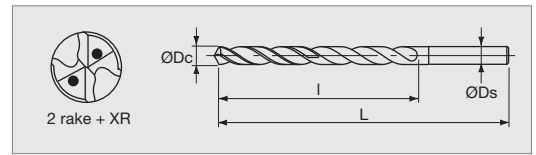


AQDEXOH25D

AQUA Drills EX Oil-Hole Long 25D



| LIST9618 | | | | Unit: mm |
|----------|-----|-----|----|----------|
| Dc | l | L | Ds | |
| 3.0 | 84 | 134 | 3 | |
| 3.1 | 98 | 148 | 4 | |
| 3.2 | 98 | 148 | 4 | |
| 3.3 | 98 | 148 | 4 | |
| 3.4 | 98 | 148 | 4 | |
| 3.5 | 98 | 148 | 4 | |
| 3.6 | 112 | 162 | 4 | |
| 3.7 | 112 | 162 | 4 | |
| 3.8 | 112 | 162 | 4 | |
| 3.9 | 112 | 162 | 4 | |
| 4.0 | 112 | 162 | 4 | |
| 4.1 | 126 | 176 | 5 | |
| 4.2 | 126 | 176 | 5 | |
| 4.3 | 126 | 176 | 5 | |
| 4.4 | 126 | 176 | 5 | |
| 4.5 | 126 | 176 | 5 | |
| 4.6 | 140 | 190 | 5 | |
| 4.7 | 140 | 190 | 5 | |
| 4.8 | 140 | 190 | 5 | |
| 4.9 | 140 | 190 | 5 | |

| LIST9618 | | | | Unit: mm |
|----------|-----|-----|----|----------|
| Dc | l | L | Ds | |
| 5.0 | 140 | 190 | 5 | |
| 5.1 | 154 | 204 | 6 | |
| 5.2 | 154 | 204 | 6 | |
| 5.3 | 154 | 204 | 6 | |
| 5.4 | 154 | 204 | 6 | |
| 5.5 | 154 | 204 | 6 | |
| 5.6 | 168 | 218 | 6 | |
| 5.7 | 168 | 218 | 6 | |
| 5.8 | 168 | 218 | 6 | |
| 5.9 | 168 | 218 | 6 | |
| 6.0 | 168 | 218 | 6 | |
| 6.1 | 182 | 232 | 7 | |
| 6.2 | 182 | 232 | 7 | |
| 6.3 | 182 | 232 | 7 | |
| 6.4 | 182 | 232 | 7 | |
| 6.5 | 182 | 232 | 7 | |
| 6.6 | 196 | 246 | 7 | |
| 6.7 | 196 | 246 | 7 | |
| 6.8 | 196 | 246 | 7 | |
| 6.9 | 196 | 246 | 7 | |

| LIST9618 | | | | Unit: mm |
|----------|-----|-----|----|----------|
| Dc | l | L | Ds | |
| 7.0 | 196 | 246 | 7 | |
| 7.1 | 210 | 260 | 8 | |
| 7.2 | 210 | 260 | 8 | |
| 7.3 | 210 | 260 | 8 | |
| 7.4 | 210 | 260 | 8 | |
| 7.5 | 210 | 260 | 8 | |
| 7.6 | 224 | 274 | 8 | |
| 7.7 | 224 | 274 | 8 | |
| 7.8 | 224 | 274 | 8 | |
| 7.9 | 224 | 274 | 8 | |
| 8.0 | 224 | 274 | 8 | |

