=150m/min f=0.22mm/rev ap=0.2mm Wet

Tooling Sheet 10

OP.11 (Finish external turning and facing).....After heat treatment For CNC lathes



DCLNR2525M12
NP-CNGA120404GAW4 MBC020

Tool features

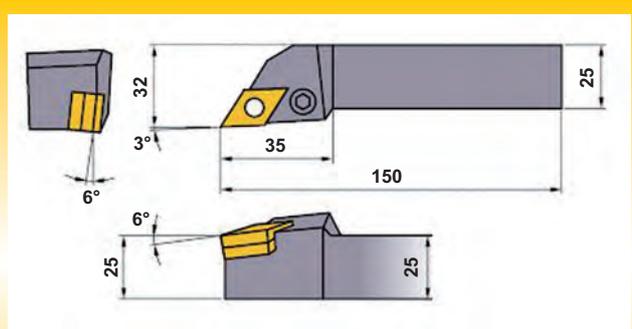
Standard holder with MBC020 inserts.
MBC020 is a MIRACLE coated CBN grade. The combination of a high rigidity CBN substrate with a coating for higher wear resistance allows MBC020 to cover a wide range of machining applications. Use of wiper inserts balances high machining efficiency and good surface finishes.

Cutting conditions

vc=140m/min f=0.2mm/rev ap=0.2mm Wet

Tooling Sheet 11

OP.12 (Sheave surface).....After heat treatment For CNC lathes



PDJNR2525M15
NP-DNGA150408GA4 MBC020

Tool features

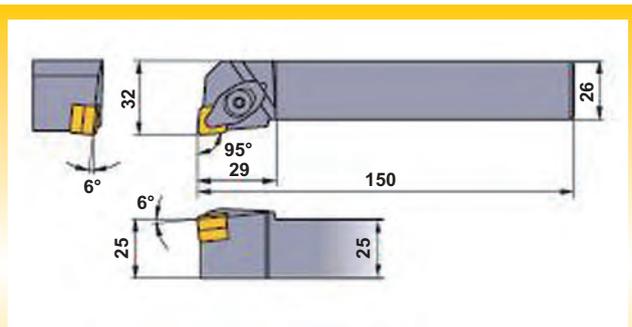
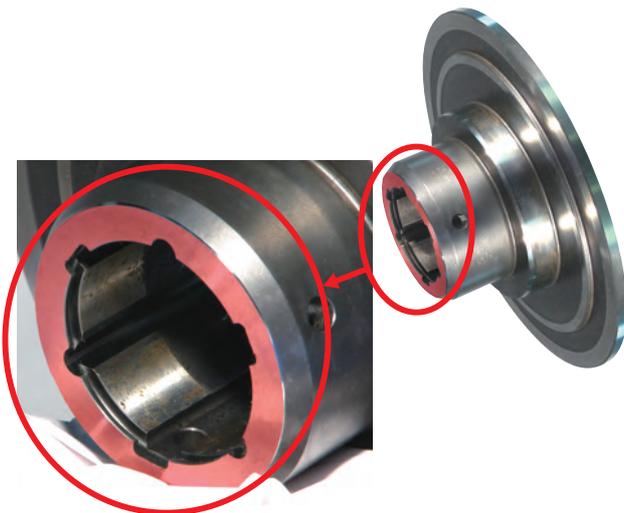
Standard holder with MBC020 inserts.
MBC020 is a MIRACLE coated CBN grade. The combination of a high rigidity CBN substrate with a coating for higher wear resistance allows MBC020 to cover a wide range of machining applications. Use of cost effective, double sided, multi-corner type inserts.

Cutting conditions

vc=150m/min f=0.2mm/rev ap=0.2mm Wet

Tooling Sheet 12

OP.13 (Finishing sensor end face).....After heat treatment For CNC lathes



DCLNR2525M12
NP-CNGA120404GAW4 MBC020

Tool features

Standard holder with MBC020 inserts.
MBC020 is a MIRACLE coated CBN grade. The combination of a high rigidity CBN substrate with a coating for higher wear resistance allows MBC020 to cover a wide range of machining applications. Use of wiper inserts balances high machining efficiency and good surface finishes.

Cutting conditions

vc=150m/min f=0.2mm/rev ap=0.1mm Wet

Tooling Sheet 13

Epicyclic carriers



Work material : S25C

Main machining

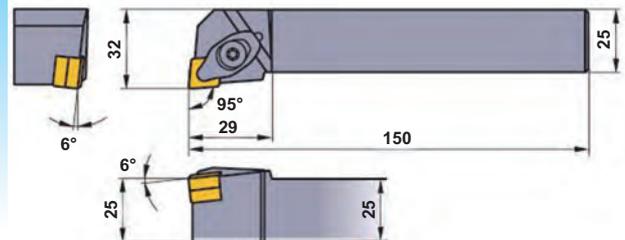
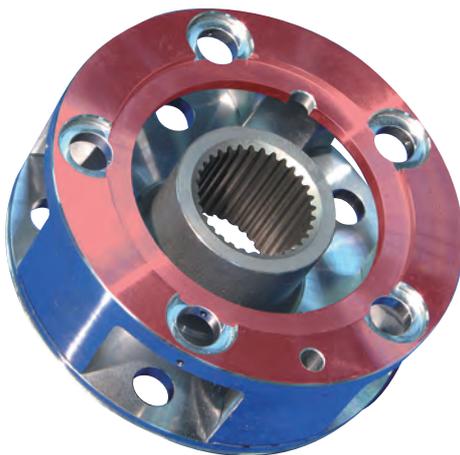
- ① External turning, facing
- ② Boring
- ③ Drilling

