



# HARTNER

Precision Cutting Tools



VHM-BOHRWERKZEUGE  
NEUHEITEN 2024



# ISO-Codes

|          |  |
|----------|--|
| <b>P</b> | Stahl, hochlegierter Stahl             |
| <b>M</b> | Rostfreier Stahl                       |
| <b>K</b> | Grauguss, Sphäroguss und Temperguss    |
| <b>N</b> | Aluminium und andere Nichteisenmetalle |
| <b>S</b> | Sonder-, Super- und Titanlegierungen   |
| <b>H</b> | Gehärteter Stahl und Hartguss          |

## Piktogramme

Schneidstoff

**VHM**

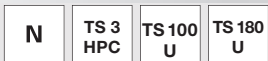
Vollhartmetall

Oberfläche



nanoFIRE

Typ



Bearbeitungstiefe



Norm



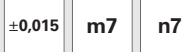
nach DIN

nach Hartner Standard

Spitzenwinkel



Ø-Toleranz



Schneidrichtung



rechts

Schaftform



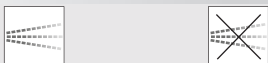
~ nach DIN 6535

nach DIN 6535

Ausspitzung



Innenkühlung



mit Innenkühlung

ohne Innenkühlung



| P | M | K | N | S | H | Norm | Typ | Schneidstoff | Oberfläche | Schneid-<br>richtung | Schaft-<br>form | Bohrtiefe | d1/mm | Artikel-Nr. | Progr.<br>Seite |
|---|---|---|---|---|---|------|-----|--------------|------------|----------------------|-----------------|-----------|-------|-------------|-----------------|
|---|---|---|---|---|---|------|-----|--------------|------------|----------------------|-----------------|-----------|-------|-------------|-----------------|

## Flachbohrer mit Kühlkanälen



|   |   |   |   |   |   |           |          |     |   |        |     |      |                |       |   |
|---|---|---|---|---|---|-----------|----------|-----|---|--------|-----|------|----------------|-------|---|
| • | • | • | ○ | ○ | ○ | Werksnorm | TS 180 U | VHM | Ⓢ | rechts | ~HA | ~3xD | 3,000 - 20,000 | 89519 | 4 |
|---|---|---|---|---|---|-----------|----------|-----|---|--------|-----|------|----------------|-------|---|

## TS-Drills, 3-schneidig



|   |   |   |   |   |   |           |          |     |   |        |    |     |                |       |   |
|---|---|---|---|---|---|-----------|----------|-----|---|--------|----|-----|----------------|-------|---|
| • | ○ | • | ○ | ○ | ○ | DIN 6537K | TS 3 HPC | VHM | Ⓢ | rechts | HA | 3xD | 4,000 - 20,000 | 89527 | 6 |
|---|---|---|---|---|---|-----------|----------|-----|---|--------|----|-----|----------------|-------|---|



|   |   |   |   |   |   |           |          |     |   |        |    |     |                |       |   |
|---|---|---|---|---|---|-----------|----------|-----|---|--------|----|-----|----------------|-------|---|
| • | ○ | • | ○ | ○ | ○ | DIN 6537L | TS 3 HPC | VHM | Ⓢ | rechts | HA | 5xD | 4,000 - 20,000 | 89526 | 8 |
|---|---|---|---|---|---|-----------|----------|-----|---|--------|----|-----|----------------|-------|---|

## NC-Anbohrer



|   |   |   |   |   |   |           |   |     |   |        |       |  |                |       |    |
|---|---|---|---|---|---|-----------|---|-----|---|--------|-------|--|----------------|-------|----|
| • | • | • | ○ | • | ○ | Werksnorm | N | VHM | Ⓢ | rechts | HA/HB |  | 1,000 - 20,000 | 89203 | 10 |
|---|---|---|---|---|---|-----------|---|-----|---|--------|-------|--|----------------|-------|----|

## TS-Drills mit Innenkühlung



|   |   |   |   |   |   |           |          |     |   |        |    |     |                |       |    |
|---|---|---|---|---|---|-----------|----------|-----|---|--------|----|-----|----------------|-------|----|
| • | ○ | • | ○ | ○ | ○ | DIN 6537K | TS 100 U | VHM | Ⓢ | rechts | HB | 3xD | 3,000 - 20,000 | 89428 | 11 |
|---|---|---|---|---|---|-----------|----------|-----|---|--------|----|-----|----------------|-------|----|



|   |   |   |   |   |   |           |          |     |   |        |    |     |                |       |    |
|---|---|---|---|---|---|-----------|----------|-----|---|--------|----|-----|----------------|-------|----|
| • | ○ | • | ○ | ○ | ○ | DIN 6537L | TS 100 U | VHM | Ⓢ | rechts | HB | 5xD | 3,000 - 20,000 | 89429 | 13 |
|---|---|---|---|---|---|-----------|----------|-----|---|--------|----|-----|----------------|-------|----|

## TS-Drills ohne Innenkühlung



|   |   |   |   |   |   |           |          |     |   |        |    |     |                |       |    |
|---|---|---|---|---|---|-----------|----------|-----|---|--------|----|-----|----------------|-------|----|
| • | ○ | • | ○ | ○ | ○ | DIN 6537K | TS 100 U | VHM | Ⓢ | rechts | HB | 3xD | 3,000 - 20,000 | 89430 | 15 |
|---|---|---|---|---|---|-----------|----------|-----|---|--------|----|-----|----------------|-------|----|



|   |   |   |   |   |   |           |          |     |   |        |    |     |                |       |    |
|---|---|---|---|---|---|-----------|----------|-----|---|--------|----|-----|----------------|-------|----|
| • | ○ | • | ○ | ○ | ○ | DIN 6537L | TS 100 U | VHM | Ⓢ | rechts | HB | 5xD | 3,000 - 20,000 | 89431 | 17 |
|---|---|---|---|---|---|-----------|----------|-----|---|--------|----|-----|----------------|-------|----|

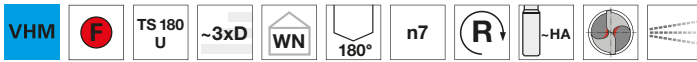


## Flachbohrer mit Kühlkanälen

Artikel-Nr. 89519

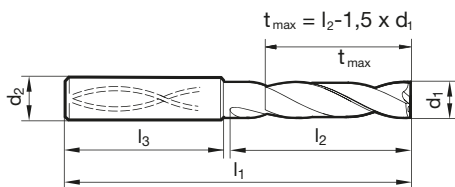


|   |   |   |   |   |   |
|---|---|---|---|---|---|
| P | M | K | N | S | H |
| ● | ● | ● | ○ | ○ | ○ |



Ausspitzung  $\geq \text{Ø } 3,000$  •  $180^\circ$  Spitzenanschliff für ebenen Bohrungsgrund • zum Pilotieren, Bohren, Anspiegeln • geringe Gratbildung  
 • Pilotieren in allen Lagen und Werkstoffen

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • legierte Stähle bis  $1200 \text{ N/mm}^2$  • rostfreie Stähle • Gusswerkstoffe



| d1    |       | d2 h6 | l1     | l2     | l3     | d1    |       | d2 h6  | l1     | l2     | l3     |
|-------|-------|-------|--------|--------|--------|-------|-------|--------|--------|--------|--------|
| mm    | inch  | mm    | mm     | mm     | mm     | mm    | inch  | mm     | mm     | mm     | mm     |
| 3,000 |       | 6,000 | 61,000 | 16,000 | 40,000 | 5,900 |       | 6,000  | 65,000 | 26,000 | 36,000 |
| 3,100 |       | 6,000 | 61,000 | 16,000 | 40,000 | 5,950 | 15/64 | 6,000  | 65,000 | 26,000 | 36,000 |
| 3,170 | 1/8   | 6,000 | 61,000 | 16,000 | 40,000 | 6,000 |       | 6,000  | 65,000 | 26,000 | 36,000 |
| 3,200 |       | 6,000 | 61,000 | 16,000 | 40,000 | 6,100 |       | 8,000  | 78,000 | 31,000 | 36,000 |
| 3,250 |       | 6,000 | 61,000 | 16,000 | 40,000 | 6,200 |       | 8,000  | 78,000 | 31,000 | 36,000 |
| 3,300 |       | 6,000 | 61,000 | 16,000 | 40,000 | 6,300 |       | 8,000  | 78,000 | 31,000 | 36,000 |
| 3,400 |       | 6,000 | 61,000 | 16,000 | 40,000 | 6,350 | 1/4   | 8,000  | 78,000 | 31,000 | 36,000 |
| 3,500 |       | 6,000 | 61,000 | 16,000 | 40,000 | 6,400 |       | 8,000  | 78,000 | 31,000 | 36,000 |
| 3,570 | 9/64  | 6,000 | 61,000 | 16,000 | 40,000 | 6,500 |       | 8,000  | 78,000 | 31,000 | 36,000 |
| 3,600 |       | 6,000 | 61,000 | 16,000 | 40,000 | 6,530 |       | 8,000  | 78,000 | 31,000 | 36,000 |
| 3,700 |       | 6,000 | 61,000 | 16,000 | 40,000 | 6,550 |       | 8,000  | 78,000 | 31,000 | 36,000 |
| 3,800 |       | 6,000 | 65,000 | 18,000 | 40,000 | 6,600 |       | 8,000  | 78,000 | 31,000 | 36,000 |
| 3,900 |       | 6,000 | 65,000 | 18,000 | 40,000 | 6,700 |       | 8,000  | 78,000 | 31,000 | 36,000 |
| 3,970 | 5/32  | 6,000 | 65,000 | 18,000 | 40,000 | 6,750 | 17/64 | 8,000  | 78,000 | 31,000 | 36,000 |
| 4,000 |       | 6,000 | 65,000 | 18,000 | 40,000 | 6,800 |       | 8,000  | 78,000 | 31,000 | 36,000 |
| 4,040 |       | 6,000 | 65,000 | 18,000 | 40,000 | 6,900 |       | 8,000  | 78,000 | 31,000 | 36,000 |
| 4,100 |       | 6,000 | 65,000 | 18,000 | 40,000 | 7,000 |       | 8,000  | 78,000 | 31,000 | 36,000 |
| 4,200 |       | 6,000 | 65,000 | 18,000 | 40,000 | 7,100 |       | 8,000  | 78,000 | 35,000 | 36,000 |
| 4,300 |       | 6,000 | 65,000 | 21,000 | 40,000 | 7,140 | 9/32  | 8,000  | 78,000 | 35,000 | 36,000 |
| 4,370 | 11/64 | 6,000 | 65,000 | 21,000 | 40,000 | 7,200 |       | 8,000  | 78,000 | 35,000 | 36,000 |
| 4,400 |       | 6,000 | 65,000 | 21,000 | 40,000 | 7,300 |       | 8,000  | 78,000 | 35,000 | 36,000 |
| 4,500 |       | 6,000 | 65,000 | 21,000 | 40,000 | 7,400 |       | 8,000  | 78,000 | 35,000 | 36,000 |
| 4,600 |       | 6,000 | 65,000 | 21,000 | 40,000 | 7,500 |       | 8,000  | 78,000 | 35,000 | 36,000 |
| 4,650 |       | 6,000 | 65,000 | 21,000 | 40,000 | 7,540 | 19/64 | 8,000  | 78,000 | 35,000 | 36,000 |
| 4,700 |       | 6,000 | 65,000 | 21,000 | 40,000 | 7,550 |       | 8,000  | 78,000 | 35,000 | 36,000 |
| 4,760 | 3/16  | 6,000 | 65,000 | 26,000 | 36,000 | 7,600 |       | 8,000  | 78,000 | 35,000 | 36,000 |
| 4,800 |       | 6,000 | 65,000 | 26,000 | 36,000 | 7,650 |       | 8,000  | 78,000 | 35,000 | 36,000 |
| 4,900 |       | 6,000 | 65,000 | 26,000 | 36,000 | 7,700 |       | 8,000  | 78,000 | 35,000 | 36,000 |
| 5,000 |       | 6,000 | 65,000 | 26,000 | 36,000 | 7,800 |       | 8,000  | 78,000 | 35,000 | 36,000 |
| 5,100 |       | 6,000 | 65,000 | 26,000 | 36,000 | 7,900 |       | 8,000  | 78,000 | 35,000 | 36,000 |
| 5,110 |       | 6,000 | 65,000 | 26,000 | 36,000 | 7,940 | 5/16  | 8,000  | 78,000 | 35,000 | 36,000 |
| 5,160 | 13/64 | 6,000 | 65,000 | 26,000 | 36,000 | 8,000 |       | 8,000  | 78,000 | 35,000 | 36,000 |
| 5,200 |       | 6,000 | 65,000 | 26,000 | 36,000 | 8,100 |       | 10,000 | 87,000 | 43,000 | 40,000 |
| 5,300 |       | 6,000 | 65,000 | 26,000 | 36,000 | 8,200 |       | 10,000 | 87,000 | 43,000 | 40,000 |
| 5,400 |       | 6,000 | 65,000 | 26,000 | 36,000 | 8,300 |       | 10,000 | 87,000 | 43,000 | 40,000 |
| 5,410 |       | 6,000 | 65,000 | 26,000 | 36,000 | 8,330 | 21/64 | 10,000 | 87,000 | 43,000 | 40,000 |
| 5,500 |       | 6,000 | 65,000 | 26,000 | 36,000 | 8,400 |       | 10,000 | 87,000 | 43,000 | 40,000 |
| 5,550 |       | 6,000 | 65,000 | 26,000 | 36,000 | 8,500 |       | 10,000 | 87,000 | 43,000 | 40,000 |
| 5,560 | 7/32  | 6,000 | 65,000 | 26,000 | 36,000 | 8,600 |       | 10,000 | 87,000 | 43,000 | 40,000 |
| 5,600 |       | 6,000 | 65,000 | 26,000 | 36,000 | 8,700 |       | 10,000 | 87,000 | 43,000 | 40,000 |
| 5,700 |       | 6,000 | 65,000 | 26,000 | 36,000 | 8,730 | 11/32 | 10,000 | 87,000 | 43,000 | 40,000 |
| 5,800 |       | 6,000 | 65,000 | 26,000 | 36,000 | 8,800 |       | 10,000 | 87,000 | 43,000 | 40,000 |



