SUSPENSION PARTS AND ACCESSORIES
Knuckle arm
Constant velocity universal joint
Hub
Brake caliper
Rail
Injector
Knuckle arm

Main machining
① Various holes
② Various locating faces

Machining methods
Milling
Drilling
Boring

Work material: FCD450 equivalent

OP.10 T1 (Rough boring of boss) For machining centres

Tool features
Combination boring cutter with HTi10 inserts.
Facing and chamfering can be performed in one process, allowing higher production efficiency.
Cartridge type prevents the body from damage.

Cutting conditions
vc=108~120m/min fz=0.20mm/tooth
ap=1.0mm Wet

Tooling Sheet 1
OP.10 T2 (Finish boring of the boss) For machining centres

Tool features
Combination boring cutter with NX2525 inserts.
Facing and chamfering can be performed in one process, allowing higher production efficiency.
Use of micro-boring units enables high precision machining.

Cutting conditions
vc=180~200m/min  fz=0.15mm/tooth
ap=0.5mm  Wet

OP.20 T1 (Tie-rod mounting face) For machining centres

Tool features
Special side cutter with UC5115 inserts.
Use of quick change system for easy tool change.
Shorten tool change time and increase efficiency in machining lines.

Cutting conditions
vc=120m/min  fz=0.10mm/tooth
ap=0.6mm  Wet
OP.20 T2 (Tie-rod mounting holes)  
For machining centres

![Tooling Sheet Image]

**Tool features**
Standard WSTAR drill.
Use of a wavy cutting edge and special flute geometry with superior chip disposal properties reduces cutting resistance, resulting in high precision, stable machining.

**Cutting conditions**
- vc=60m/min
- fz=0.25mm/rev
- Id=30mm
- Wet

**Tooling Sheet 4**

OP.20 T3 (ABS sensor mounting face)  
For machining centres

![Tooling Sheet Image]

**Tool features**
Standard APX3000 type cutter with VP15TF inserts.
Effective in various 3-D machining operations including ramping, leading to a substantially reduction of tool exchange time.
Use of a general-purpose low resistance M type breaker.

**Cutting conditions**
- vc=100m/min
- fz=0.08mm/tooth
- ap=1.2mm
- Wet

**Tooling Sheet 5**
OP.30 T1 (Brake caliper mounting face)  For machining centres

Tool features
Standard APX3000 type cutter with VP15TF inserts. Effective in various 3-D machining operations including ramping, leading to a substantially reduction of tool exchange time. Use of a general-purpose low resistance M type breaker.

Cutting conditions
vc=200m/min  fz=0.12mm/tooth  ap=1.2mm  Wet

OP.30 T2 (Brake caliper mounting holes)  For machining centres

Tool features
Standard WSTAR drill. Use of a wavy cutting edge and special flute geometry with superior chip disposal properties reduces cutting resistance, resulting in high precision, stable machining.

Cutting conditions
vc=60m/min  fz=0.25mm/rev  ap=1.2mm  Wet
Constant velocity universal joint

Main machining
①External turning
②Boring

Machining methods
Turning

Work material: S53C equivalent

OP.10 T1 (External roughing) 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 MP breaker gives good chip control in a wide application area, ensuring higher productivity.

Cutting conditions
vc=250m/min  fr=0.4~0.5mm/rev
ap=1.0mm  Dry

DWLNL2525M08
WNMG080412-MP
UE6020
OP.10 T2 (Roughing of end face)  
For CNC lathes

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=230m/min  fr=0.3mm/rev  
ap=1.0~1.5mm  Dry

OP.20 T1 (External finishing)  
For CNC lathes

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

Cutting conditions
vc=250m/min  fr=0.3~0.5mm/rev  
ap=0.3mm  Dry
OP.20 T2 (External finishing)  For CNC lathes

![Tool Image]

**Tool features**
- Standard holder with UE6020 inserts.
- The highly reliable UE6020 grade employs Even Coating Technology to deliver higher welding and fracture resistance.
- The MP breaker gives good chip control in a wide application area, ensuring higher productivity.