Machining methods

Turning
Drilling

OP.1 (Facing)

For machining centres



DCLNR2525M12
CNMG120404-MA US735

Tool features

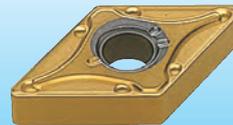
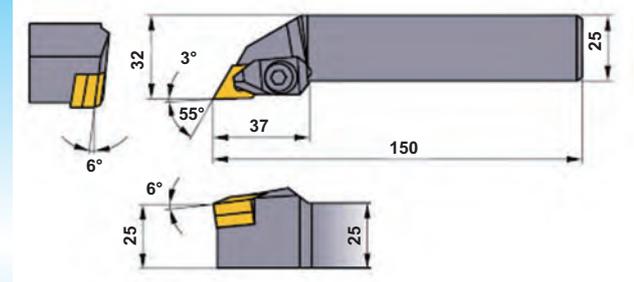
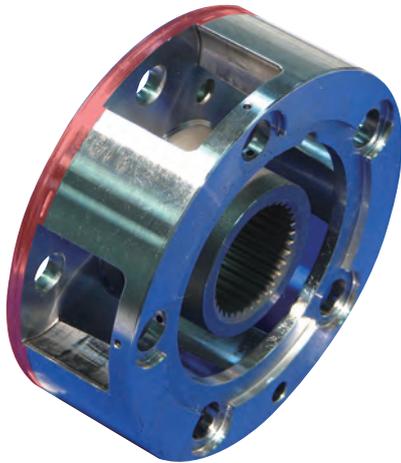
Standard holder with US735 inserts.
The US735 grade helps prevent welding problems during low speed cutting and abnormal wear problems and fracturing of cutting edges at medium to low speed, interrupted cutting.
General-purpose MA breaker.

Cutting conditions

$vc=100\text{m/min}$ $fr=0.2\text{mm/rev}$ $ap=1.2\text{mm}$ Wet

OP.2 (Outer diameter)

For machining centres



DDJNR2525M15
DNMG150408-MA US735

Tool features

Standard holder with US735 inserts.
The US735 grade helps prevent welding problems during low speed cutting and abnormal wear problems and fracturing of cutting edges at medium to low speed, interrupted cutting. General-purpose MA breaker.

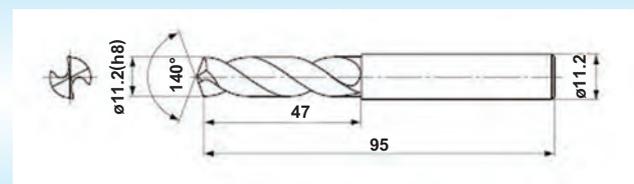
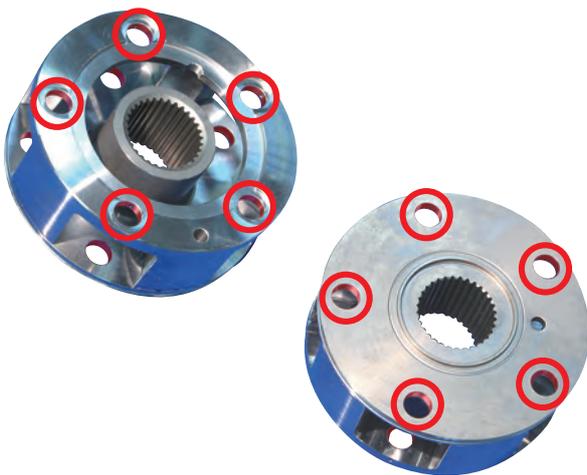
Cutting conditions

$vc=150\text{m/min}$ $fr=0.1\text{mm/rev}$ $ap=1.2\text{mm}$ Wet

Tooling Sheet 2

OP.3 (Pre-drilling of holes)

For machining centres



MWE1120SA
VP15TF

Tool features

Standard WSTAR drill.
Wave cutting edge gives a balance of edge strength and sharpness.
High precision, stable machining.

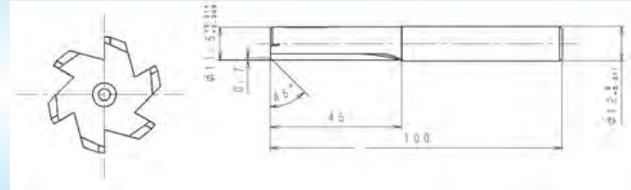
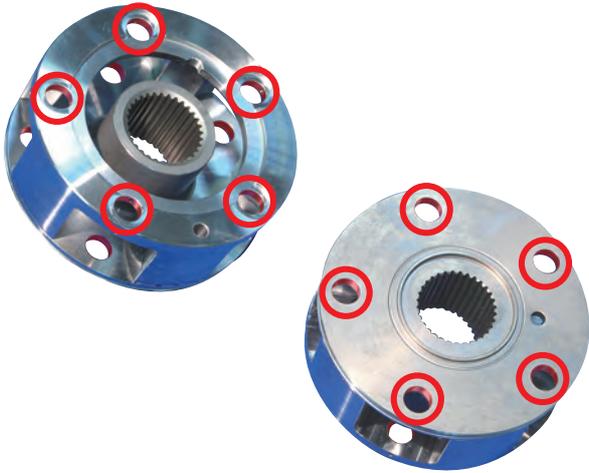
Cutting conditions

$vc=60\text{m/min}$ $n=1,706\text{min}^{-1}$ $fr=0.1\text{mm/rev}$ $vf=170\text{mm/min}$ Wet

Tooling Sheet 3

OP.4 (Finishing of holes)

For machining centres



Carbide reamer
HTi10

Tool features

Special solid carbide reamer in HTi10 grade.
6-flute cutting edge enables high performance machining.
Straight flute for easy re-grinding.