## Flachbohrer mit Kühlkanälen

| d1<br>mm | inch  | d2 h6<br>mm | l1<br>mm | l2<br>mm | l3<br>mm | d1<br>mm | inch  | d2 h6<br>mm | l1<br>mm | l2<br>mm | l3<br>mm |
|----------|-------|-------------|----------|----------|----------|----------|-------|-------------|----------|----------|----------|
| 8,900    |       | 10,000      | 87,000   | 43,000   | 40,000   | 14,100   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,000    |       | 10,000      | 87,000   | 43,000   | 40,000   | 14,200   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,100    |       | 10,000      | 87,000   | 43,000   | 40,000   | 14,290   | 9/16  | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,130    | 23/64 | 10,000      | 87,000   | 43,000   | 40,000   | 14,300   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,200    |       | 10,000      | 87,000   | 43,000   | 40,000   | 14,400   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,250    |       | 10,000      | 87,000   | 43,000   | 40,000   | 14,500   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,300    |       | 10,000      | 87,000   | 43,000   | 40,000   | 14,600   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,340    |       | 10,000      | 87,000   | 43,000   | 40,000   | 14,680   | 37/64 | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,400    |       | 10,000      | 87,000   | 43,000   | 40,000   | 14,700   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,500    |       | 10,000      | 87,000   | 43,000   | 40,000   | 14,800   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,520    | 3/8   | 10,000      | 87,000   | 43,000   | 40,000   | 14,900   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,550    |       | 10,000      | 87,000   | 43,000   | 40,000   | 15,000   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,600    |       | 10,000      | 87,000   | 43,000   | 40,000   | 15,080   | 19/32 | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,700    |       | 10,000      | 87,000   | 43,000   | 40,000   | 15,100   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,800    |       | 10,000      | 87,000   | 43,000   | 40,000   | 15,200   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,900    |       | 10,000      | 87,000   | 43,000   | 40,000   | 15,300   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 9,920    | 25/64 | 10,000      | 87,000   | 43,000   | 40,000   | 15,400   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 10,000   |       | 10,000      | 87,000   | 43,000   | 40,000   | 15,480   | 39/64 | 16,000      | 112,000  | 62,000   | 48,000   |
| 10,100   |       | 12,000      | 100,000  | 52,000   | 45,000   | 15,500   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 10,200   |       | 12,000      | 100,000  | 52,000   | 45,000   | 15,550   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 10,300   |       | 12,000      | 100,000  | 52,000   | 45,000   | 15,600   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 10,320   | 13/32 | 12,000      | 100,000  | 52,000   | 45,000   | 15,700   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 10,400   |       | 12,000      | 100,000  | 52,000   | 45,000   | 15,800   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 10,500   |       | 12,000      | 100,000  | 52,000   | 45,000   | 15,870   | 5/8   | 16,000      | 112,000  | 62,000   | 48,000   |
| 10,600   |       | 12,000      | 100,000  | 52,000   | 45,000   | 15,900   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 10,700   |       | 12,000      | 100,000  | 52,000   | 45,000   | 16,000   |       | 16,000      | 112,000  | 62,000   | 48,000   |
| 10,720   | 27/64 | 12,000      | 100,000  | 52,000   | 45,000   | 16,270   | 41/64 | 18,000      | 120,000  | 70,000   | 48,000   |
| 10,800   |       | 12,000      | 100,000  | 52,000   | 45,000   | 16,300   |       | 18,000      | 120,000  | 70,000   | 48,000   |
| 10,900   |       | 12,000      | 100,000  | 52,000   | 45,000   | 16,500   |       | 18,000      | 120,000  | 70,000   | 48,000   |
| 11,000   |       | 12,000      | 100,000  | 52,000   | 45,000   | 16,670   | 21/32 | 18,000      | 120,000  | 70,000   | 48,000   |
| 11,100   |       | 12,000      | 100,000  | 52,000   | 45,000   | 16,700   |       | 18,000      | 120,000  | 70,000   | 48,000   |
| 11,110   | 7/16  | 12,000      | 100,000  | 52,000   | 45,000   | 16,900   |       | 18,000      | 120,000  | 70,000   | 48,000   |
| 11,200   |       | 12,000      | 100,000  | 52,000   | 45,000   | 17,000   |       | 18,000      | 120,000  | 70,000   | 48,000   |
| 11,300   |       | 12,000      | 100,000  | 52,000   | 45,000   | 17,070   | 43/64 | 18,000      | 120,000  | 70,000   | 48,000   |
| 11,400   |       | 12,000      | 100,000  | 52,000   | 45,000   | 17,460   | 11/16 | 18,000      | 120,000  | 70,000   | 48,000   |
| 11,500   |       | 12,000      | 100,000  | 52,000   | 45,000   | 17,500   |       | 18,000      | 120,000  | 70,000   | 48,000   |
| 11,510   | 29/64 | 12,000      | 100,000  | 52,000   | 45,000   | 17,550   |       | 18,000      | 120,000  | 70,000   | 48,000   |
| 11,550   |       | 12,000      | 100,000  | 52,000   | 45,000   | 17,700   |       | 18,000      | 120,000  | 70,000   | 48,000   |
| 11,600   |       | 12,000      | 100,000  | 52,000   | 45,000   | 17,860   | 45/64 | 18,000      | 120,000  | 70,000   | 48,000   |
| 11,700   |       | 12,000      | 100,000  | 52,000   | 45,000   | 18,000   |       | 18,000      | 120,000  | 70,000   | 48,000   |
| 11,800   |       | 12,000      | 100,000  | 52,000   | 45,000   | 18,260   | 23/32 | 20,000      | 128,000  | 76,000   | 50,000   |
| 11,900   |       | 12,000      | 100,000  | 52,000   | 45,000   | 18,500   |       | 20,000      | 128,000  | 76,000   | 50,000   |
| 11,910   | 15/32 | 12,000      | 100,000  | 52,000   | 45,000   | 18,700   |       | 20,000      | 128,000  | 76,000   | 50,000   |
| 12,000   |       | 12,000      | 100,000  | 52,000   | 45,000   | 18,900   |       | 20,000      | 128,000  | 76,000   | 50,000   |
| 12,100   |       | 14,000      | 104,000  | 57,000   | 45,000   | 19,000   |       | 20,000      | 128,000  | 76,000   | 50,000   |
| 12,200   |       | 14,000      | 104,000  | 57,000   | 45,000   | 19,050   | 3/4   | 20,000      | 128,000  | 76,000   | 50,000   |
| 12,300   | 31/64 | 14,000      | 104,000  | 57,000   | 45,000   | 19,250   |       | 20,000      | 128,000  | 76,000   | 50,000   |
| 12,400   |       | 14,000      | 104,000  | 57,000   | 45,000   | 19,300   |       | 20,000      | 128,000  | 76,000   | 50,000   |
| 12,500   |       | 14,000      | 104,000  | 57,000   | 45,000   | 19,450   | 49/64 | 20,000      | 128,000  | 76,000   | 50,000   |
| 12,600   |       | 14,000      | 104,000  | 57,000   | 45,000   | 19,500   |       | 20,000      | 128,000  | 76,000   | 50,000   |
| 12,700   | 1/2   | 14,000      | 104,000  | 57,000   | 45,000   | 19,550   |       | 20,000      | 128,000  | 76,000   | 50,000   |
| 12,800   |       | 14,000      | 104,000  | 57,000   | 45,000   | 19,700   |       | 20,000      | 128,000  | 76,000   | 50,000   |
| 12,900   |       | 14,000      | 104,000  | 57,000   | 45,000   | 19,800   |       | 20,000      | 128,000  | 76,000   | 50,000   |
| 13,000   |       | 14,000      | 104,000  | 57,000   | 45,000   | 19,840   | 25/32 | 20,000      | 128,000  | 76,000   | 50,000   |
| 13,100   | 33/64 | 14,000      | 104,000  | 57,000   | 45,000   | 20,000   |       | 20,000      | 128,000  | 76,000   | 50,000   |
| 13,200   |       | 14,000      | 104,000  | 57,000   | 45,000   |          |       |             |          |          |          |
| 13,300   |       | 14,000      | 104,000  | 57,000   | 45,000   |          |       |             |          |          |          |
| 13,400   |       | 14,000      | 104,000  | 57,000   | 45,000   |          |       |             |          |          |          |
| 13,490   | 17/32 | 14,000      | 104,000  | 57,000   | 45,000   |          |       |             |          |          |          |
| 13,500   |       | 14,000      | 104,000  | 57,000   | 45,000   |          |       |             |          |          |          |
| 13,600   |       | 14,000      | 104,000  | 57,000   | 45,000   |          |       |             |          |          |          |
| 13,700   |       | 14,000      | 104,000  | 57,000   | 45,000   |          |       |             |          |          |          |
| 13,800   |       | 14,000      | 104,000  | 57,000   | 45,000   |          |       |             |          |          |          |
| 13,890   | 35/64 | 14,000      | 104,000  | 57,000   | 45,000   |          |       |             |          |          |          |
| 13,900   |       | 14,000      | 104,000  | 57,000   | 45,000   |          |       |             |          |          |          |
| 14,000   |       | 14,000      | 104,000  | 57,000   | 45,000   |          |       |             |          |          |          |