**Cutting conditions**
- \( vc = 180 \text{ m/min} \)
- \( fr = 0.2 \sim 0.3 \text{ mm/rev} \)
- \( ap = 0.3 \sim 0.4 \text{ mm} \)
- Dry

**Tools**
- DDJNL2525M15
- DNMG150412-MP
- UE6020

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OP.30 T1 (External finishing after heat treating)  For CNC lathes

![Tool Image]

**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**
- \( vc = 180 \text{ m/min} \)
- \( fr = 0.08 \sim 0.1 \text{ mm/rev} \)
- \( ap = 0.15 \text{ mm} \)
- Dry

**Tools**
- DCLNL2525M12
- NP-CNGA120412GN4
- MBC020

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Tooling Sheet 4

Tooling Sheet 5
OP.30 T2 (Finish boring after heat treating)  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=105m/min  fr=0.3mm/rev  ap=0.1mm  Dry

A40T-DDUNR15
NP-DNGA150412TA4
MBC020

Tooling Sheet 6
Hub

Main machining
①External turning
②Boring
③Bolt hole
④Shaft hole

Machining methods
Turning
Drilling
Broach

Work material: S55C equivalent

OP.10 T1 (Roughing of end face) 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 MP breaker gives good chip control in a wide application area, ensuring higher productivity.

Cutting conditions
vc=180m/min  fr=0.3~0.4mm/rev
ap=0.8mm Wet

DCLNR2525M12
CNMG120412-MP
UE6020
**OP.10 T2 (Finishing of end face)**

**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=220m/min
- fr=0.3~0.4mm/rev
- ap=0.2mm Wet

**OP.10 T3 (Rough boring)**

**For CNC lathes**

**Tool features**
Standard boring bar with UE6020 inserts. The highly reliable UE6020 grade employs Even Coating Technology to deliver higher welding and fracture resistance. The MV breaker gives effective chip control in the light to medium cutting application areas.

**Cutting conditions**
- vc=200m/min
- fr=0.3mm/rev
- ap=0.8mm Wet
OP.20 T1 (External roughing)  
For CNC lathes

![Tool Image]

**Tool features**
Standard holder with UE6020 inserts. The highly reliable UE6020 grade employs Even Coating Technology to deliver higher welding and fracture resistance. The MP breaker gives good chip control in a wide application area, ensuring higher productivity.

**Cutting conditions**
- \( vc=200 \text{m/min} \)
- \( f_r=0.2\sim0.4\text{mm/rev} \)
- \( a_p=0.8\text{mm} \) Wet

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OP.20 T2 (External finishing)  
For CNC lathes

![Tool Image]

**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**
- \( vc=230\text{m/min} \)
- \( f_r=0.2\sim0.3\text{mm/rev} \)
- \( a_p=0.2\text{mm} \) Wet

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**OP.20 T3 (Finish boring)**

**Tool features**

Standard boring bar with UE6020 inserts. The highly reliable UE6020 grade employs Even Coating Technology to deliver higher welding and fracture resistance. The MV breaker gives effective chip control in the light to medium cutting application areas.

**Cutting conditions**

\[ \begin{align*}
  & vc = 200 \text{m/min} \\
  & fr = 0.2 \sim 0.3 \text{mm/rev} \\
  & ap = 0.2 \text{mm} \\
  & \text{Wet}
\end{align*} \]

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**OP.30 T1 (Bolt hole)**

**Tool features**

MHE drill for wheel hubs. Specially designed for drilling of bolt holes, highly efficient, precision drilling can be achieved. High precision drilling enables production of holes with a single tool.