Standard drilling condition

Wet Condition

AQDEXOH 10D 15D 20D

| Work material | SS400 S50C FC250 Structural steels Carbon steels | | SCM440 NAK HPM Alloy steels | | SKD61 NAK HPM Mold steels Hardened Steels | | Hardened steels | | FCD400 Ductile cast iron | | SUS304 SUS316 Stainless steel | | Nickel Alloys Titanium Alloys | |
|---------------|--|--------|--------------------------------|--------|---|--------|-------------------|--------|-----------------------------|--------|----------------------------------|--------|----------------------------------|--------|
| | ~200HB | | 20~30HRC | | 30~40HRC | | | | 30~40HRC | | | | | |
| mm | min ⁻¹ | mm/min | min ⁻¹ | mm/min | min ⁻¹ | mm/min | min ⁻¹ | mm/min | min ⁻¹ | mm/min | min ⁻¹ | mm/min | min ⁻¹ | mm/min |
| 1.0 | 14300 | 310 | 12700 | 250 | 11150 | 170 | 6350 | 65 | 11150 | | 7950 | 80 | 3150 | 30 |
| 1.5 | 9550 | 310 | 8500 | 250 | 7400 | 170 | 4250 | 65 | 7400 | | 5300 | 80 | 2100 | 30 |
| 2.0 | 7150 | 310 | 6350 | 250 | 5550 | 170 | 3200 | 65 | 5550 | | 4000 | 80 | 1600 | 30 |
| 2.5 | 7000 | 470 | 6350 | 360 | 5700 | 280 | 3200 | 95 | 5700 | | 3800 | 140 | 1650 | 50 |
| 2.9 | 6050 | 470 | 5500 | 360 | 4950 | 280 | 2750 | 95 | 4950 | | 3300 | 140 | 1400 | 50 |
| 3.0 | 11500 | 1140 | 7600 | 570 | 6700 | 500 | | | 6700 | 600 | 6700 | 440 | | |
| 4.0 | 8600 | 1140 | 5700 | 570 | 5000 | 500 | | | 5000 | 600 | 5000 | 440 | | |
| 5.0 | 7600 | 1260 | 5100 | 640 | 4500 | 560 | | | 4500 | 670 | 4500 | 490 | | |
| 6.0 | 6400 | 1260 | 4200 | 640 | 3700 | 560 | | | 3700 | 670 | 3700 | 490 | | |
| 7.0 | 5500 | 1260 | 3600 | 640 | 3200 | 560 | | | 3200 | 670 | 3200 | 490 | | |
| 8.0 | 4800 | 1260 | 3200 | 640 | 2800 | 560 | | | 2800 | 670 | 2800 | 490 | | |
| 9.0 | 4200 | 1190 | 2800 | 610 | 2500 | 540 | | | 2500 | 650 | 2500 | 470 | | |
| 10.0 | 3800 | 1100 | 2500 | 590 | 2200 | 510 | | | 2200 | 620 | 2200 | 450 | | |
| 11.0 | 3500 | 1030 | 2300 | 560 | 2000 | 490 | | | 2000 | 600 | 2000 | 420 | | |
| 12.0 | 3200 | 960 | 2100 | 540 | 1900 | 470 | | | 1900 | 580 | 1900 | 400 | | |

AQDEXOH 25D 30D

| Work material | SS400 S50C FC250 Structural steels Carbon steels | | SCM440 NAK HPM Alloy steels | | SKD61 NAK HPM Mold steels Hardened Steels | | FCD400 Ductile cast iron | | SUS304 SUS316 Stainless steel | |
|---------------|--|--------|--------------------------------|--------|---|--------|-----------------------------|--------|----------------------------------|--------|
| | ~200HB | | 20~30HRC | | 30~40HRC | | | | | |
| mm | min ⁻¹ | mm/min | min ⁻¹ | mm/min | min ⁻¹ | mm/min | min ⁻¹ | mm/min | min ⁻¹ | mm/min |
| 3.0 | 11500 | 1030 | 7600 | 530 | 6700 | 460 | 6700 | 560 | 6700 | 400 |
| 4.0 | 8600 | 1030 | 5700 | 530 | 5000 | 460 | 5000 | 560 | 5000 | 400 |
| 5.0 | 7600 | 1150 | 5100 | 590 | 4500 | 510 | 4500 | 620 | 4500 | 450 |
| 6.0 | 6400 | 1150 | 4200 | 590 | 3700 | 510 | 3700 | 620 | 3700 | 450 |
| 7.0 | 5500 | 1150 | 3600 | 590 | 3200 | 510 | 3200 | 620 | 3200 | 450 |
| 8.0 | 4800 | 1150 | 3200 | 590 | 2800 | 510 | 2800 | 620 | 2800 | 450 |
| 9.0 | 4200 | 1070 | 2800 | 560 | 2500 | 490 | 2500 | 600 | 2500 | 420 |
| 10.0 | 3800 | 1000 | 2500 | 540 | 2200 | 470 | 2200 | 580 | 2200 | 400 |