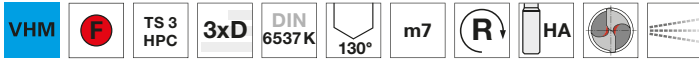


## TS-Drills, 3-schneidig

Artikel-Nr. 89527

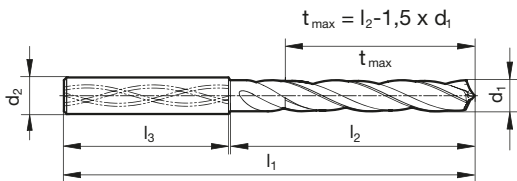


|   |   |   |   |   |   |
|---|---|---|---|---|---|
| P | M | K | N | S | H |
| ● | ○ | ● | ○ | ○ | ○ |



Ausspitzung  $\geq \varnothing 4,000$  • Spiropointanschliff • optimales Zentrieren • für unterbrochenen Schnitt geeignet • höchste Leistungsfähigkeit

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis 1400 N/mm<sup>2</sup> • Gusswerkstoffe



| d1    | d2 h6 | l1     | l2     | l3     | d1    | d2 h6  | l1     | l2     | l3     |
|-------|-------|--------|--------|--------|-------|--------|--------|--------|--------|
| mm    | mm    | mm     | mm     | mm     | mm    | mm     | mm     | mm     | mm     |
| 4,000 | 6,000 | 66,000 | 24,000 | 36,000 | 6,800 | 8,000  | 79,000 | 34,000 | 36,000 |
| 4,040 | 6,000 | 66,000 | 24,000 | 36,000 | 6,900 | 8,000  | 79,000 | 34,000 | 36,000 |
| 4,100 | 6,000 | 66,000 | 24,000 | 36,000 | 7,000 | 8,000  | 79,000 | 34,000 | 36,000 |
| 4,200 | 6,000 | 66,000 | 24,000 | 36,000 | 7,100 | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,300 | 6,000 | 66,000 | 24,000 | 36,000 | 7,140 | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,370 | 6,000 | 66,000 | 24,000 | 36,000 | 7,200 | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,400 | 6,000 | 66,000 | 24,000 | 36,000 | 7,300 | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,500 | 6,000 | 66,000 | 24,000 | 36,000 | 7,400 | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,600 | 6,000 | 66,000 | 24,000 | 36,000 | 7,500 | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,650 | 6,000 | 66,000 | 24,000 | 36,000 | 7,540 | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,700 | 6,000 | 66,000 | 24,000 | 36,000 | 7,550 | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,760 | 6,000 | 66,000 | 28,000 | 36,000 | 7,600 | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,800 | 6,000 | 66,000 | 28,000 | 36,000 | 7,650 | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,900 | 6,000 | 66,000 | 28,000 | 36,000 | 7,700 | 8,000  | 79,000 | 41,000 | 36,000 |
| 5,000 | 6,000 | 66,000 | 28,000 | 36,000 | 7,800 | 8,000  | 79,000 | 41,000 | 36,000 |
| 5,100 | 6,000 | 66,000 | 28,000 | 36,000 | 7,900 | 8,000  | 79,000 | 41,000 | 36,000 |
| 5,110 | 6,000 | 66,000 | 28,000 | 36,000 | 7,940 | 8,000  | 79,000 | 41,000 | 36,000 |
| 5,160 | 6,000 | 66,000 | 28,000 | 36,000 | 8,000 | 8,000  | 79,000 | 41,000 | 36,000 |
| 5,200 | 6,000 | 66,000 | 28,000 | 36,000 | 8,100 | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,300 | 6,000 | 66,000 | 28,000 | 36,000 | 8,200 | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,400 | 6,000 | 66,000 | 28,000 | 36,000 | 8,300 | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,410 | 6,000 | 66,000 | 28,000 | 36,000 | 8,330 | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,500 | 6,000 | 66,000 | 28,000 | 36,000 | 8,400 | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,550 | 6,000 | 66,000 | 28,000 | 36,000 | 8,500 | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,560 | 6,000 | 66,000 | 28,000 | 36,000 | 8,600 | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,600 | 6,000 | 66,000 | 28,000 | 36,000 | 8,700 | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,700 | 6,000 | 66,000 | 28,000 | 36,000 | 8,730 | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,800 | 6,000 | 66,000 | 28,000 | 36,000 | 8,800 | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,900 | 6,000 | 66,000 | 28,000 | 36,000 | 8,900 | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,950 | 6,000 | 66,000 | 28,000 | 36,000 | 9,000 | 10,000 | 89,000 | 47,000 | 40,000 |
| 6,000 | 6,000 | 66,000 | 28,000 | 36,000 | 9,100 | 10,000 | 89,000 | 47,000 | 40,000 |
| 6,100 | 8,000 | 79,000 | 34,000 | 36,000 | 9,130 | 10,000 | 89,000 | 47,000 | 40,000 |
| 6,200 | 8,000 | 79,000 | 34,000 | 36,000 | 9,200 | 10,000 | 89,000 | 47,000 | 40,000 |
| 6,300 | 8,000 | 79,000 | 34,000 | 36,000 | 9,250 | 10,000 | 89,000 | 47,000 | 40,000 |
| 6,350 | 8,000 | 79,000 | 34,000 | 36,000 | 9,300 | 10,000 | 89,000 | 47,000 | 40,000 |
| 6,400 | 8,000 | 79,000 | 34,000 | 36,000 | 9,340 | 10,000 | 89,000 | 47,000 | 40,000 |
| 6,500 | 8,000 | 79,000 | 34,000 | 36,000 | 9,400 | 10,000 | 89,000 | 47,000 | 40,000 |
| 6,530 | 8,000 | 79,000 | 34,000 | 36,000 | 9,500 | 10,000 | 89,000 | 47,000 | 40,000 |
| 6,550 | 8,000 | 79,000 | 34,000 | 36,000 | 9,520 | 10,000 | 89,000 | 47,000 | 40,000 |
| 6,600 | 8,000 | 79,000 | 34,000 | 36,000 | 9,550 | 10,000 | 89,000 | 47,000 | 40,000 |
| 6,700 | 8,000 | 79,000 | 34,000 | 36,000 | 9,600 | 10,000 | 89,000 | 47,000 | 40,000 |
| 6,750 | 8,000 | 79,000 | 34,000 | 36,000 | 9,700 | 10,000 | 89,000 | 47,000 | 40,000 |



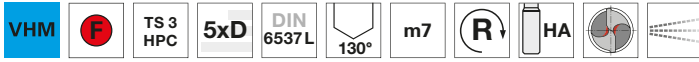


## TS-Drills, 3-schneidig

Artikel-Nr. 89526

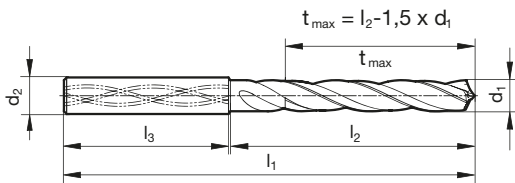


|   |   |   |   |   |   |
|---|---|---|---|---|---|
| P | M | K | N | S | H |
| ● | ○ | ● | ○ | ○ | ○ |



Ausspitzung  $\geq \varnothing 4,000$  • Spiropointanschliff • optimales Zentrieren • für unterbrochenen Schnitt geeignet • höchste Leistungsfähigkeit

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis 1400 N/mm<sup>2</sup> • Gusswerkstoffe



| d1    | d2 h6 | l1     | l2     | l3     | d1    | d2 h6  | l1      | l2     | l3     |
|-------|-------|--------|--------|--------|-------|--------|---------|--------|--------|
| mm    | mm    | mm     | mm     | mm     | mm    | mm     | mm      | mm     | mm     |
| 4,000 | 6,000 | 74,000 | 36,000 | 36,000 | 6,800 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,040 | 6,000 | 74,000 | 36,000 | 36,000 | 6,900 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,100 | 6,000 | 74,000 | 36,000 | 36,000 | 7,000 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,200 | 6,000 | 74,000 | 36,000 | 36,000 | 7,100 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,300 | 6,000 | 74,000 | 36,000 | 36,000 | 7,140 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,370 | 6,000 | 74,000 | 36,000 | 36,000 | 7,200 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,400 | 6,000 | 74,000 | 36,000 | 36,000 | 7,300 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,500 | 6,000 | 74,000 | 36,000 | 36,000 | 7,400 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,600 | 6,000 | 74,000 | 36,000 | 36,000 | 7,500 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,650 | 6,000 | 74,000 | 36,000 | 36,000 | 7,540 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,700 | 6,000 | 74,000 | 36,000 | 36,000 | 7,550 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,760 | 6,000 | 82,000 | 44,000 | 36,000 | 7,600 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,800 | 6,000 | 82,000 | 44,000 | 36,000 | 7,650 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,900 | 6,000 | 82,000 | 44,000 | 36,000 | 7,700 | 8,000  | 91,000  | 53,000 | 36,000 |
| 5,000 | 6,000 | 82,000 | 44,000 | 36,000 | 7,800 | 8,000  | 91,000  | 53,000 | 36,000 |
| 5,100 | 6,000 | 82,000 | 44,000 | 36,000 | 7,900 | 8,000  | 91,000  | 53,000 | 36,000 |
| 5,110 | 6,000 | 82,000 | 44,000 | 36,000 | 7,940 | 8,000  | 91,000  | 53,000 | 36,000 |
| 5,160 | 6,000 | 82,000 | 44,000 | 36,000 | 8,000 | 8,000  | 91,000  | 53,000 | 36,000 |
| 5,200 | 6,000 | 82,000 | 44,000 | 36,000 | 8,100 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,300 | 6,000 | 82,000 | 44,000 | 36,000 | 8,200 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,400 | 6,000 | 82,000 | 44,000 | 36,000 | 8,300 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,410 | 6,000 | 82,000 | 44,000 | 36,000 | 8,330 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,500 | 6,000 | 82,000 | 44,000 | 36,000 | 8,400 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,550 | 6,000 | 82,000 | 44,000 | 36,000 | 8,500 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,560 | 6,000 | 82,000 | 44,000 | 36,000 | 8,600 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,600 | 6,000 | 82,000 | 44,000 | 36,000 | 8,700 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,700 | 6,000 | 82,000 | 44,000 | 36,000 | 8,730 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,800 | 6,000 | 82,000 | 44,000 | 36,000 | 8,800 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,900 | 6,000 | 82,000 | 44,000 | 36,000 | 8,900 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,950 | 6,000 | 82,000 | 44,000 | 36,000 | 9,000 | 10,000 | 103,000 | 61,000 | 40,000 |
| 6,000 | 6,000 | 82,000 | 44,000 | 36,000 | 9,100 | 10,000 | 103,000 | 61,000 | 40,000 |
| 6,100 | 8,000 | 91,000 | 53,000 | 36,000 | 9,130 | 10,000 | 103,000 | 61,000 | 40,000 |
| 6,200 | 8,000 | 91,000 | 53,000 | 36,000 | 9,200 | 10,000 | 103,000 | 61,000 | 40,000 |
| 6,300 | 8,000 | 91,000 | 53,000 | 36,000 | 9,250 | 10,000 | 103,000 | 61,000 | 40,000 |
| 6,350 | 8,000 | 91,000 | 53,000 | 36,000 | 9,300 | 10,000 | 103,000 | 61,000 | 40,000 |
| 6,400 | 8,000 | 91,000 | 53,000 | 36,000 | 9,340 | 10,000 | 103,000 | 61,000 | 40,000 |
| 6,500 | 8,000 | 91,000 | 53,000 | 36,000 | 9,400 | 10,000 | 103,000 | 61,000 | 40,000 |
| 6,530 | 8,000 | 91,000 | 53,000 | 36,000 | 9,500 | 10,000 | 103,000 | 61,000 | 40,000 |
| 6,550 | 8,000 | 91,000 | 53,000 | 36,000 | 9,520 | 10,000 | 103,000 | 61,000 | 40,000 |
| 6,600 | 8,000 | 91,000 | 53,000 | 36,000 | 9,550 | 10,000 | 103,000 | 61,000 | 40,000 |
| 6,700 | 8,000 | 91,000 | 53,000 | 36,000 | 9,600 | 10,000 | 103,000 | 61,000 | 40,000 |
| 6,750 | 8,000 | 91,000 | 53,000 | 36,000 | 9,700 | 10,000 | 103,000 | 61,000 | 40,000 |