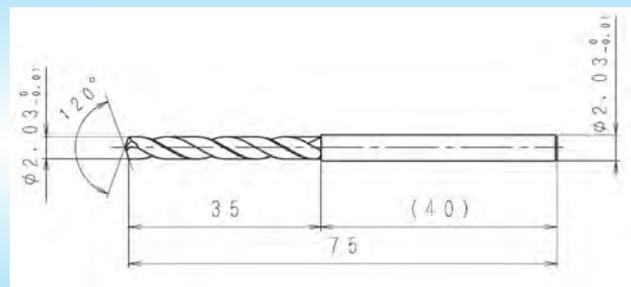
Cutting conditions

vc=40m/min n=1108min⁻¹ vf=220mm/min Wet

Tooling Sheet 4

OP.5 (Drilling of the pin holes)

For machining centres



MZE/MZS drill (Special)
TF15

Tool features

Special MZE / MZS drill with through coolant holes in HTi10 grade. Step drill consolidates processes and reduces machining costs. (Non-coated MZE / MZS offers a sharp cutting edge geometry)

Cutting conditions

vc=30m/min n=4,700min⁻¹ vf=235mm/min Wet

Tooling Sheet 5

Stators



Main machining

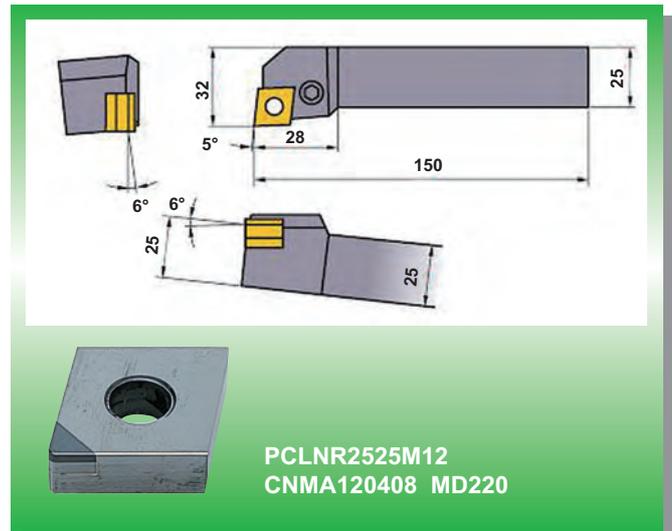
- ① External turning, facing
- ② Boring
- ③ Seat face
- ④ Drilling

Machining methods

- Turning
- Milling
- Drilling

Work material : ADC12

OP.1 (Turning of the outer diameter and facing of the RR side) For machining centres



Tool features

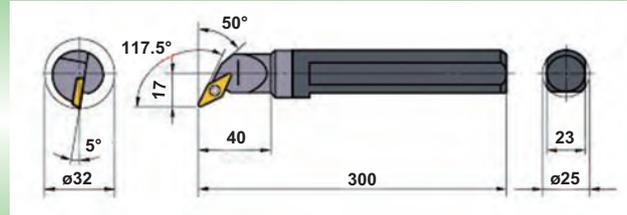
Standard holder with MD220 inserts.
Use of PCD inserts suitable for ultra high-speed machining of aluminum alloys.

Cutting conditions

$vc=1,064m/min$ $fr=0.2mm/rev$ $ap=1.2mm$ Wet

OP.2 (Boring of the inner diameter of the RR side)

For machining centres



C25TSVQCR16
Special VC insert MD220

Tool features

Standard boring bar with special MD220 inserts.
Use of PCD inserts suitable for ultra high-speed machining of aluminum alloys.

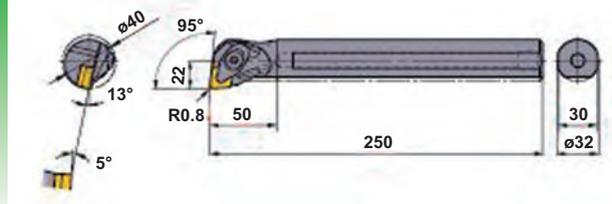
Cutting conditions

vc=405m/min fr=0.2mm/rev ap=1.0mm Wet

Tooling Sheet 2

OP.3 (Boring of the inner diameter and facing of the FR side)

For machining centres



A32S-DCLNR12
CNMA120408 MD220

Tool features

Standard boring bar with special MD220 inserts.
Use of PCD inserts suitable for ultra high-speed machining of aluminum alloys.