Warnings on using the drilling condition tables

- Adjust drilling condition according to the rigidity of machine or work clamp state.
- The table values condition are for drilling with water-soluble cutting fluid.
- Reduce RPM and feed speeds by 30% for non-water-soluble cutting fluid.
- Use the internal lubricating oil hole.
- Non-step drilling is possible. However, a work material and drilling condition to chip removal may be worse.
In that case, add step feed or review the drilling condition.
For holes deeper than 20D in stainless steels, recommend in step feed.
- In step feed, return to the entrance hole.
- Step feed interval is about 0.5-1xD.
- Recommend pre-drilling of guide holes. Depth is 2-3xD.
- Recommend the AQDEXOHPLT for guide drilling.
Recommend the diameter that is 0.03mm larger than the deep hole drill.

ML Condition

AQDEXOH 10D 15D 20D

| Work material | SS400 S50C FC250 Structural steels Carbon steels ~200 HB | | SCM440 NAK HPM Alloy steels Pre-Hardened steels 20~30 HRC | | SKD61 NAK HPM Mold steels Hardened Steels 30~40HRC | | FCD400 Ductile cast iron | |
|---------------|---|--------|--|--------|---|--------|-----------------------------|--------|
| | min ⁻¹ | mm/min | min ⁻¹ | mm/min | min ⁻¹ | mm/min | min ⁻¹ | mm/min |
| 3.0 | 7600 | 750 | 6700 | 500 | 5700 | 430 | 5700 | 520 |
| 4.0 | 5700 | 750 | 5000 | 500 | 4300 | 430 | 4300 | 520 |
| 5.0 | 5100 | 840 | 4450 | 560 | 3800 | 480 | 3800 | 570 |
| 6.0 | 4200 | 840 | 3700 | 560 | 3200 | 480 | 3200 | 570 |
| 7.0 | 3600 | 840 | 3200 | 560 | 2700 | 480 | 2700 | 570 |
| 8.0 | 3200 | 840 | 2800 | 560 | 2400 | 480 | 2400 | 570 |
| 9.0 | 2800 | 790 | 2500 | 540 | 2100 | 460 | 2100 | 550 |
| 10.0 | 2550 | 740 | 2200 | 510 | 1900 | 440 | 1900 | 540 |
| 11.0 | 2300 | 690 | 2000 | 490 | 1700 | 420 | 1700 | 520 |
| 12.0 | 2100 | 640 | 1900 | 470 | 1600 | 400 | 1600 | 500 |

AQDEXOH 25D 30D

| Work material | SS400 S50C FC250 Structural steels Carbon steels ~200 HB | | SCM440 NAK HPM Alloy steels Pre-Hardened steels 20~30 HRC | | SKD61 NAK HPM Mold steels Hardened Steels 30~40HRC | | FCD400 Ductile cast iron | |
|---------------|---|--------|--|--------|---|--------|-----------------------------|--------|
| | min ⁻¹ | mm/min | min ⁻¹ | mm/min | min ⁻¹ | mm/min | min ⁻¹ | mm/min |
| 3.0 | 7700 | 690 | 6700 | 460 | 5700 | 400 | 5700 | 480 |
| 4.0 | 5700 | 690 | 5000 | 460 | 4300 | 400 | 4300 | 480 |
| 5.0 | 5100 | 750 | 4450 | 510 | 3800 | 440 | 3800 | 540 |
| 6.0 | 4200 | 750 | 3700 | 510 | 3200 | 440 | 3200 | 540 |
| 7.0 | 3600 | 750 | 3200 | 510 | 2700 | 440 | 2700 | 540 |
| 8.0 | 3200 | 750 | 2800 | 510 | 2400 | 440 | 2400 | 540 |
| 9.0 | 2800 | 730 | 2500 | 490 | 2100 | 420 | 2100 | 520 |
| 10.0 | 2550 | 690 | 2200 | 470 | 1900 | 400 | 1900 | 500 |

Warnings on using the drilling condition tables

1. Adjust drilling condition according to the rigidity of machine or work clamp state.
2. The table values condition are for drilling with water-soluble cutting fluid.
3. Non-step drilling is possible. However, a work material and drilling condition to chip removal may be worse.