## NC-Anbohrer

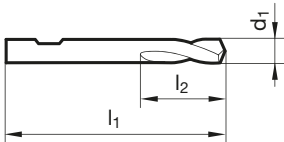
Artikel-Nr. 89203



|   |   |   |   |   |   |
|---|---|---|---|---|---|
| P | M | K | N | S | H |
| • | • | • | ○ | • | ○ |



nur zum Anbohren geeignet •  $\geq \varnothing 6,0$  mm mit Spannfläche Schaffform HB •  $\leq \varnothing 3,0$  mm Schaft- $\varnothing 4,0$  mm mit HA-Ausführung  
universelle Materialeignung



| d1<br>mm | d2<br>mm | l1<br>mm | l2<br>mm | d1<br>mm | d2<br>mm | l1<br>mm | l2<br>mm |
|----------|----------|----------|----------|----------|----------|----------|----------|
| 1,000    | 4,000    | 50,000   | 3,000    | 8,000    | 8,000    | 79,000   | 21,000   |
| 2,000    | 4,000    | 50,000   | 6,000    | 10,000   | 10,000   | 89,000   | 25,000   |
| 3,000    | 4,000    | 50,000   | 9,000    | 12,000   | 12,000   | 102,000  | 30,000   |
| 4,000    | 4,000    | 55,000   | 12,000   | 16,000   | 16,000   | 115,000  | 37,500   |
| 5,000    | 5,000    | 62,000   | 14,000   | 20,000   | 20,000   | 131,000  | 45,000   |
| 6,000    | 6,000    | 66,000   | 16,000   |          |          |          |          |

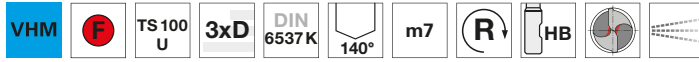


## TS-Drills mit Innenkühlung

Artikel-Nr. 89428

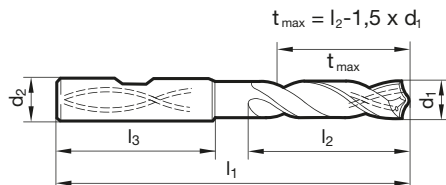


|   |   |   |   |   |   |
|---|---|---|---|---|---|
| P | M | K | N | S | H |
| ● | ○ | ● | ○ | ○ | ○ |



Ausspitzung  $\geq \text{Ø } 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis  $1200 \text{ N/mm}^2$  • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



| d1    |       | d2 h6 | l1     | l2     | l3     | d1    |       | d2 h6  | l1     | l2     | l3     |
|-------|-------|-------|--------|--------|--------|-------|-------|--------|--------|--------|--------|
| mm    | inch  | mm    | mm     | mm     | mm     | mm    | inch  | mm     | mm     | mm     | mm     |
| 3,000 |       | 6,000 | 62,000 | 20,000 | 36,000 | 5,700 |       | 6,000  | 66,000 | 28,000 | 36,000 |
| 3,100 |       | 6,000 | 62,000 | 20,000 | 36,000 | 5,750 |       | 6,000  | 66,000 | 28,000 | 36,000 |
| 3,170 | 1/8   | 6,000 | 62,000 | 20,000 | 36,000 | 5,800 |       | 6,000  | 66,000 | 28,000 | 36,000 |
| 3,200 |       | 6,000 | 62,000 | 20,000 | 36,000 | 5,900 |       | 6,000  | 66,000 | 28,000 | 36,000 |
| 3,250 |       | 6,000 | 62,000 | 20,000 | 36,000 | 5,950 | 15/64 | 6,000  | 66,000 | 28,000 | 36,000 |
| 3,300 |       | 6,000 | 62,000 | 20,000 | 36,000 | 6,000 |       | 6,000  | 66,000 | 28,000 | 36,000 |
| 3,400 |       | 6,000 | 62,000 | 20,000 | 36,000 | 6,100 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,500 |       | 6,000 | 62,000 | 20,000 | 36,000 | 6,200 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,570 | 9/64  | 6,000 | 62,000 | 20,000 | 36,000 | 6,300 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,600 |       | 6,000 | 62,000 | 20,000 | 36,000 | 6,350 | 1/4   | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,700 |       | 6,000 | 62,000 | 20,000 | 36,000 | 6,400 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,800 |       | 6,000 | 66,000 | 24,000 | 36,000 | 6,500 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,900 |       | 6,000 | 66,000 | 24,000 | 36,000 | 6,530 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,970 | 5/32  | 6,000 | 66,000 | 24,000 | 36,000 | 6,600 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 4,000 |       | 6,000 | 66,000 | 24,000 | 36,000 | 6,700 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 4,040 |       | 6,000 | 66,000 | 24,000 | 36,000 | 6,750 | 17/64 | 8,000  | 79,000 | 34,000 | 36,000 |
| 4,100 |       | 6,000 | 66,000 | 24,000 | 36,000 | 6,800 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 4,200 |       | 6,000 | 66,000 | 24,000 | 36,000 | 6,900 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 4,300 |       | 6,000 | 66,000 | 24,000 | 36,000 | 7,000 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 4,370 | 11/64 | 6,000 | 66,000 | 24,000 | 36,000 | 7,100 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,400 |       | 6,000 | 66,000 | 24,000 | 36,000 | 7,140 | 9/32  | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,500 |       | 6,000 | 66,000 | 24,000 | 36,000 | 7,200 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,600 |       | 6,000 | 66,000 | 24,000 | 36,000 | 7,300 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,650 |       | 6,000 | 66,000 | 24,000 | 36,000 | 7,400 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,700 |       | 6,000 | 66,000 | 24,000 | 36,000 | 7,450 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,760 | 3/16  | 6,000 | 66,000 | 28,000 | 36,000 | 7,500 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,800 |       | 6,000 | 66,000 | 28,000 | 36,000 | 7,540 | 19/64 | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,900 |       | 6,000 | 66,000 | 28,000 | 36,000 | 7,600 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 5,000 |       | 6,000 | 66,000 | 28,000 | 36,000 | 7,700 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 5,100 |       | 6,000 | 66,000 | 28,000 | 36,000 | 7,800 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 5,110 |       | 6,000 | 66,000 | 28,000 | 36,000 | 7,900 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 5,160 | 13/64 | 6,000 | 66,000 | 28,000 | 36,000 | 7,940 | 5/16  | 8,000  | 79,000 | 41,000 | 36,000 |
| 5,200 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,000 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 5,250 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,100 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,300 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,200 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,400 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,300 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,410 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,330 | 21/64 | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,500 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,400 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,550 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,500 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,560 | 7/32  | 6,000 | 66,000 | 28,000 | 36,000 | 8,550 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,600 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,600 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,650 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,700 |       | 10,000 | 89,000 | 47,000 | 40,000 |