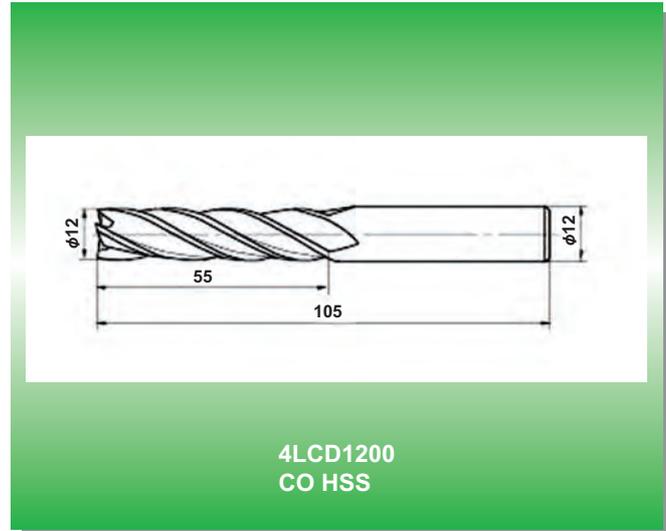
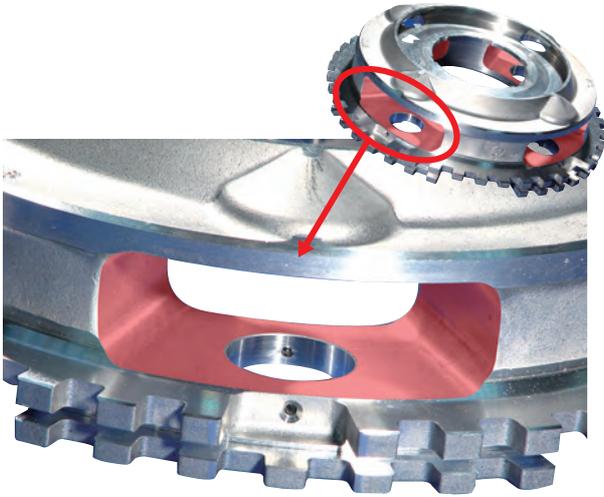
Cutting conditions

vc=561m/min fr=0.17mm/rev ap=1.0mm Wet

Tooling Sheet 3

OP.4 (Pinion seat face)

For machining centres



4LCD1200
CO HSS

Tool features

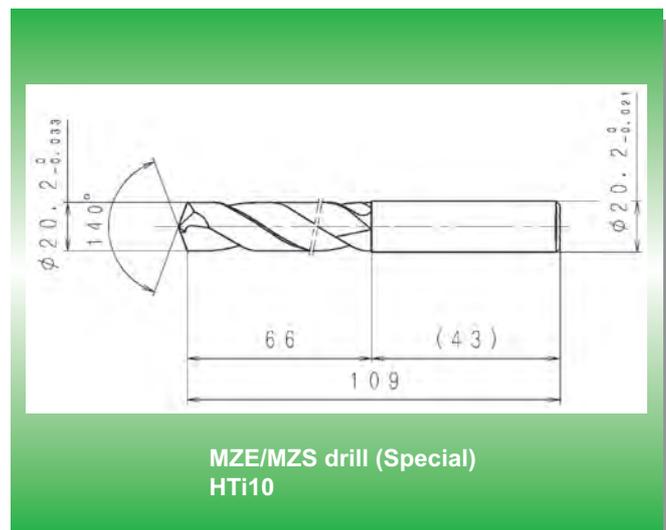
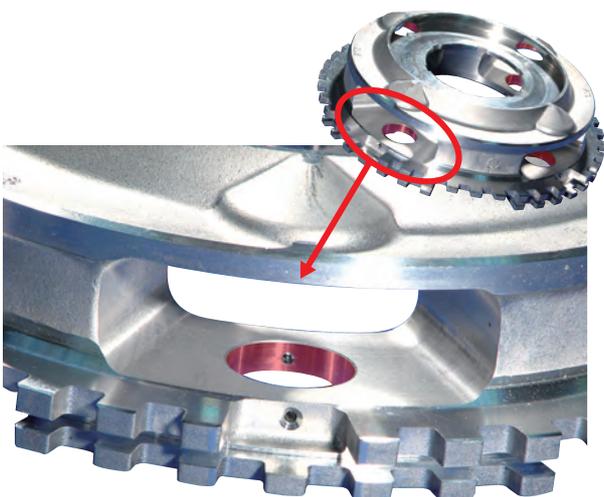
Standard 4-flute centre cutting end mill.
Suitable for deep slotting and finishing. Centre cutting type allows vertical feed milling.

Cutting conditions

$vc=45.2\text{m/min}$ $n=1,200\text{min}^{-1}$ $vf=480\text{mm/min}$ Wet

Tooling Sheet 4

OP.5 (Drilling of the shaft holes) For machining centres



MZE/MZS drill (Special)
HTi10

Tool features

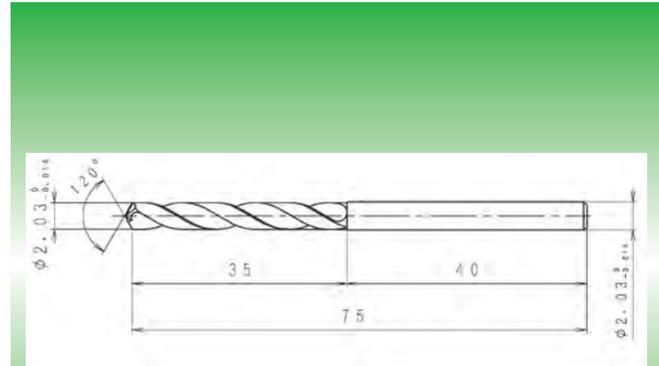
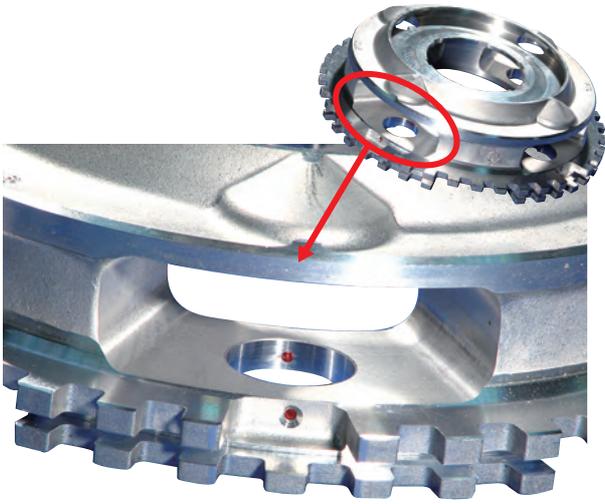
Special MZE / MZS drill with through coolant holes in HTi10 grade.
Step drill consolidates processes and reduces machining costs.
(Non-coated MZE / MZS offers a sharp cutting edge geometry)