In that case, add step feed or review the drilling condition.

For holes deeper than 20D in stainless steels, recommend in step feed.

4. In step feed, return to the entrance hole.








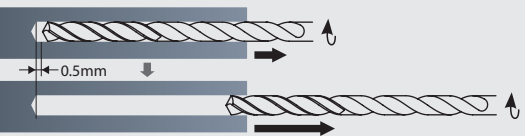
5. Step feed interval is about 0.5-1×D.

6. Recommend pre-drilling of guide holes. Depth is 2-3×D.

7. Recommend the AQDEXOHPLT for guide drilling.

Recommend the diameter that is 0.03mm larger than the deep hole drill.

Recommended usage for Deep hole drill

| | |
|---|---|
| <p>Guide hole drilling (AQDEXOHPLT)</p>  <p>AQDEXOHPLT</p> <p>For angled surface</p>  <p>AQDEXZ</p>  <p>AQDEXOHPLT</p> | <p>We recommend pre-drilling of guide holes. Depth is 2 to 3D. We recommend the AQDEXOHPLT for guide hole drilling. Select one with a diameter 0.03 mm larger than the deep hole drill when using AQDEXOHPLT. If the part is canted or misshapened, use the AQDEXZ to make a flat surface before use.</p> |
| <p>Deep hole drilling (Insert it in a guide hole)</p>  | <p>Penetrate into the guide hole at low speed until 2 to 3 mm from the bottom of the guide hole. (About, Rotation 500min⁻¹, Feed 1000 mm/min)</p> |
| <p>Deep hole drilling</p>  | <p>Start drilling at normal speed and feed</p> |
| <p>Deep hole drilling (Completion)</p> <p>Penetration on angled surface</p>  <p>Normal feed</p>  <p>Feed by 50%</p>  | <p>For through holes, drill at normal feed until penetration. Before penetrating through, lower the feed. To prevent drill from breaking.</p> |
| <p>Deep hole drilling (Back)</p>  | <p>After drilling is completed and once the bit has passed through the bottom of the drill hole, decrease speed and pull the drill back through the hole. (About, Rotation 500min⁻¹, Feed 2000 mm/min)</p> |

High-Efficient Deep Hole Drill

AQUA Drills EX Oil Hole Long



AQDEXOH

AQDEX AQDEXR AQDEXOH10D AQDEXOH15D AQDEXOH20D AQDEXOH25D AQDEXOH30D

- 30D Non step drilling possible
- High efficient & long tool life in both Wet & MQL
- Low cutting force point geometry provides long tool life on stainless steel deep hole drilling

Improved sharpness and stability

Point geometry which reduces the cutting force and improves the chip evacuation

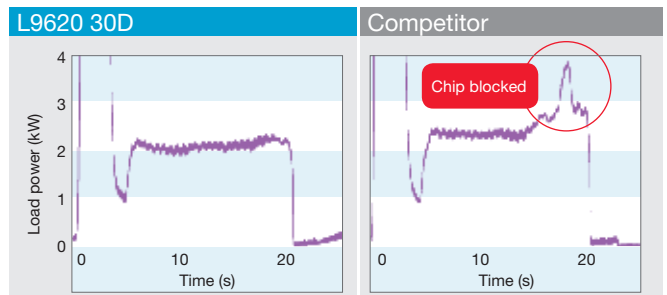
Double margin supports the guide and realizes stable deep drilling



Guide pad located on the vertical direction against the cutting edge lead the drill stable