## TS-Drills mit Innenkühlung

| d1<br>mm | inch  | d2 h6<br>mm | l1<br>mm | l2<br>mm | l3<br>mm | d1<br>mm | inch  | d2 h6<br>mm | l1<br>mm | l2<br>mm | l3<br>mm |
|----------|-------|-------------|----------|----------|----------|----------|-------|-------------|----------|----------|----------|
| 8,730    | 11/32 | 10,000      | 89,000   | 47,000   | 40,000   | 14,100   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 8,800    |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,200   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 8,900    |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,290   | 9/16  | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,000    |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,300   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,100    |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,400   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,130    | 23/64 | 10,000      | 89,000   | 47,000   | 40,000   | 14,500   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,200    |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,600   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,250    |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,680   | 37/64 | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,300    |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,700   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,340    |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,800   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,400    |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,900   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,500    |       | 10,000      | 89,000   | 47,000   | 40,000   | 15,000   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,520    | 3/8   | 10,000      | 89,000   | 47,000   | 40,000   | 15,080   | 19/32 | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,600    |       | 10,000      | 89,000   | 47,000   | 40,000   | 15,100   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,700    |       | 10,000      | 89,000   | 47,000   | 40,000   | 15,200   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,800    |       | 10,000      | 89,000   | 47,000   | 40,000   | 15,300   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,900    |       | 10,000      | 89,000   | 47,000   | 40,000   | 15,400   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,920    | 25/64 | 10,000      | 89,000   | 47,000   | 40,000   | 15,480   | 39/64 | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,000   |       | 10,000      | 89,000   | 47,000   | 40,000   | 15,500   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,100   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,600   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,200   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,700   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,300   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,800   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,320   | 13/32 | 12,000      | 102,000  | 55,000   | 45,000   | 15,870   | 5/8   | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,400   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,900   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,500   |       | 12,000      | 102,000  | 55,000   | 45,000   | 16,000   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,600   |       | 12,000      | 102,000  | 55,000   | 45,000   | 16,100   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 10,700   |       | 12,000      | 102,000  | 55,000   | 45,000   | 16,200   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 10,720   | 27/64 | 12,000      | 102,000  | 55,000   | 45,000   | 16,270   | 41/64 | 18,000      | 123,000  | 73,000   | 48,000   |
| 10,800   |       | 12,000      | 102,000  | 55,000   | 45,000   | 16,500   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 10,900   |       | 12,000      | 102,000  | 55,000   | 45,000   | 16,670   | 21/32 | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,000   |       | 12,000      | 102,000  | 55,000   | 45,000   | 16,900   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,100   |       | 12,000      | 102,000  | 55,000   | 45,000   | 17,000   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,110   | 7/16  | 12,000      | 102,000  | 55,000   | 45,000   | 17,070   | 43/64 | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,200   |       | 12,000      | 102,000  | 55,000   | 45,000   | 17,200   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,300   |       | 12,000      | 102,000  | 55,000   | 45,000   | 17,300   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,400   |       | 12,000      | 102,000  | 55,000   | 45,000   | 17,400   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,500   |       | 12,000      | 102,000  | 55,000   | 45,000   | 17,460   | 11/16 | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,510   | 29/64 | 12,000      | 102,000  | 55,000   | 45,000   | 17,500   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,600   |       | 12,000      | 102,000  | 55,000   | 45,000   | 17,600   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,700   |       | 12,000      | 102,000  | 55,000   | 45,000   | 17,700   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,800   |       | 12,000      | 102,000  | 55,000   | 45,000   | 17,860   | 45/64 | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,900   |       | 12,000      | 102,000  | 55,000   | 45,000   | 17,900   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,910   | 15/32 | 12,000      | 102,000  | 55,000   | 45,000   | 18,000   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 12,000   |       | 12,000      | 102,000  | 55,000   | 45,000   | 18,260   | 23/32 | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,100   |       | 14,000      | 107,000  | 60,000   | 45,000   | 18,300   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,200   |       | 14,000      | 107,000  | 60,000   | 45,000   | 18,500   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,300   | 31/64 | 14,000      | 107,000  | 60,000   | 45,000   | 18,900   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,400   |       | 14,000      | 107,000  | 60,000   | 45,000   | 19,000   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,500   |       | 14,000      | 107,000  | 60,000   | 45,000   | 19,050   | 3/4   | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,600   |       | 14,000      | 107,000  | 60,000   | 45,000   | 19,250   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,700   | 1/2   | 14,000      | 107,000  | 60,000   | 45,000   | 19,300   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,800   |       | 14,000      | 107,000  | 60,000   | 45,000   | 19,446   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,900   |       | 14,000      | 107,000  | 60,000   | 45,000   | 19,500   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 13,000   |       | 14,000      | 107,000  | 60,000   | 45,000   | 19,840   | 25/32 | 20,000      | 131,000  | 79,000   | 50,000   |
| 13,100   | 33/64 | 14,000      | 107,000  | 60,000   | 45,000   | 19,900   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 13,200   |       | 14,000      | 107,000  | 60,000   | 45,000   | 20,000   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 13,300   |       | 14,000      | 107,000  | 60,000   | 45,000   |          |       |             |          |          |          |
| 13,400   |       | 14,000      | 107,000  | 60,000   | 45,000   |          |       |             |          |          |          |
| 13,490   | 17/32 | 14,000      | 107,000  | 60,000   | 45,000   |          |       |             |          |          |          |
| 13,500   |       | 14,000      | 107,000  | 60,000   | 45,000   |          |       |             |          |          |          |
| 13,600   |       | 14,000      | 107,000  | 60,000   | 45,000   |          |       |             |          |          |          |
| 13,700   |       | 14,000      | 107,000  | 60,000   | 45,000   |          |       |             |          |          |          |
| 13,800   |       | 14,000      | 107,000  | 60,000   | 45,000   |          |       |             |          |          |          |
| 13,890   | 35/64 | 14,000      | 107,000  | 60,000   | 45,000   |          |       |             |          |          |          |
| 13,900   |       | 14,000      | 107,000  | 60,000   | 45,000   |          |       |             |          |          |          |
| 14,000   |       | 14,000      | 107,000  | 60,000   | 45,000   |          |       |             |          |          |          |

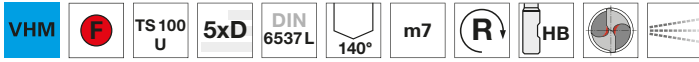


## TS-Drills mit Innenkühlung

Artikel-Nr. 89429

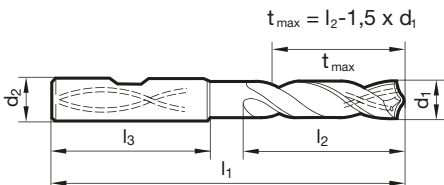


|   |   |   |   |   |   |
|---|---|---|---|---|---|
| P | M | K | N | S | H |
| ● | ○ | ● | ○ | ○ | ○ |



Ausspitzung  $\geq \text{Ø } 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis  $1200 \text{ N/mm}^2$  • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



| d1    |       | d2 h6 | l1     | l2     | l3     | d1    |       | d2 h6  | l1      | l2     | l3     |
|-------|-------|-------|--------|--------|--------|-------|-------|--------|---------|--------|--------|
| mm    | inch  | mm    | mm     | mm     | mm     | mm    | inch  | mm     | mm      | mm     | mm     |
| 3,000 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,100 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,100 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,200 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,170 | 1/8   | 6,000 | 66,000 | 28,000 | 36,000 | 6,300 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,200 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,350 | 1/4   | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,250 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,400 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,300 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,500 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,400 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,600 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,500 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,700 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,570 | 9/64  | 6,000 | 66,000 | 28,000 | 36,000 | 6,750 | 17/64 | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,600 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,800 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,700 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,900 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,800 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,000 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,900 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,100 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,970 | 5/32  | 6,000 | 74,000 | 36,000 | 36,000 | 7,140 | 9/32  | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,000 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,200 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,100 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,300 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,200 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,400 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,300 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,500 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,370 | 11/64 | 6,000 | 74,000 | 36,000 | 36,000 | 7,540 | 19/64 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,400 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,600 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,500 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,700 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,600 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,800 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,650 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,900 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,700 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,940 | 5/16  | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,760 | 3/16  | 6,000 | 82,000 | 44,000 | 36,000 | 8,000 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,800 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,100 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 4,900 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,200 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,000 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,300 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,100 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,330 | 21/64 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,160 | 13/64 | 6,000 | 82,000 | 44,000 | 36,000 | 8,400 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,200 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,500 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,300 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,600 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,400 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,700 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,500 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,730 | 11/32 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,550 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,800 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,560 | 7/32  | 6,000 | 82,000 | 44,000 | 36,000 | 8,900 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,600 |       | 6,000 | 82,000 | 44,000 | 36,000 | 9,000 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,700 |       | 6,000 | 82,000 | 44,000 | 36,000 | 9,100 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,800 |       | 6,000 | 82,000 | 44,000 | 36,000 | 9,130 | 23/64 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,900 |       | 6,000 | 82,000 | 44,000 | 36,000 | 9,200 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,950 | 15/64 | 6,000 | 82,000 | 44,000 | 36,000 | 9,250 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 6,000 |       | 6,000 | 82,000 | 44,000 | 36,000 | 9,300 |       | 10,000 | 103,000 | 61,000 | 40,000 |



## TS-Drills mit Innenkühlung

| d1<br>mm | inch  | d2 h6<br>mm | l1<br>mm | l2<br>mm | l3<br>mm | d1<br>mm | inch  | d2 h6<br>mm | l1<br>mm | l2<br>mm | l3<br>mm |
|----------|-------|-------------|----------|----------|----------|----------|-------|-------------|----------|----------|----------|
| 9,400    |       | 10,000      | 103,000  | 61,000   | 40,000   | 11,910   | 15/32 | 12,000      | 118,000  | 71,000   | 45,000   |
| 9,500    |       | 10,000      | 103,000  | 61,000   | 40,000   | 12,000   |       | 12,000      | 118,000  | 71,000   | 45,000   |
| 9,520    | 3/8   | 10,000      | 103,000  | 61,000   | 40,000   | 12,200   |       | 14,000      | 124,000  | 77,000   | 45,000   |
| 9,600    |       | 10,000      | 103,000  | 61,000   | 40,000   | 12,500   |       | 14,000      | 124,000  | 77,000   | 45,000   |
| 9,700    |       | 10,000      | 103,000  | 61,000   | 40,000   | 12,700   | 1/2   | 14,000      | 124,000  | 77,000   | 45,000   |
| 9,800    |       | 10,000      | 103,000  | 61,000   | 40,000   | 13,000   |       | 14,000      | 124,000  | 77,000   | 45,000   |
| 9,900    |       | 10,000      | 103,000  | 61,000   | 40,000   | 13,500   |       | 14,000      | 124,000  | 77,000   | 45,000   |
| 9,920    | 25/64 | 10,000      | 103,000  | 61,000   | 40,000   | 13,700   |       | 14,000      | 124,000  | 77,000   | 45,000   |
| 10,000   |       | 10,000      | 103,000  | 61,000   | 40,000   | 14,000   |       | 14,000      | 124,000  | 77,000   | 45,000   |
| 10,100   |       | 12,000      | 118,000  | 71,000   | 45,000   | 14,200   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,200   |       | 12,000      | 118,000  | 71,000   | 45,000   | 14,290   | 9/16  | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,300   |       | 12,000      | 118,000  | 71,000   | 45,000   | 14,500   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,320   | 13/32 | 12,000      | 118,000  | 71,000   | 45,000   | 14,700   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,400   |       | 12,000      | 118,000  | 71,000   | 45,000   | 15,000   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,500   |       | 12,000      | 118,000  | 71,000   | 45,000   | 15,200   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,600   |       | 12,000      | 118,000  | 71,000   | 45,000   | 15,500   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,700   |       | 12,000      | 118,000  | 71,000   | 45,000   | 15,700   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,800   |       | 12,000      | 118,000  | 71,000   | 45,000   | 16,000   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,900   |       | 12,000      | 118,000  | 71,000   | 45,000   | 16,500   |       | 18,000      | 143,000  | 93,000   | 48,000   |
| 11,000   |       | 12,000      | 118,000  | 71,000   | 45,000   | 17,000   |       | 18,000      | 143,000  | 93,000   | 48,000   |
| 11,100   |       | 12,000      | 118,000  | 71,000   | 45,000   | 17,500   |       | 18,000      | 143,000  | 93,000   | 48,000   |
| 11,110   | 7/16  | 12,000      | 118,000  | 71,000   | 45,000   | 18,000   |       | 18,000      | 143,000  | 93,000   | 48,000   |
| 11,200   |       | 12,000      | 118,000  | 71,000   | 45,000   | 18,500   |       | 20,000      | 153,000  | 101,000  | 50,000   |
| 11,300   |       | 12,000      | 118,000  | 71,000   | 45,000   | 19,000   |       | 20,000      | 153,000  | 101,000  | 50,000   |
| 11,400   |       | 12,000      | 118,000  | 71,000   | 45,000   | 19,050   | 3/4   | 20,000      | 153,000  | 101,000  | 50,000   |
| 11,500   |       | 12,000      | 118,000  | 71,000   | 45,000   | 19,500   |       | 20,000      | 153,000  | 101,000  | 50,000   |
| 11,600   |       | 12,000      | 118,000  | 71,000   | 45,000   | 20,000   |       | 20,000      | 153,000  | 101,000  | 50,000   |
| 11,700   |       | 12,000      | 118,000  | 71,000   | 45,000   |          |       |             |          |          |          |
| 11,800   |       | 12,000      | 118,000  | 71,000   | 45,000   |          |       |             |          |          |          |
| 11,900   |       | 12,000      | 118,000  | 71,000   | 45,000   |          |       |             |          |          |          |