**Cutting conditions**

\[ \begin{align*}
  & vc = 80 \text{m/min} \\
  & n = 1,840 \text{min}^{-1} \\
  & fr = 0.15 \text{mm/rev} \\
  & id = 11 \text{mm} \\
  & \text{Wet}
\end{align*} \]

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**For CNC lathes**

**Tooling Sheet 6**

**Tooling Sheet 7**
### OP.30 T2 (Chamfering of bolt holes)

#### Tooling Sheet 8

**Tool features**
- Special chamfering cutter with UE6110 inserts.
- Plunging is carried out to chamfer bolt holes.
- The UE6110 steel turning grade with a nano-texture coating provides excellent balance of wear and fracture resistance.

**Cutting conditions**
- \( v_c = 210 \text{ m/min} \)
- \( n = 3,342 \text{ min}^{-1} \)
- \( f_r = 0.15 \text{ mm/rev} \)
- Wet

### OP.40 T1 (Finishing the end face after heat treating)

#### Tooling Sheet 9

**Tool features**
- Standard holder with US735 inserts.
- US735 with high welding resistance helps prevent abnormal wear at medium to low speed, interrupted cutting.
- The SH breaker featuring the curved edge gives sharp cutting action.

**Cutting conditions**
- \( v_c = 180 \text{ m/min} \)
- \( f_r = 0.18\sim0.22 \text{ mm/rev} \)
- \( a_p = 0.2 \text{ mm} \)
- Wet
OP.40 T2 (Finish boring after heat treating)  For CNC lathes

Tool features
Standard boring bar with UE6020 inserts.
The highly reliable UE6020 grade employs Even Coating Technology to deliver higher welding and fracture resistance.
Use of the finishing type SV breaker.

Cutting conditions
vc=170m/min  fr=0.18~0.2mm/rev
ap=0.2mm  Wet

OP.50 (Broach)  For broaching machine

Tool features
Longer tool life by reducing the load on each cutting edge.

Cutting conditions
vc=6~10m/min
Brake caliper

Main machining
1. Piston hole
2. Outer pad face
3. Slide pin hole

Machining methods
Milling
Drilling

Work material: FCD400 equivalent

OP.10 T1 (Roughing of the piston bore) For machining centres

Tool features
Special boring cutter with HT10 inserts. Employs a solid drill at the point. The cutting edge at the shank portion enables half-round machining of the outer pad face.

Cutting conditions
vc=80m/min fr=0.16mm/rev ap=0.8mm Wet
**Tooling Sheet 2**

**OP.10 T2 (Rough chamfering of the piston bore) For machining centres**

**Tool features**
- Special boring cutter with HT10 inserts.
- Combination boring bar to perform roughing and chamfering in one process.

**Cutting conditions**
- $v_c=120\text{m/min}$
- $f_r=0.1\text{mm/rev}$
- Wet

**OP.10 T3 (Finishing of the piston bore) For machining centres**

**Tool features**
- Special boring cutter with HT10 inserts.
- Use of micro-boring units enables high precision machining.

**Cutting conditions**
- $v_c=80\text{m/min}$
- $f_r=0.2\text{mm/rev}$
- Wet

**Tooling Sheet 3**

**TPGX160304 HT10**

**TPGX110308 HT10**

**TPGX160304 HT10**

**TPGX110308 HT10**

**TPGX110308 HT10**
**OP.20 T1 (Outer pad face)**

**Tool features**
- Special side cutter with HTi10 inserts.
- Use of quick change system for easy tool change.
- Shorten tool change time and increase efficiency in machining lines.

**Cutting conditions**
- \( vc=70 \text{ m/min} \)
- \( fz=0.2 \text{ mm/rev} \)
- \( W \text{ wet} \)

**OP.30 T1 (Slide pin holes)**

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

**Cutting conditions**
- \( vc=100 \text{ m/min} \)
- \( fz=0.9 \text{ mm/rev} \)
- \( ap=0.25 \text{ mm} \)
- \( W \text{ wet} \)

**For machining centres**
Common rail

Main machining
①External turning
②Boring
③Bolt hole

Machining methods
Milling
Drilling
Boring

Work material: SCM435 equivalent

OP.10 T1 (Mounting bolt seat face) For machining centres

Tool features
Standard APX3000 type cutter with VP15TF inserts.
Use of a general-purpose low resistance M type breaker.
Can be used in the machining of low clamp rigidity workpiece and thin wall applications.