30D Non step drilling

No chip block



Cutting Condition

| | | | |
|----------------|----------------|----------------|----------------------------------|
| Tool: | 5.0mm 30D type | Cutting fluid: | Water soluble (internal coolant) |
| Speed: | 120 m/min | Cutting depth: | 150 mm (30D) |
| Feed: | 1150 mm/min | Guide hole: | 5.03mm, 10mm depth |
| Work material: | C50 (180HB) | | |

Stable deep hole drilling in stainless steels

Divided in small chips



Cutting Condition

| | | | |
|----------------|-------------------------|----------------|----------------------------------|
| Tool: | 5.0mm 20D type | Cutting fluid: | Water soluble (internal coolant) |
| Cutting speed: | 75 m/min | Cutting depth: | 100 mm blind hole |
| Feed: | 450 mm/min (0.1 mm/rev) | Guide hole: | 5.03mm, 10mm depth |
| Work material: | 1.4301 (SUS304) | | |

AQUA EX Oil-Hole Pilot

AQDEXOHPLT

Ideal guide hole drill for AQUA EX Oil-Hole long
Improved concentricity and realize stable deep hole drilling

AQUA EX Coating

Improved heat and wear resistance

Anti-oxidation test

After 1 hour in 1100°C

AQUA EX Coat 50% oxidized

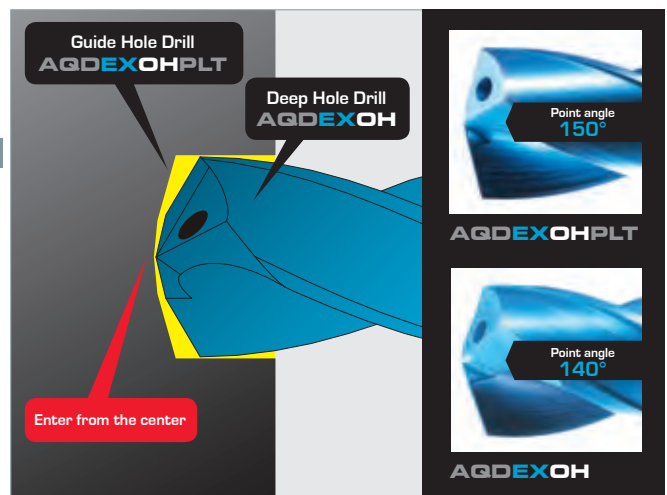
Competitor (1200°C catalog condition) Complete oxidation

Anti-adhesion layer

TiAlCrX Anti-oxidant & wear resistant multi-layer


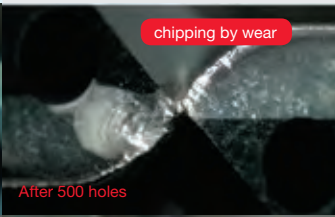
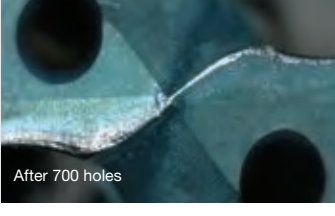
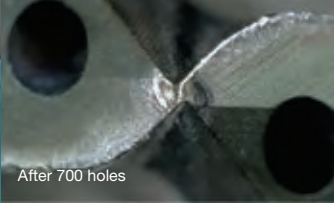
High strength carbide material

- Anti-adhesion layer and smoothed surface makes easy chip evacuation
- Al rich layer realize high anti-oxidant (1100°C)
- Multi-layered avoids crack propagation. Compressive stress moderates hardened film (3300HV) which increases the wear resistance.