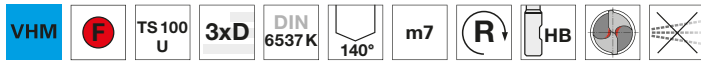


## TS-Drills ohne Innenkühlung

Artikel-Nr. 89430

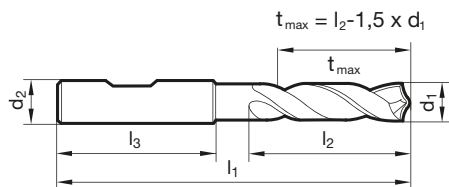


|   |   |   |   |   |   |
|---|---|---|---|---|---|
| P | M | K | N | S | H |
| ● | ○ | ● | ○ | ○ | ○ |



Ausspitzung  $\geq \text{Ø } 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis  $1200 \text{ N/mm}^2$  • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



| d1    |       | d2 h6 | l1     | l2     | l3     | d1    |       | d2 h6  | l1     | l2     | l3     |
|-------|-------|-------|--------|--------|--------|-------|-------|--------|--------|--------|--------|
| mm    | inch  | mm    | mm     | mm     | mm     | mm    | inch  | mm     | mm     | mm     | mm     |
| 3,000 |       | 6,000 | 62,000 | 20,000 | 36,000 | 5,800 |       | 6,000  | 66,000 | 28,000 | 36,000 |
| 3,100 |       | 6,000 | 62,000 | 20,000 | 36,000 | 5,900 |       | 6,000  | 66,000 | 28,000 | 36,000 |
| 3,170 | 1/8   | 6,000 | 62,000 | 20,000 | 36,000 | 5,950 | 15/64 | 6,000  | 66,000 | 28,000 | 36,000 |
| 3,200 |       | 6,000 | 62,000 | 20,000 | 36,000 | 6,000 |       | 6,000  | 66,000 | 28,000 | 36,000 |
| 3,250 |       | 6,000 | 62,000 | 20,000 | 36,000 | 6,100 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,300 |       | 6,000 | 62,000 | 20,000 | 36,000 | 6,200 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,400 |       | 6,000 | 62,000 | 20,000 | 36,000 | 6,300 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,500 |       | 6,000 | 62,000 | 20,000 | 36,000 | 6,350 | 1/4   | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,570 | 9/64  | 6,000 | 62,000 | 20,000 | 36,000 | 6,400 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,600 |       | 6,000 | 62,000 | 20,000 | 36,000 | 6,500 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,700 |       | 6,000 | 62,000 | 20,000 | 36,000 | 6,530 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,800 |       | 6,000 | 66,000 | 24,000 | 36,000 | 6,600 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,900 |       | 6,000 | 66,000 | 24,000 | 36,000 | 6,700 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 3,970 | 5/32  | 6,000 | 66,000 | 24,000 | 36,000 | 6,750 | 17/64 | 8,000  | 79,000 | 34,000 | 36,000 |
| 4,000 |       | 6,000 | 66,000 | 24,000 | 36,000 | 6,800 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 4,040 |       | 6,000 | 66,000 | 24,000 | 36,000 | 6,900 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 4,100 |       | 6,000 | 66,000 | 24,000 | 36,000 | 7,000 |       | 8,000  | 79,000 | 34,000 | 36,000 |
| 4,200 |       | 6,000 | 66,000 | 24,000 | 36,000 | 7,100 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,300 |       | 6,000 | 66,000 | 24,000 | 36,000 | 7,140 | 9/32  | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,370 | 11/64 | 6,000 | 66,000 | 24,000 | 36,000 | 7,200 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,400 |       | 6,000 | 66,000 | 24,000 | 36,000 | 7,300 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,500 |       | 6,000 | 66,000 | 24,000 | 36,000 | 7,400 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,600 |       | 6,000 | 66,000 | 24,000 | 36,000 | 7,500 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,650 |       | 6,000 | 66,000 | 24,000 | 36,000 | 7,540 | 19/64 | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,700 |       | 6,000 | 66,000 | 24,000 | 36,000 | 7,600 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,760 | 3/16  | 6,000 | 66,000 | 28,000 | 36,000 | 7,700 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,800 |       | 6,000 | 66,000 | 28,000 | 36,000 | 7,800 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 4,900 |       | 6,000 | 66,000 | 28,000 | 36,000 | 7,900 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 5,000 |       | 6,000 | 66,000 | 28,000 | 36,000 | 7,940 | 5/16  | 8,000  | 79,000 | 41,000 | 36,000 |
| 5,100 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,000 |       | 8,000  | 79,000 | 41,000 | 36,000 |
| 5,110 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,100 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,160 | 13/64 | 6,000 | 66,000 | 28,000 | 36,000 | 8,200 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,200 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,300 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,250 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,330 | 21/64 | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,300 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,400 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,400 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,500 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,410 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,600 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,500 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,700 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,550 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,730 | 11/32 | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,560 | 7/32  | 6,000 | 66,000 | 28,000 | 36,000 | 8,800 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,600 |       | 6,000 | 66,000 | 28,000 | 36,000 | 8,900 |       | 10,000 | 89,000 | 47,000 | 40,000 |
| 5,700 |       | 6,000 | 66,000 | 28,000 | 36,000 | 9,000 |       | 10,000 | 89,000 | 47,000 | 40,000 |



## TS-Drills ohne Innenkühlung

| d1<br>mm | inch  | d2 h6<br>mm | l1<br>mm | l2<br>mm | l3<br>mm | d1<br>mm | inch  | d2 h6<br>mm | l1<br>mm | l2<br>mm | l3<br>mm |
|----------|-------|-------------|----------|----------|----------|----------|-------|-------------|----------|----------|----------|
| 9,100    |       | 10,000      | 89,000   | 47,000   | 40,000   | 13,490   | 17/32 | 14,000      | 107,000  | 60,000   | 45,000   |
| 9,130    | 23/64 | 10,000      | 89,000   | 47,000   | 40,000   | 13,500   |       | 14,000      | 107,000  | 60,000   | 45,000   |
| 9,200    |       | 10,000      | 89,000   | 47,000   | 40,000   | 13,600   |       | 14,000      | 107,000  | 60,000   | 45,000   |
| 9,250    |       | 10,000      | 89,000   | 47,000   | 40,000   | 13,700   |       | 14,000      | 107,000  | 60,000   | 45,000   |
| 9,300    |       | 10,000      | 89,000   | 47,000   | 40,000   | 13,800   |       | 14,000      | 107,000  | 60,000   | 45,000   |
| 9,340    |       | 10,000      | 89,000   | 47,000   | 40,000   | 13,890   | 35/64 | 14,000      | 107,000  | 60,000   | 45,000   |
| 9,400    |       | 10,000      | 89,000   | 47,000   | 40,000   | 13,900   |       | 14,000      | 107,000  | 60,000   | 45,000   |
| 9,500    |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,000   |       | 14,000      | 107,000  | 60,000   | 45,000   |
| 9,520    | 3/8   | 10,000      | 89,000   | 47,000   | 40,000   | 14,100   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,600    |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,200   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,700    |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,290   | 9/16  | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,800    |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,300   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,900    |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,400   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 9,920    | 25/64 | 10,000      | 89,000   | 47,000   | 40,000   | 14,500   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,000   |       | 10,000      | 89,000   | 47,000   | 40,000   | 14,600   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,100   |       | 12,000      | 102,000  | 55,000   | 45,000   | 14,680   | 37/64 | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,200   |       | 12,000      | 102,000  | 55,000   | 45,000   | 14,700   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,300   |       | 12,000      | 102,000  | 55,000   | 45,000   | 14,800   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,320   | 13/32 | 12,000      | 102,000  | 55,000   | 45,000   | 14,900   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,400   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,000   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,500   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,080   | 19/32 | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,600   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,100   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,700   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,200   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,720   | 27/64 | 12,000      | 102,000  | 55,000   | 45,000   | 15,300   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,800   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,400   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 10,900   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,480   | 39/64 | 16,000      | 115,000  | 65,000   | 48,000   |
| 11,000   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,500   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 11,100   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,600   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 11,110   | 7/16  | 12,000      | 102,000  | 55,000   | 45,000   | 15,700   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 11,200   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,800   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 11,300   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,870   | 5/8   | 16,000      | 115,000  | 65,000   | 48,000   |
| 11,400   |       | 12,000      | 102,000  | 55,000   | 45,000   | 15,900   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 11,500   |       | 12,000      | 102,000  | 55,000   | 45,000   | 16,000   |       | 16,000      | 115,000  | 65,000   | 48,000   |
| 11,510   | 29/64 | 12,000      | 102,000  | 55,000   | 45,000   | 16,270   | 41/64 | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,600   |       | 12,000      | 102,000  | 55,000   | 45,000   | 16,500   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,700   |       | 12,000      | 102,000  | 55,000   | 45,000   | 16,670   | 21/32 | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,800   |       | 12,000      | 102,000  | 55,000   | 45,000   | 17,000   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,900   |       | 12,000      | 102,000  | 55,000   | 45,000   | 17,070   | 43/64 | 18,000      | 123,000  | 73,000   | 48,000   |
| 11,910   | 15/32 | 12,000      | 102,000  | 55,000   | 45,000   | 17,460   | 11/16 | 18,000      | 123,000  | 73,000   | 48,000   |
| 12,000   |       | 12,000      | 102,000  | 55,000   | 45,000   | 17,500   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 12,100   |       | 14,000      | 107,000  | 60,000   | 45,000   | 17,860   | 45/64 | 18,000      | 123,000  | 73,000   | 48,000   |
| 12,200   |       | 14,000      | 107,000  | 60,000   | 45,000   | 18,000   |       | 18,000      | 123,000  | 73,000   | 48,000   |
| 12,300   | 31/64 | 14,000      | 107,000  | 60,000   | 45,000   | 18,260   | 23/32 | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,400   |       | 14,000      | 107,000  | 60,000   | 45,000   | 18,500   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,500   |       | 14,000      | 107,000  | 60,000   | 45,000   | 19,000   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,600   |       | 14,000      | 107,000  | 60,000   | 45,000   | 19,050   | 3/4   | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,700   | 1/2   | 14,000      | 107,000  | 60,000   | 45,000   | 19,250   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,800   |       | 14,000      | 107,000  | 60,000   | 45,000   | 19,446   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 12,900   |       | 14,000      | 107,000  | 60,000   | 45,000   | 19,500   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 13,000   |       | 14,000      | 107,000  | 60,000   | 45,000   | 19,840   | 25/32 | 20,000      | 131,000  | 79,000   | 50,000   |
| 13,100   | 33/64 | 14,000      | 107,000  | 60,000   | 45,000   | 20,000   |       | 20,000      | 131,000  | 79,000   | 50,000   |
| 13,200   |       | 14,000      | 107,000  | 60,000   | 45,000   |          |       |             |          |          |          |
| 13,300   |       | 14,000      | 107,000  | 60,000   | 45,000   |          |       |             |          |          |          |
| 13,400   |       | 14,000      | 107,000  | 60,000   | 45,000   |          |       |             |          |          |          |