Cutting conditions
vc=120m/min fx=0.12mm/tooth
ap=1.2mm Wet
OP.10 T2 (Bolt 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 cutting resistance, resulting in high precision, stable machining.

**Cutting conditions**
- $vc=65\text{m/min}$
- $fr=0.20\text{mm/rev}$
- $ld=12.0\text{mm}$
- Wet

OP.10 T3 (Chamfering of bolt holes)  
For machining centres

**Tool features**
Standard CFSPR type cutter with NX2525 inserts.
For chamfering. 30°, 45° and 60° chamfer series.

**Cutting conditions**
- $vc=70\text{m/min}$
- $fz=0.25\text{mm/tooth}$
- Wet
OP.20 T1 (End holes)  

**Tool features**
Standard ASX445 type cutter with F7030 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=180m/min  
- fz=0.05mm/tooth  
- ap=1.8mm  
- Wet

OP.20 T2 (End holes)  

**Tool features**
Standard TAF drill with UE6020 inserts.  
Highly durable body with high insert seat rigidity.  
Economical 4 cutting edge type inserts.

**Cutting conditions**
- vc=105m/min  
- fr=0.10mm/rev  
- Wet

---

**For machining centres**

ASX445-050A04R  
SEMT13T3AGSN-JM  
F7030

TAFS1700F25  
GPMT060204-U2  
UE6020
OP.20 T3 (Tap drilling and chamfering of end holes)  For machining centres

**Tool features**
- Standard boring bar with UP20M inserts.
- Highly rigid & light head configuration prevents deflection and vibration.

**Cutting conditions**
- $vc=80m/min$
- $fr=0.14mm/rev$
- $ap=0.12mm$
- Wet

**Tool features**
- Standard boring bar with UP20M inserts.
- Highly rigid & light head configuration prevents deflection and vibration.

**Cutting conditions**
- $vc=80m/min$
- $fr=0.14mm/rev$
- $ap=0.12mm$
- Wet

OP.20 T4 (Threading of end holes)  For machining centres

**Tool features**
- Standard boring bar with VP10MF inserts.
- G-class ground inserts ensures high precision threading.
- 3-D chip breaker available to provide good chip control.

**Cutting conditions**
- $vc=80m/min$
- Wet
OP.30 T1 (Top face of branching holes)  For machining centres

Tool features
Standard ASX445 type cutter with F7030 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=90m/min  fz=0.12mm/tooth
ap=0.8mm  Wet

OP.30 T2 (Branching hole 1)  For machining centres

Tool features
Standard WSTAR drill.
Use of a wavy cutting edge and special flute geometry with superior chip disposal properties reduces cutting resistance, resulting in high precision, stable machining.

Cutting conditions
vc=70m/min  fr=0.15mm/rev
Wet
OP.30 T3 (Branching hole 2)  
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. 
Use of ultra micro grain carbide substrate enables stable performance even when micro hole drilling that may cause possible tool breakage.

Cutting conditions
vc=40m/min  fr=0.08mm/rev 
Wet

OP.30 T4 (Centre hole)  
For machining centres

Tool features
Standard WSTAR super long drill. 
Wave type cutting edge and flute geometry with good chip discharge properties reduces cutting resistance and enables deep hole drilling with a single tool. 
By replacing the reaming, drastic reduction of machining time is achieved.

Cutting conditions
vc=80m/min  fr=0.15mm/rev 
Wet
Injector

Main machining
1. External turning
2. Boring
3. Various holes

Machining methods
Turning
Drilling

Work material: SCM420 equivalent

OP.10 T1 (Rough boring of the lower body) For CNC lathes

Tool features
Standard TAF drill with VP15TF inserts.
Highly durable body with high insert seat rigidity.
Economical 4 cutting edge type inserts.

