ASP®2030 Powder metallurgy HSS

CHEMICAL COMPOSITION

<table>
<thead>
<tr>
<th>C</th>
<th>Cr</th>
<th>Mo</th>
<th>W</th>
<th>Co</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.28</td>
<td>4.20</td>
<td>5.00</td>
<td>6.40</td>
<td>8.50</td>
<td>3.10</td>
</tr>
</tbody>
</table>

STANDARDS
- Europe: HS 6-5-3-8
- Germany: 1.3294

DELIVERY HARDNESS
- Soft annealed: max. 300 HB
- Cold drawn: max. 320 HB

DESCRIPTION
ASP®2030 is a cobalt grade for high performance cutting and cold work tools.

APPLICATIONS
- End mills
- Hobs
- Shaper cutters
- Broaches
- Bi-metal saws
- Taps
- Drills
- Cold work tools
- Fine blanking
- Dies

FORM SUPPLIED
- Coils
- Round bars
- Flat & square bars
- Forged blanks
- Sheets

Available surface conditions: drawn, ground, hot worked, peeled, rough machined.

HEAT TREATMENT
- Soft annealing in a protective atmosphere at 850-900°C for 3 hours, followed by slow cooling at 10°C/h down to 700°C, then air cooling.
- Stress-relieving at 600-700°C for approximately 2 hours, slow cooling down to 500°C.
- Hardening in a protective atmosphere at a temperature suitable for chosen working hardness. Pre-heating in 2 or 3 steps depending on tool dimension-design and austenitising temperature, last step 50°C below chosen austenitising temperature. Cooling down to 40-50°C.
- Tempering at 560°C three times for at least 1 hour each time. Cooling to room temperature (25°C) between temperings.

PROCESSING
ASP®2030 can be worked as follows:
- Machining (grinding, turning, milling)
- Polishing
- Plastic forming
- Electrical discharge machining
- Welding (special procedure including preheating and filler materials of base material composition)

GRINDING
During grinding, local heating of the surface, which may alter the temper, must be avoided. Grinding wheel manufacturers can furnish advice on the choice of grinding wheels.

SURFACE TREATMENT
The steel grade is a good substrate material for PVD and CVD coating. If nitriding is requested a small zone of 2-15 µm is recommended. The steel grade can also be steam-tempered if so desired.
**PROPERTIES**

**PHYSICAL PROPERTIES**

<table>
<thead>
<tr>
<th></th>
<th>20°C</th>
<th>400°C</th>
<th>600°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density g/cm³ (1)</td>
<td>8.1</td>
<td>7.9</td>
<td>7.9</td>
</tr>
<tr>
<td>Modulus of elasticity kN/mm² (2)</td>
<td>240</td>
<td>214</td>
<td>192</td>
</tr>
<tr>
<td>Thermal expansion coefficient from 20°C per °C (2)</td>
<td>-11.8x10⁻⁶</td>
<td>12.3x10⁻⁶</td>
<td></td>
</tr>
<tr>
<td>Thermal conductivity W/m°C (2)</td>
<td>24</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>Specific heat J/kg °C (2)</td>
<td>420</td>
<td>510</td>
<td>600</td>
</tr>
</tbody>
</table>

(1)=Soft annealed
(2)=Hardened 1180°C and tempered 560°C, 3x1 hour

**IMPACT ENERGY**

<table>
<thead>
<tr>
<th>Nm</th>
<th>HRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>68</td>
</tr>
<tr>
<td>40</td>
<td>66</td>
</tr>
<tr>
<td>30</td>
<td>64</td>
</tr>
<tr>
<td>20</td>
<td>62</td>
</tr>
<tr>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>0</td>
<td>58</td>
</tr>
</tbody>
</table>

Hardening temperature in °C
Original dimensions Ø 6 mm
Tempering 3 x 1 hour at 560°C
Dimensions of test piece Ø 4.7 mm

Rmb = Ultimate bend strength in kN/mm²
Reb = Bend yield strength in kN/mm²
Tot. work = Total work in Nm

**COMPRESSION YIELD STRESS**

<table>
<thead>
<tr>
<th>Rc 0.2 kN/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

HRC

Test piece with 10 mm waist diameter

**COMPARATIVE PROPERTIES**

<table>
<thead>
<tr>
<th>Machinability</th>
<th>Wear resistance</th>
<th>Toughness</th>
<th>Hot hardness</th>
<th>Grindability</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASP 2005</td>
<td>ASP 2015</td>
<td>ASP 2017</td>
<td>ASP 2023</td>
<td>ASP 2030</td>
</tr>
<tr>
<td>ASP 2052</td>
<td>ASP 2053</td>
<td>ASP 2060</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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ASP® is a registered trademark of Erasteel
Recommendations for machining in soft annealed condition, 260-300 HB