Cutting conditions

$vc=120\text{m/min}$ $n=1,898\text{min}^{-1}$ $fr=0.15\text{mm/rev}$ Wet

Tooling Sheet 5

OP.6 (Drilling of the pin holes) For machining centres



MZE/MZS drill (Special)
TF15

Tool features

Special MZE / MZS drill with through coolant holes in HTi10 grade.
Step drill consolidates processes and reduces machining costs.
(Non-coated MZE / MZS offers a sharp cutting edge geometry)

Cutting conditions

$vc=29.5\text{m/min}$ $n=4,628\text{min}^{-1}$ $fr=0.13\text{mm/rev}$
 $vf=611\text{mm/min}$ Wet

Tooling Sheet 6

Output shafts

Main machining

- ① External turning, facing
- ② Oil holes
- ③ Grooving



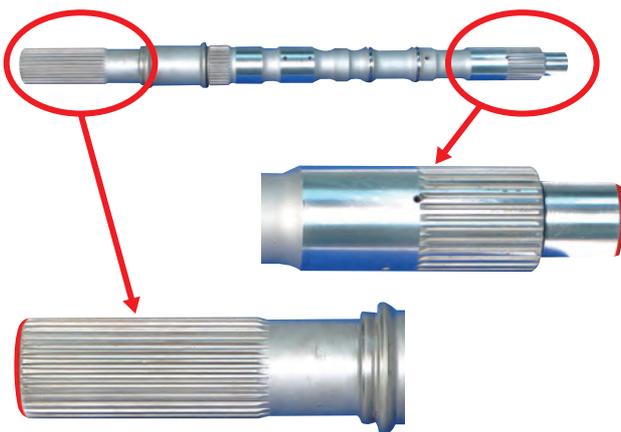
Work material : SCM420H

Machining methods

- Turning
- Milling
- Drilling

OP.1 (Facing of the FR/RR faces)

For machining centres



ASX445R10007D
SEMT13T3AGSN-JM VP15TF

Tool features

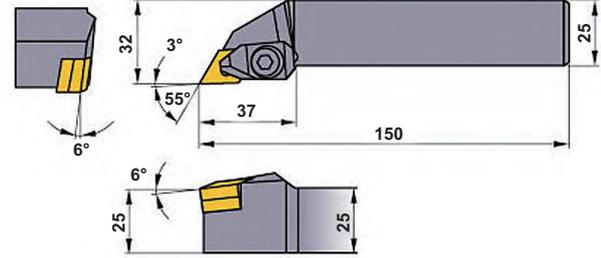
Standard ASX445 type cutter with VP15TF inserts. The body is made from a special alloy steel that provides high heat resistance and excellent durability. Use of a screw-on type for easy and high accuracy insert clamping. General-purpose JM breaker.

Cutting conditions

vc=110m/min n=350min⁻¹ fz=0.08mm/tooth
vf=190mm/min ap=1.7mm Wet

OP.2 (External roughing of the FR side)

For CNC lathes



DDJNR2525M15
DNMG150408-MV UE6110

Tool features

Standard holder with UE6110 inserts.
The UE6110 steel turning grade with a nano-texture coating provides excellent balance of wear and fracture resistance. The MV breaker gives effective chip control in the light to medium cutting application areas.

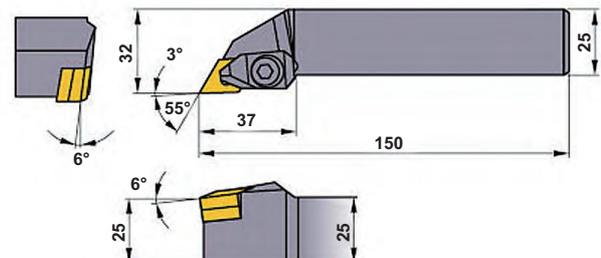
Cutting conditions

vc=220~140m/min fr=0.35mm/rev ap=1.7~2.0mm Wet

Tooling Sheet 2

OP.3 (External roughing of the RR side)

For CNC lathes



DDJNR2525M15
DNMG150408-MV UE6110

Tool features

Standard holder with UE6110 inserts.
The UE6110 steel turning grade with a nano-texture coating provides excellent balance of wear and fracture resistance. The MV breaker gives effective chip control in the light to medium cutting application areas.