## TS-Drills ohne Innenkühlung

Artikel-Nr. 89431

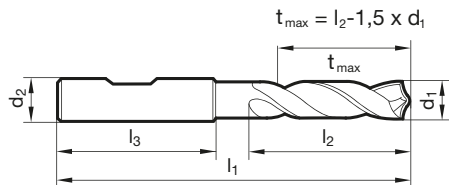


|   |   |   |   |   |   |
|---|---|---|---|---|---|
| P | M | K | N | S | H |
| ● | ○ | ● | ○ | ○ | ○ |



Ausspitzung  $\geq \text{Ø } 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis  $1200 \text{ N/mm}^2$  • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



| d1    |       | d2 h6 | l1     | l2     | l3     | d1    |       | d2 h6  | l1      | l2     | l3     |
|-------|-------|-------|--------|--------|--------|-------|-------|--------|---------|--------|--------|
| mm    | inch  | mm    | mm     | mm     | mm     | mm    | inch  | mm     | mm      | mm     | mm     |
| 3,000 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,100 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,100 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,200 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,170 | 1/8   | 6,000 | 66,000 | 28,000 | 36,000 | 6,300 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,200 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,350 | 1/4   | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,250 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,400 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,300 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,500 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,400 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,600 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,500 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,700 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,570 | 9/64  | 6,000 | 66,000 | 28,000 | 36,000 | 6,750 | 17/64 | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,600 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,800 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,700 |       | 6,000 | 66,000 | 28,000 | 36,000 | 6,900 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,800 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,000 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,900 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,100 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 3,970 | 5/32  | 6,000 | 74,000 | 36,000 | 36,000 | 7,140 | 9/32  | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,000 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,200 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,100 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,300 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,200 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,400 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,300 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,500 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,370 | 11/64 | 6,000 | 74,000 | 36,000 | 36,000 | 7,540 | 19/64 | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,400 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,600 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,500 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,700 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,600 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,800 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,650 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,900 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,700 |       | 6,000 | 74,000 | 36,000 | 36,000 | 7,940 | 5/16  | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,760 | 3/16  | 6,000 | 82,000 | 44,000 | 36,000 | 8,000 |       | 8,000  | 91,000  | 53,000 | 36,000 |
| 4,800 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,100 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 4,900 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,200 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,000 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,300 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,100 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,330 | 21/64 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,160 | 13/64 | 6,000 | 82,000 | 44,000 | 36,000 | 8,400 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,200 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,500 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,300 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,600 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,400 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,700 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,500 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,730 | 11/32 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,550 |       | 6,000 | 82,000 | 44,000 | 36,000 | 8,800 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,560 | 7/32  | 6,000 | 82,000 | 44,000 | 36,000 | 8,900 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,600 |       | 6,000 | 82,000 | 44,000 | 36,000 | 9,000 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,700 |       | 6,000 | 82,000 | 44,000 | 36,000 | 9,100 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,800 |       | 6,000 | 82,000 | 44,000 | 36,000 | 9,130 | 23/64 | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,900 |       | 6,000 | 82,000 | 44,000 | 36,000 | 9,200 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 5,950 | 15/64 | 6,000 | 82,000 | 44,000 | 36,000 | 9,250 |       | 10,000 | 103,000 | 61,000 | 40,000 |
| 6,000 |       | 6,000 | 82,000 | 44,000 | 36,000 | 9,300 |       | 10,000 | 103,000 | 61,000 | 40,000 |



## TS-Drills ohne Innenkühlung

| d1<br>mm | inch  | d2 h6<br>mm | l1<br>mm | l2<br>mm | l3<br>mm | d1<br>mm | inch  | d2 h6<br>mm | l1<br>mm | l2<br>mm | l3<br>mm |
|----------|-------|-------------|----------|----------|----------|----------|-------|-------------|----------|----------|----------|
| 9,400    |       | 10,000      | 103,000  | 61,000   | 40,000   | 11,910   | 15/32 | 12,000      | 118,000  | 71,000   | 45,000   |
| 9,500    |       | 10,000      | 103,000  | 61,000   | 40,000   | 12,000   |       | 12,000      | 118,000  | 71,000   | 45,000   |
| 9,520    | 3/8   | 10,000      | 103,000  | 61,000   | 40,000   | 12,200   |       | 14,000      | 124,000  | 77,000   | 45,000   |
| 9,600    |       | 10,000      | 103,000  | 61,000   | 40,000   | 12,500   |       | 14,000      | 124,000  | 77,000   | 45,000   |
| 9,700    |       | 10,000      | 103,000  | 61,000   | 40,000   | 12,700   | 1/2   | 14,000      | 124,000  | 77,000   | 45,000   |
| 9,800    |       | 10,000      | 103,000  | 61,000   | 40,000   | 13,000   |       | 14,000      | 124,000  | 77,000   | 45,000   |
| 9,900    |       | 10,000      | 103,000  | 61,000   | 40,000   | 13,500   |       | 14,000      | 124,000  | 77,000   | 45,000   |
| 9,920    | 25/64 | 10,000      | 103,000  | 61,000   | 40,000   | 13,700   |       | 14,000      | 124,000  | 77,000   | 45,000   |
| 10,000   |       | 10,000      | 103,000  | 61,000   | 40,000   | 14,000   |       | 14,000      | 124,000  | 77,000   | 45,000   |
| 10,100   |       | 12,000      | 118,000  | 71,000   | 45,000   | 14,200   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,200   |       | 12,000      | 118,000  | 71,000   | 45,000   | 14,290   | 9/16  | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,300   |       | 12,000      | 118,000  | 71,000   | 45,000   | 14,500   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,320   | 13/32 | 12,000      | 118,000  | 71,000   | 45,000   | 14,700   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,400   |       | 12,000      | 118,000  | 71,000   | 45,000   | 15,000   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,500   |       | 12,000      | 118,000  | 71,000   | 45,000   | 15,200   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,600   |       | 12,000      | 118,000  | 71,000   | 45,000   | 15,500   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,700   |       | 12,000      | 118,000  | 71,000   | 45,000   | 15,700   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,800   |       | 12,000      | 118,000  | 71,000   | 45,000   | 16,000   |       | 16,000      | 133,000  | 83,000   | 48,000   |
| 10,900   |       | 12,000      | 118,000  | 71,000   | 45,000   | 16,500   |       | 18,000      | 143,000  | 93,000   | 48,000   |
| 11,000   |       | 12,000      | 118,000  | 71,000   | 45,000   | 17,000   |       | 18,000      | 143,000  | 93,000   | 48,000   |
| 11,100   |       | 12,000      | 118,000  | 71,000   | 45,000   | 17,500   |       | 18,000      | 143,000  | 93,000   | 48,000   |
| 11,110   | 7/16  | 12,000      | 118,000  | 71,000   | 45,000   | 18,000   |       | 18,000      | 143,000  | 93,000   | 48,000   |
| 11,200   |       | 12,000      | 118,000  | 71,000   | 45,000   | 18,500   |       | 20,000      | 153,000  | 101,000  | 50,000   |
| 11,300   |       | 12,000      | 118,000  | 71,000   | 45,000   | 19,000   |       | 20,000      | 153,000  | 101,000  | 50,000   |
| 11,400   |       | 12,000      | 118,000  | 71,000   | 45,000   | 19,500   |       | 20,000      | 153,000  | 101,000  | 50,000   |
| 11,500   |       | 12,000      | 118,000  | 71,000   | 45,000   | 20,000   |       | 20,000      | 153,000  | 101,000  | 50,000   |
| 11,600   |       | 12,000      | 118,000  | 71,000   | 45,000   |          |       |             |          |          |          |
| 11,700   |       | 12,000      | 118,000  | 71,000   | 45,000   |          |       |             |          |          |          |
| 11,800   |       | 12,000      | 118,000  | 71,000   | 45,000   |          |       |             |          |          |          |
| 11,900   |       | 12,000      | 118,000  | 71,000   | 45,000   |          |       |             |          |          |          |

# EINSATZEMPFEHLUNGEN



# ANWENDUNGSEMPFEHLUNGEN

## VHM-Bohrer

### Allgemeine Hinweise:

Leistungsstarke Maschinen, spielarme Spindeln, fluchtungsgenaue Werkzeugaufnahmen, Rundlauffehler der Werkzeuge im eingespannten Zustand max. 0,02 mm, hohe Kühlmitteldrücke. Wir empfehlen die Anwendung von Hydraulik-Dehnspannfuttern oder Schrumpffutter.

### Hinweise zur Kühlung für VHM-Bohrer:

Wir empfehlen Kühlschmierung durch Emulsion oder Öl. Alternativ kann unter bestimmten Voraussetzungen auch mit Luftkühlung gearbeitet werden. Statt Luftkühlung würden wir jedoch immer den Einsatz unter MQL-Bedingungen bevorzugen, für den die Werkzeuge besonders geeignet sind. Bei MQL-Einsatz empfehlen wir die Verwendung des kegeligen MQL-Schaffendes sowie der Hartner MQL-Einbauteile. Unser Außendienst berät Sie gerne.

## Flachbohrer

Beim Anbohren mit dem Flachbohrer (Art. 89519) gibt es folgendes zu beachten:

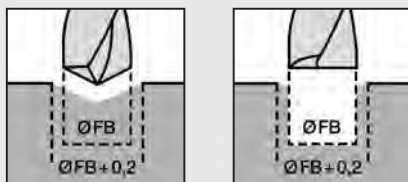
### Anbohren an geneigten Flächen/beim Austritt an geneigten Flächen:

- Neigung bis 15° = Vorschubreduzierung  $f$  in mm/U um 25 %
- Neigung bis 30° = Vorschubreduzierung  $f$  in mm/U um 50 %
- Neigung bis max. 45° = Vorschubreduzierung  $f$  in mm/U um 75 %
- bei voller Umschlingung des Flachbohrers kann der Vorschub auf 100 % erhöht werden

### Anbohren auf ebenen Flächen:



ACHTUNG: Beim Bohren auf ebenen Flächen muss immer vorgebohrt werden.

1. Anbohren mit herkömmlichem VHM-Bohrer auf  $\varnothing$  FB des folgenden Flachbohrers oder auf  $\varnothing$  FB + 0,20 mm des folgenden Flachbohrers, um direkt eine Fase anzubringen.
2. Den Flachbohrer mit vollem Vorschub einsetzen.