Cutting conditions
vc=85m/min  fz=0.1mm/rev
Wet

TAFS1800F25
GPMT070204-U2
VP15TF

Injector
OP.10 T2 (Finish boring of the lower body)  For CNC lathes

Tool features
Standard boring bar with VP15TF inserts.
Highly rigid & light head configuration prevents deflection and vibration.

Cutting conditions
vc=70m/min  fr=0.1mm/rev
ap=0.5mm  Wet

OP.20 T1 (External turning of the lower body)  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.
Use of the finishing type FH breaker.

Cutting conditions
vc=150m/min  fr=0.15mm/rev
ap=0.7mm  Wet
OP.20 T2 (External grooving of the lower body) For CNC lathes

Tool features
Standard holder with VP20MF inserts.
The holder can be used with several different modular blades for variable groove depths, offering high cost performance.
VP20MF employs micro-grain cemented carbide substrate to deliver excellent wear and fracture resistance and longer tool life.

Cutting conditions
vc=80m/min  fr=0.08mm/rev
Wet

OP.20 T3 (External threading of the lower body) For CNC lathes

Tool features
Standard holder with VP10MF inserts.
G-class ground inserts ensures high precision threading.
3-D chip breaker available to provide good chip control.

Cutting conditions
vc=100m/min
Wet
OP.20 T4 (External finishing of the lower body)  For CNC lathes

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. Use of the finishing type FH breaker.

Cutting conditions
vc=240m/min  fr=0.08mm/rev
ap=0.3mm  Wet

OP.30 T1 (Lower body centre hole)  For CNC lathes

Tool features
Standard WSTAR super long drill. Wage type cutting edge and flute geometry with good chip discharge properties reduces cutting resistance and enables deep hole drilling with a single tool. By replacing reaming, drastic reduction of machining time is achieved.

Cutting conditions
vc=75m/min  fr=0.15mm/rev
Wet
**OP.40 T1 (External roughing of the lower body nozzle)**  For CNC lathes

**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.  
Use of the finishing type FH breaker.

**Cutting conditions**
- $v_c=120\text{m/min}$  
- $f_r=0.10\text{mm/rev}$  
- $a_p=0.3\text{mm}$  
- Wet

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**OP.40 T2 (External finishing of the lower body nozzle)**  For CNC lathes

**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.  
Use of the finishing type FH breaker.

**Cutting conditions**
- $v_c=120\text{m/min}$  
- $f_r=0.12\text{mm/rev}$  
- $a_p=0.6\text{mm}$  
- Wet
**OP.50 T1 (Drilling of the lower body)**

**Tool features**
Standard WSTAR drill. Use of a wavy cutting edge and special flute geometry with superior chip disposal properties reduces cutting resistance, resulting in high precision, stable machining.

**Cutting conditions**
- vc=75m/min
- fr=0.15mm/rev
- Wet

**MWS0500LB VP15TF**

**OP.50 T2 (Drilling of the lower body inlet)**

**Tool features**
Standard WSTAR drill. Use of a wavy cutting edge and special flute geometry with superior chip disposal properties reduces the cutting resistance. Use of ultra micro grain carbide substrate enables stable performance even when micro hole drilling that may cause possible tool breakage.

**Cutting conditions**
- vc=58m/min
- fr=0.30mm/rev
- Wet

**MWS0150XB VP15TF**
**Tool features**

Standard WSTAR drill.
Use of a wavy cutting edge and special flute geometry with superior chip disposal properties reduces the cutting resistance.
Use of ultra micro grain carbide substrate enables stable performance even when micro hole drilling that may cause possible tool breakage.

**Cutting conditions**

- vc=75m/min
- fr=0.40mm/rev
- Wet

**MWS0200XB VP15TF**

**OP.50 T3 (Drilling of the lower body outlet) For machining centres**
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