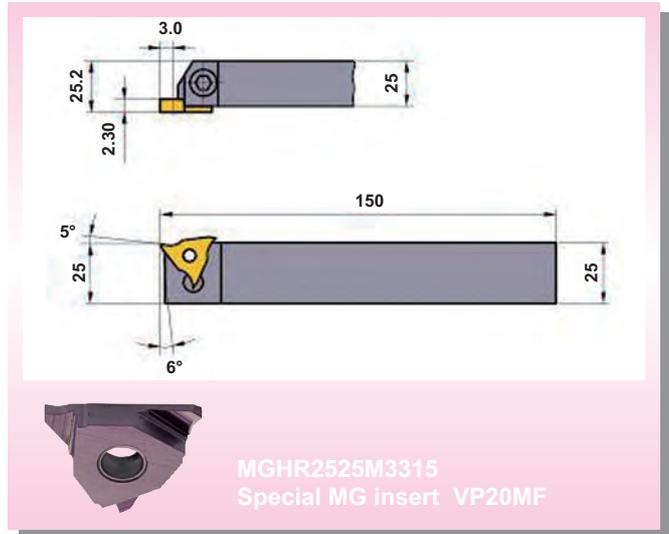
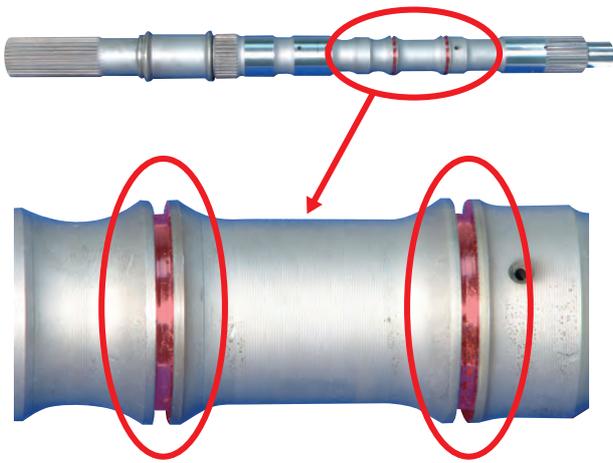
Cutting conditions

vc=270~170m/min fr=0.35mm/rev ap=1.7~2.0mm Wet

Tooling Sheet 3

OP.4 (Grooving)

For CNC lathes



Tool features

Standard holder with special VP20MF inserts.
The VP20MF grade uses a micro-grain cemented carbide substrate. Excellent wear and fracture resistance and long tool life.

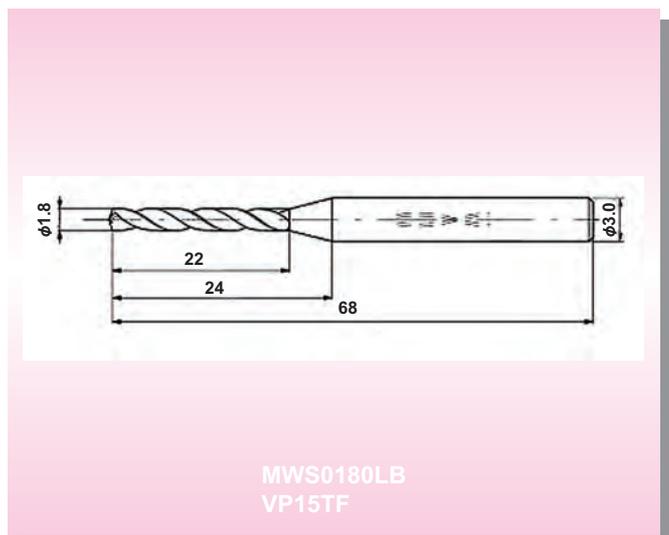
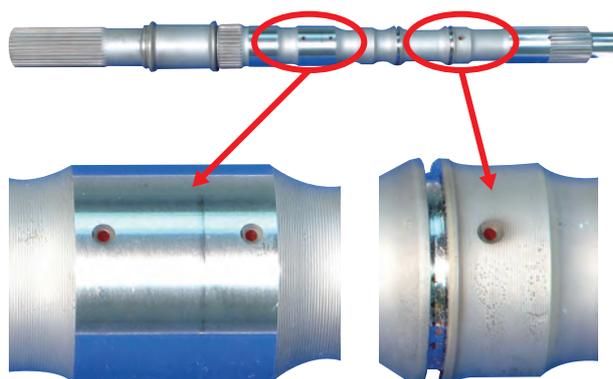
Cutting conditions

vc=150~138m/min fr=0.1mm/rev ap=2.2mm W=2.15mm
Wet

Tooling Sheet 4

OP.5 (Drilling of the oil holes)

For machining centres



Tool features

Standard WSTAR drill.
Wave cutting edge gives a balance of edge strength and sharpness.
High precision, stable machining.

Cutting conditions

vc= 50m/min n=8,845min⁻¹ fr=0.08mm/rev Wet

Tooling Sheet 5

GEAR CUTTING



STH treated shaving cutter

Location

Open gear



Spur gears



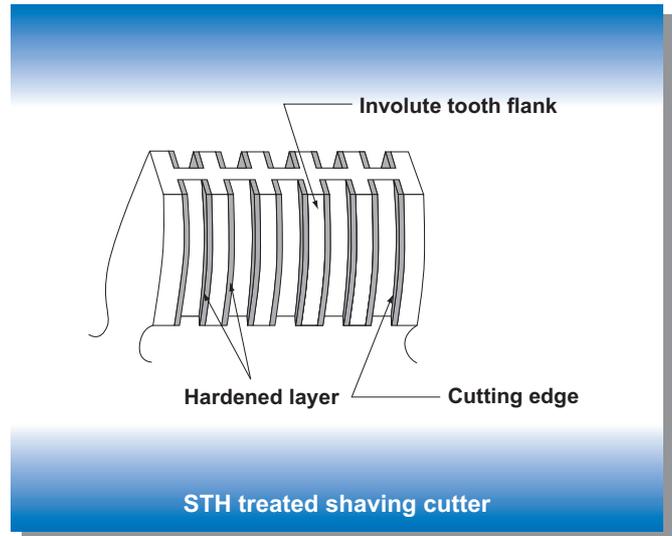
Helical gears

Shaft shoulder gear



Tool features

Hardening only the serrated parts improves wear resistance without decreasing the toughness of the tool substrate. The surface hardened layer remains unremoved after being reground, allowing stable tool life.