<table>
<thead>
<tr>
<th>Turning</th>
<th>Cemented Carbide</th>
<th>HSS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medium turning</td>
<td>Finishing turning</td>
</tr>
<tr>
<td>Cutting speed, (v_c) (m/min)</td>
<td>80-110</td>
<td>110-140</td>
</tr>
<tr>
<td>Feed, (f) (mm/rev)</td>
<td>0.2-0.4</td>
<td>0.05-0.2</td>
</tr>
<tr>
<td>Cutting depth, (a_p) (mm)</td>
<td>2-4</td>
<td>0.5-2</td>
</tr>
<tr>
<td>Tools according to ISO</td>
<td>coated carbide P10-P20</td>
<td>coated carbide P10</td>
</tr>
</tbody>
</table>

Use a wear resistant coated cemented carbide e.g. Coromant 4015 or Seco TP 100. Black ceramics are usually the best tools at finish turning, e.g. Coromant 650 or Feldmühle SH20.

### Side Milling

The same cutting speed can be used in side milling as in slot milling. However, the feed has to be adjusted to produce an adequate chip thickness. The diameter of the mill (D) over the radial depth of cut (\(a_e\)) is used as a parameter. Read the correction coefficient (Cf) from the diagram and multiply by the feed for slot milling from the table above.

#### Comments (slot and side milling)

1. Coated tools are always recommended for end milling both with HSS tools and cemented carbide tools. TiCN, TiAIN or multilayer (Futura) is preferred.
2. The cutting speed must be decreased considerably if uncoated tools are used.

#### Example

- **Tool**: End mill with indexable tips
- **Diameter of the end mill**: D=40 mm
- **Radial depth or cut**: \(a_e\)=2 mm
- **D/\(a_e\)**: 40/2=20
- **Correction coefficient**: \(C_f=2.8\)
- **Feed**: \(f_z=2.8\times0.17=0.48\) mm/tooth
- **Cutting speed**: \(v_c=80\) m/min
MACHINING DATA

FACE MILLING

<table>
<thead>
<tr>
<th>Cutting speed, ( v_c ) (m/min)</th>
<th>Rough machining</th>
<th>Finishing machining</th>
</tr>
</thead>
<tbody>
<tr>
<td>60-80</td>
<td>80-110</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feed, ( f_z ) (mm/tooth)</th>
<th>0.2-0.3</th>
<th>0.1-0.2</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Cutting depth, ( a_p ) (mm)</th>
<th>2-4</th>
<th>1-2</th>
</tr>
</thead>
</table>

Tools according to ISO coated cemented carbide K15, P25

SQUARE SHOULDER MILLING

<table>
<thead>
<tr>
<th>( a_e = 0.1 \times D )</th>
<th>( a_e = 0.5 \times D )</th>
<th>( a_e = 1 \times D )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting speed, ( v_c ) (m/min)</td>
<td>100-130</td>
<td>90-120</td>
</tr>
<tr>
<td>Feed, ( f_z ) (mm/tooth)</td>
<td>0.25</td>
<td>0.15</td>
</tr>
<tr>
<td>Tools according to ISO coated cemented carbide K15, P25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use a wear resistant coated cemented carbide e.g Coromant 3150 or Seco T15M.

DRILLING

<table>
<thead>
<tr>
<th>DRILL DIAMETER (mm)</th>
<th>1-5</th>
<th>5-10</th>
<th>10-20</th>
<th>20-30</th>
<th>30-40</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting speed, ( v_c ) (m/min)</td>
<td>10-12</td>
<td>0.05-0.15</td>
<td>10-12</td>
<td>0.15-0.25</td>
<td>10-12</td>
</tr>
<tr>
<td>Feed, ( f_z ) (mm/rev)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coated HSS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting speed, ( v_c ) (m/min)</td>
<td>15-20</td>
<td>0.05-0.15</td>
<td>15-20</td>
<td>0.15-0.25</td>
<td>15-20</td>
</tr>
<tr>
<td>Feed, ( f_z ) (mm/rev)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short hole drill indexable (cemented carbide)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting speed, ( v_c ) (m/min)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>120-130</td>
<td>0.08-0.12</td>
</tr>
<tr>
<td>Feed, ( f_z ) (mm/rev)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid cemented carbide</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting speed, ( v_c ) (m/min)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>45-50</td>
<td>0.1-0.15</td>
</tr>
<tr>
<td>Feed, ( f_z ) (mm/rev)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brazed cemented carbide</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting speed, ( v_c ) (m/min)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>32</td>
<td>0.1-0.2</td>
</tr>
<tr>
<td>Feed, ( f_z ) (mm/rev)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TiCN or TiAlN multi layer are recommended coatings for HSS drilling.

MACHINING IN HARDENED CONDITION

ASP®2030 has been machined in hardened condition up to 67 HRC. CBN tools are recommended. Whisker reinforced ceramics (Coromant 670 or Kennametal 4300) can be used in turning, but the tool life is shorter and more difficult to predict.