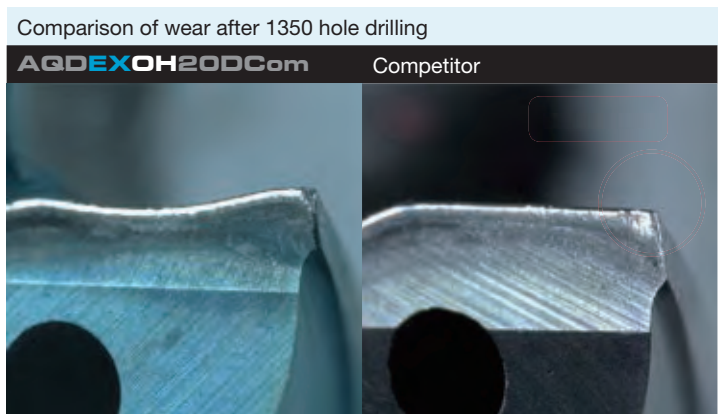
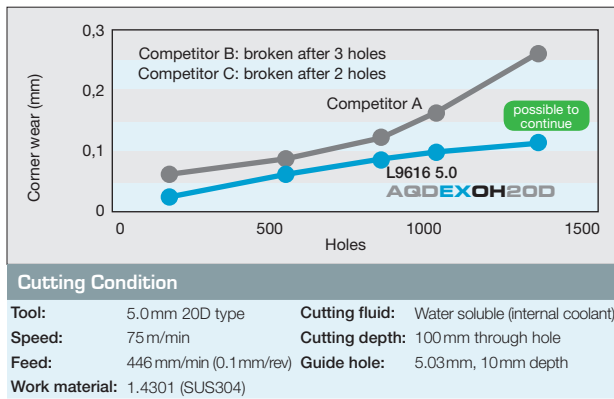
30D Non-step drilling on C50

High efficient & long tool life in both wet & MQL

| | AGDEXOH30D | Competitor | Cutting conditions | |
|-----|---|---|---------------------------------------|--|
| Wet |  |  | Tool: 5.0mm 30D type | Cutting fluid: Water soluble (internal coolant) |
| | After 700 holes | After 500 holes | Speed: 120m/min | Cutting depth: 150mm through hole |
| MQL |  |  | Feed: 1150 mm/min (0.15mm/rev) | Guide hole: 5.03mm, 10mm depth |
| | After 700 holes | After 700 holes | Work material: C50 | |
| | | | Tool: 5.0mm 30D type | Cutting fluid: MQL |
| | | | Speed: 80m/min | Cutting depth: 150mm through hole |
| | | | Feed: 760 mm/min (0.15mm/rev) | Guide hole: 5.03mm, 10mm depth |
| | | | Work material: C50 | |

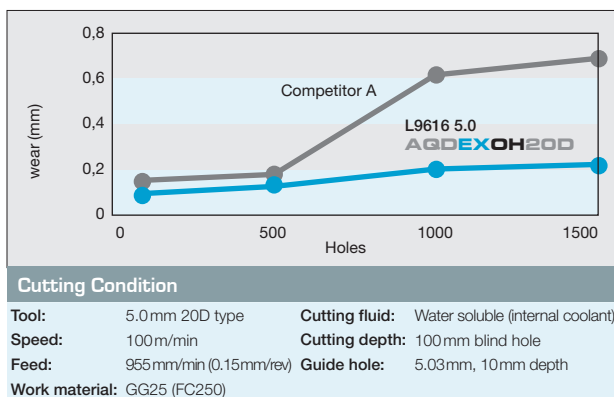
Wet drilling on stainless steel 304 (1.4301)

stable and long tool life even on stainless steel



GG25(FC250) Cast Iron Wet drilling

High wear resistance with long tool life



Applicable working materials

| Structural Steels | Carbon Steels | Pre-Hardened Steels Alloy Steels | Hardened Steels Mold Steels | Hardened Steels | | Stainless Steels | | Ti Alloys Ni Alloys | Cast Iron | Aluminium Alloys | Copper Alloys |
|-------------------|---------------|----------------------------------|-----------------------------|-----------------|----------|-----------------------------|----------------------|---------------------|-----------|------------------|---------------|
| ST37-2(SS400) | C45/C50 | 42CrMo4 SCR/NAK | 30-40HRC | 40-50HRC | 50-65HRC | 1.4301/1.4401 SUS304/SUS316 | 1.4021/1.4028 SUS420 | | GG/GGG | Al/ADC | Cu |
| ■ | ■ | ■ | ○ | | | ■ | ■ | | ■ | | |