STH treated shaving cutter

Cutting conditions

$vc=110\text{m/min}$ $n=180\text{min}^{-1}$ $f=0.5\text{mm/min}$
 $T1=4, T2=4, T3=7(\text{sec})$ $BM=0.02\text{mm}$ Wet

Tooling Sheet 1

Variable land type shaving cutter

Location

Open gear



Spur gears



Helical gears

Shaft shoulder gear



Variable land type shaving cutter

Tool features

To avoid the tooth profile differences between the upper and lower position caused by irregular tooth engagement, the serration land width is varied in the tooth width direction.

Cutting conditions

$vc=110\text{m/min}$ $n=180\text{min}^{-1}$ $f=0.5\text{mm/min}$
 $T1=4, T2=4, T3=7(\text{sec})$ $BM=0.02\text{mm}$ Wet

Tooling Sheet 2

Direct 80 dressing gear

Location

Open gear



Spur gears



Helical gears

Shaft shoulder gear



Diamond grain	#80	#120	#170
Grain size (comparison)	2	1.5	1
Ratio of surface area of grain	4	2	1
Grain retentivity	High	Middle	Low
Average diameter of grain			

Direct 80 dressing gear

Tool features

Use of the #80 abrasive grain that has double the diameter and 4 times larger surface area than the #170 abrasive grain gives exceptional grain strength and retention force. A high precision electrodeposition technique and semi truing method are employed for superior tooth profile accuracy.

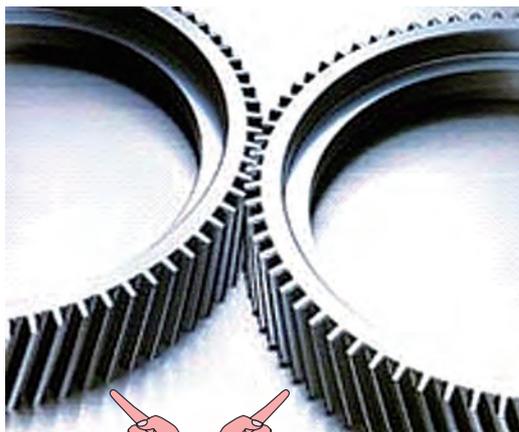
Cutting conditions (Dressing)

Feed rate=150mm/min Grinding wheel (N)=40min⁻¹
Feed length=±4mm Depth of cut/ST=0.003mm
Vertical depth of cut=0.05mm

Tooling Sheet 3

Super Violet hob

Location



Super Violet hob

Tool features

Use of a new coating for higher heat and wear resistance. Double tool life compared to conventional types when machining at vc=150m/min. Possible to machine at vc=250m/min, which was previously difficult to perform in actual machining.

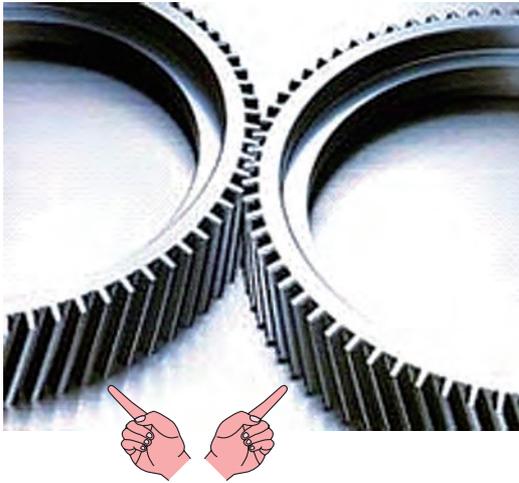
Cutting conditions

vc=150m/min n=530min⁻¹ f=2.0mm/rev Dry
vc= 200,250m/min n=700,880rpm f=2.0mm/rev Dry

Tooling Sheet 4

Miracle hob

Location



Miracle hob

Tool features

Use of (AlTi)N coating with high hardness and oxidation resistance. Possible to machine at ultra high speeds over $vc=300\text{m/min}$. Long tool life even during post-quenching finish machining of gears.

Cutting conditions

$vc=335\text{m/min}$ $n=1180\text{min}^{-1}$ $f=1.85\text{mm/rev}$ Dry

Tooling Sheet 5

Large diameter integral type helical broach

Location



Helical broach

Tool features

An integral broach type enables reduction of finishing allowance. Longer tool life by reducing the load on each cutting edge.

Cutting conditions

$vc=6\sim 10\text{m/min}$

Tooling Sheet 6

Power forming rack

Location



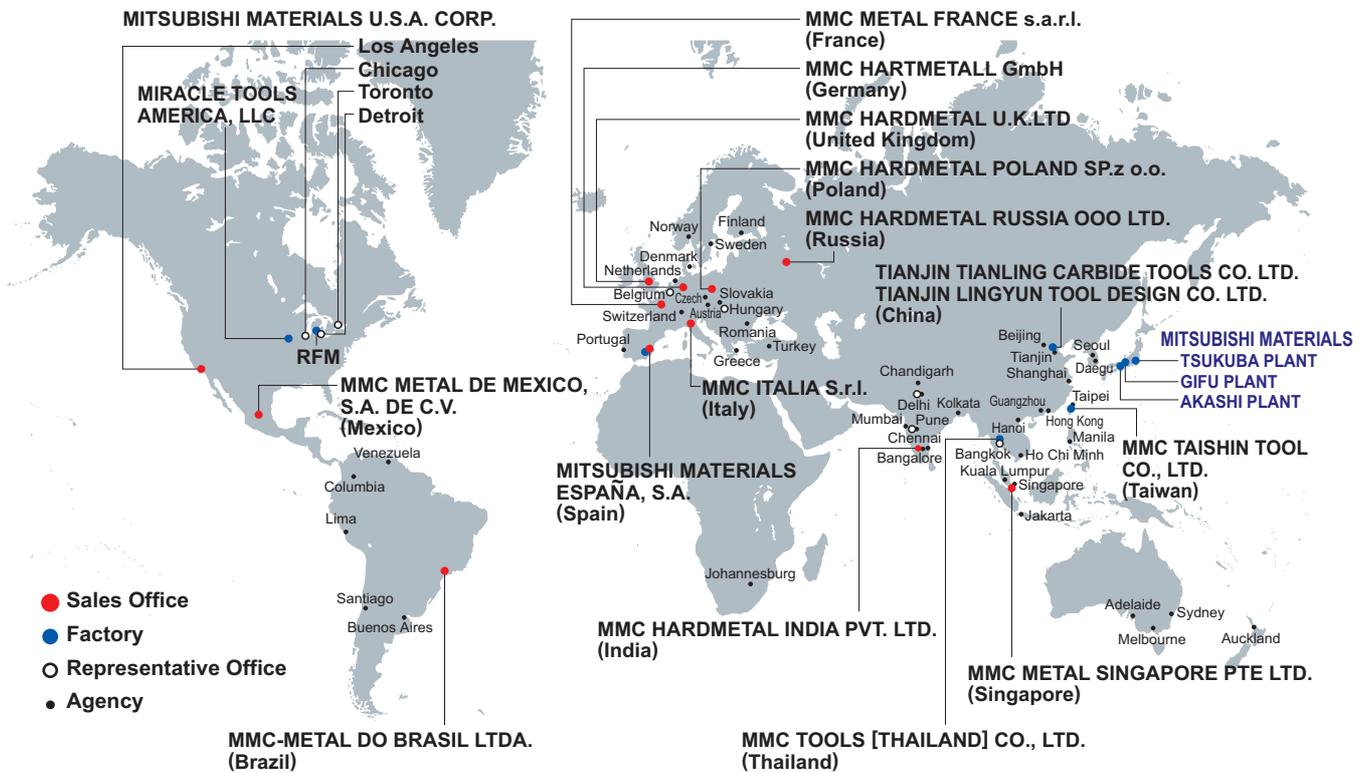
Tool features

Fine particle shot peening is provided to apply residual stress on finish teeth to dramatically increase the fracture resistance of the rack teeth.

Rolling conditions

Rolling speed:10~20m/min

Tooling Sheet 7



Overseas Sales Offices

JAPAN

MITSUBISHI MATERIALS CORPORATION

Area Marketing & Operations Department
KFC bldg., 8F, 1-6-1, Yokoami, Sumida-ku, Tokyo 130-0015 Japan
TEL +81-3-5819-8772 FAX +81-3-5819-8773

USA

MITSUBISHI MATERIALS U.S.A. CORPORATION

17401 Eastman Street, Irvine, California, 92614, USA
TEL +1-949-862-5100 FAX +1-949-862-5180

MEXICO

MMC METAL DE MEXICO, S.A. DE C.V.

Av. La Canada No.16, Parque Industrial
Bernardo Quintana, El Marques, Queretaro, CP76246 Mexico
TEL +52-442-221-6136 FAX +52-442-221-6134

BRAZIL

MMC-METAL DO BRASIL LTDA.

Rua Cincinato Braga, 340, 13th-Flor,
Bela Vista-CEP 01333-010, São Paulo-SP, Brazil
TEL +55-11-3266-7687 FAX +55-11-3287-8587

SINGAPORE

MMC METAL SINGAPORE PTE LTD.

10, Arumugam Road, #04-00 Lion Industrial Building,
409957, Singapore
TEL +65-6743-9370 FAX +65-6749-1469

THAILAND

Bangkok Representative office

4th Floor, Siam Terminal Building, 2991 Ladphao Road,
Klongjan, Bangkok, Bangkok 10240. THAILAND
TEL +66-2-370-3060 FAX +66-2-370-3068

INDIA

MMC HARDMETAL INDIA PVT. LTD.

No.10, 1st Floor, 80 Feet Road, R.M.V 2nd Stage,
Bangalore - 560094 India
TEL +91-80-2351-6083 FAX +91-80-2351-6080

GERMANY

MMC HARTMETALL GmbH

Comeniusstr. 2, 40670 Meerbusch Germany
TEL +49-2159-9189-0 FAX +49-2159-918966

UNITED KINGDOM

MMC HARDMETAL U.K. LTD

Mitsubishi House, Galena Close, B774AS Tamworth, U.K.
TEL +44-1827-312312 FAX +44-1827-312314

FRANCE

MMC METAL FRANCE s.a.r.l.

Rue Jaques Monod 6, 91400 Orsay, France
TEL +33-1-69 35 53 53 FAX +33-1-69 35 53 50

SPAIN

MITSUBISHI MATERIALS ESPAÑA, S.A.

Calle Emperador 2, 46136 Museros/Valencia, Spain
TEL +34-96-144-1711 FAX +34-96-144-3786

ITALY

MMC ITALIA S.r.l.

V. le Delle Industrie 20/5, 20020 Milano Italy
TEL +39-02 93 77 03 1 FAX +39-02 93 58 90 93

RUSSIA

MMC HARDMETAL RUSSIA OOO LTD.

UL. Bolschaja Pochtovaja, 36 Bldg.1,
105082 Moscow, Russia
TEL +7-495-72558-85 FAX +7-495-98139-73

POLAND

MMC HARDMETAL POLAND SP. z o.o.

Al. Armii Karjowey 61, 40-541 Wroclaw, Poland
TEL +48-71335-16-20 FAX +48-71335-16-21