## Flachbohrer mit Kühlkanälen



| Zerspanungsgruppe   |  | f (mm/U) bei Nenn-Ø   |       |       |       |       |       |       |       |
|---|---|---|-------|-------|-------|-------|-------|-------|-------|
|   |   |  | 3     | 6     | 8     | 10    | 12    | 14    | 16    |
|   | $v_c$ (m/min)   |   |       |       |       |       |       |       |       |
| P1.1.1 Unlegierter Stahl, gegläht, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB                            | 100   | 0,075   | 0,130 | 0,160 | 0,190 | 0,220 | 0,250 | 0,275 | 0,325 |
| P1.1.2 Unlegierter Stahl, vergütet, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB                           | 90  | 0,070   | 0,115 | 0,145 | 0,175 | 0,200 | 0,225 | 0,245 | 0,295 |
| P1.1.3 Unlegierter Stahl, gegläht, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                            | 90  | 0,070   | 0,115 | 0,145 | 0,175 | 0,200 | 0,225 | 0,245 | 0,295 |
| P1.1.4 Unlegierter Stahl, vergütet, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                           | 85  | 0,065   | 0,110 | 0,140 | 0,165 | 0,185 | 0,210 | 0,235 | 0,275 |
| P1.1.5 Unlegierter Stahl, vergütet, 0,45 % C, Rm 850 N/mm <sup>2</sup> , 250 HB                           | 85  | 0,065   | 0,110 | 0,140 | 0,165 | 0,185 | 0,210 | 0,235 | 0,275 |
| P1.1.6 Unlegierter Stahl, gegläht, 0,75 % C, Rm 915 N/mm <sup>2</sup> , 270 HB                            | 80  | 0,060   | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| P1.1.7 Unlegierter Stahl, vergütet, 0,75 % C, Rm 1020 N/mm <sup>2</sup> , 300 HB                          | 75  | 0,060   | 0,100 | 0,120 | 0,145 | 0,165 | 0,185 | 0,205 | 0,245 |
| P2.1.1 Niedriglegierter Stahl, gegläht, Rm 610 N/mm <sup>2</sup> , 180 HB                                 | 80  | 0,060   | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| P2.1.2 Niedriglegierter Stahl, vergütet, Rm 930 N/mm <sup>2</sup> , 275 HB                                | 80  | 0,060   | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| P2.1.3 Niedriglegierter Stahl, vergütet, Rm 1020 N/mm <sup>2</sup> , 300 HB                               | 70  | 0,050   | 0,090 | 0,110 | 0,130 | 0,150 | 0,170 | 0,185 | 0,220 |
| P2.1.4 Niedriglegierter Stahl, vergütet, Rm 1190 N/mm <sup>2</sup> , 350 HB                               | 60  | 0,045   | 0,080 | 0,095 | 0,115 | 0,130 | 0,150 | 0,165 | 0,195 |
| P3.1.1 Hochlegierter Stahl und Werkzeugstahl, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB                  | 50  | 0,050   | 0,080 | 0,100 | 0,120 | 0,140 | 0,155 | 0,175 | 0,205 |
| P3.1.2 Hochlegierter Stahl und Werkzeugstahl, gehärtet und angelassen, Rm 1100 N/mm <sup>2</sup> , 325 HB | 45  | 0,040   | 0,070 | 0,085 | 0,105 | 0,120 | 0,135 | 0,145 | 0,175 |
| M1.1.1 Nichtrostender Stahl, ferritisch/martensitisch, mit Zerspanungsadditiven                           | 45  | 0,050   | 0,080 | 0,100 | 0,120 | 0,140 | 0,155 | 0,175 | 0,205 |
| M1.1.2 Nichtrostender Stahl, ferritisch/martensitisch, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB         | 40  | 0,045   | 0,075 | 0,090 | 0,110 | 0,125 | 0,140 | 0,155 | 0,185 |
| M1.1.3 Nichtrostender Stahl, ferritisch/martensitisch, vergütet, Rm 810 N/mm <sup>2</sup> , 240 HB        | 40  | 0,040   | 0,070 | 0,085 | 0,105 | 0,120 | 0,135 | 0,145 | 0,175 |
| M2.1.1 Nichtrostender Stahl, austenitisch, abgeschreckt, 180 HB   | 40  | 0,050   | 0,080 | 0,100 | 0,120 | 0,140 | 0,155 | 0,175 | 0,205 |
| M2.2.1 Duplexstahl, hochfeste nichtrostende Stähle  | 35  | 0,040   | 0,070 | 0,085 | 0,105 | 0,120 | 0,135 | 0,145 | 0,175 |
| K1.1.1 Grauguss, perlitisch/ferritisch, 180 HB  | 100   | 0,075   | 0,130 | 0,160 | 0,190 | 0,220 | 0,250 | 0,275 | 0,325 |
| K1.1.2 Grauguss, perlitisch/martensitisch, 260 HB   | 85  | 0,065   | 0,110 | 0,140 | 0,165 | 0,185 | 0,210 | 0,235 | 0,275 |
| K1.2.1 Gusseisen mit Kugelgraphit, ferritisch, 160 HB   | 85  | 0,065   | 0,110 | 0,140 | 0,165 | 0,185 | 0,210 | 0,235 | 0,275 |
| K1.2.2 Gusseisen mit Kugelgraphit, perlitisch, 250 HB   | 80  | 0,060   | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| K1.3.1 Temperguss, ferritisch, 130 HB   | 80  | 0,060   | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| K1.3.2 Temperguss, perlitisch, 230 HB   | 70  | 0,055   | 0,090 | 0,115 | 0,135 | 0,155 | 0,175 | 0,190 | 0,230 |
| K2.1.1 Gusseisen mit Vermiculargraphit (GJV)  | 80  | 0,075   | 0,130 | 0,160 | 0,190 | 0,220 | 0,250 | 0,275 | 0,325 |
| K2.2.1 Austenitisch-ferritisches Gusseisen mit Kugelgraphit (ADI)   | 60  | 0,060   | 0,100 | 0,120 | 0,145 | 0,165 | 0,185 | 0,205 | 0,245 |
| N1.1.1 Aluminium-Knetlegierungen, nicht aushärtbar, 60 HB   | 185   | 0,095   | 0,165 | 0,205 | 0,240 | 0,275 | 0,310 | 0,345 | 0,405 |
| N1.1.2 Aluminium-Knetlegierungen, ausgehärtet, 100 HB   | 185   | 0,095   | 0,165 | 0,205 | 0,240 | 0,275 | 0,310 | 0,345 | 0,405 |
| N2.1.1 Aluminium-Gusslegierungen, nicht aushärtbar, ≤ 12 % Si, 75 HB                                      | 170   | 0,095   | 0,165 | 0,205 | 0,240 | 0,275 | 0,310 | 0,345 | 0,405 |
| N2.1.2 Aluminium-Gusslegierungen, ausgehärtet, ≤ 12 % Si, 90 HB   | 170   | 0,095   | 0,165 | 0,205 | 0,240 | 0,275 | 0,310 | 0,345 | 0,405 |
| N2.1.3 Aluminium-Gusslegierungen, nicht aushärtbar, > 12 % Si, 130 HB                                     | 145   | 0,080   | 0,140 | 0,170 | 0,205 | 0,235 | 0,265 | 0,290 | 0,345 |
| N3.1.1 Kupfer und Kupferlegierungen: Automatenlegierung, Pb > 1 %   | 120   | 0,095   | 0,165 | 0,205 | 0,240 | 0,275 | 0,310 | 0,345 | 0,405 |
| N3.1.2 Kupfer und Kupferlegierungen: CuZn, CuSnZn   | 100   | 0,080   | 0,140 | 0,170 | 0,205 | 0,235 | 0,265 | 0,290 | 0,345 |
| N3.1.3 Kupfer und Kupferlegierungen: CuSn, bleifreies Kupfer und Elektrolytkupfer                         | 95  | 0,075   | 0,130 | 0,160 | 0,190 | 0,220 | 0,250 | 0,275 | 0,325 |
| N4.1.1 Nichtmetallische Werkstoffe: Duroplaste, Faserverstärkte Kunststoffe                               |   |   |       |       |       |       |       |       |       |
| N4.1.2 Nichtmetallische Werkstoffe: Hartgummi, Holz usw.  |   |   |       |       |       |       |       |       |       |
| N4.1.3 Nichtmetallische Werkstoffe: Graphit   |   |   |       |       |       |       |       |       |       |
| S1.1.1 Warmfeste Legierungen, Fe-Basis, gegläht, 200 HB   | 30  | 0,050   | 0,080 | 0,100 | 0,120 | 0,140 | 0,155 | 0,175 | 0,205 |
| S1.1.2 Warmfeste Legierungen, Fe-Basis, ausgehärtet, 280 HB   | 25  | 0,040   | 0,065 | 0,080 | 0,095 | 0,110 | 0,125 | 0,140 | 0,165 |
| S1.1.3 Warmfeste Legierungen, Ni- oder Co-Basis, gegläht, 250 HB  | 25  | 0,050   | 0,080 | 0,100 | 0,120 | 0,140 | 0,155 | 0,175 | 0,205 |
| S1.1.4 Warmfeste Legierungen, Ni- oder Co-Basis, ausgehärtet, 350 HB                                      | 15  | 0,035   | 0,055 | 0,070 | 0,085 | 0,095 | 0,110 | 0,120 | 0,145 |
| S1.1.5 Warmfeste Legierungen, Ni- oder Co-Basis, gegossen, 320 HB   | 20  | 0,035   | 0,055 | 0,070 | 0,085 | 0,095 | 0,110 | 0,120 | 0,145 |
| S2.1.1 Titanlegierungen, Reintitan, Rm 400 N/mm <sup>2</sup>  | 30  | 0,050   | 0,080 | 0,100 | 0,120 | 0,140 | 0,155 | 0,175 | 0,205 |
| S2.1.2 Titanlegierungen, Alpha- und Beta-Legierungen, ausgehärtet, Rm 1050 N/mm <sup>2</sup>              | 25  | 0,040   | 0,065 | 0,080 | 0,095 | 0,110 | 0,125 | 0,140 | 0,165 |
| H1.1.1 Gehärteter Stahl, gehärtet und angelassen, < 55 HRC  | 35  | 0,030   | 0,050 | 0,065 | 0,075 | 0,090 | 0,100 | 0,110 | 0,130 |
| H1.1.2 Gehärteter Stahl, gehärtet und angelassen, < 60 HRC  |   |   |       |       |       |       |       |       |       |
| H1.1.3 Gehärteter Stahl, gehärtet und angelassen, > 60 HRC  |   |   |       |       |       |       |       |       |       |
| H2.1.1 Hartguss, gegossen, 400 HB   | 25  | 0,040   | 0,065 | 0,080 | 0,095 | 0,110 | 0,125 | 0,135 | 0,165 |
| H2.1.2 Hartguss, gehärtet und angelassen, < 55 HRC  | 20  | 0,025   | 0,045 | 0,055 | 0,065 | 0,075 | 0,085 | 0,095 | 0,115 |


## TS-Drills, 3-schneidig, 3xD



| Zerspanungsgruppe   |  | f (mm/U) bei Nenn-Ø |       |       |       |       |       |       |       |       |       |
|---|---|---------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   |   | vc (m/min)          | 4     | 6     | 8     | 10    | 12    | 14    | 16    | 18    | 20    |
|   | P1.1.1 Unlegierter Stahl, gegläht, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB    |                     | 180   | 0,300 | 0,410 | 0,510 | 0,605 | 0,695 | 0,785 | 0,865 | 0,945 |
| P1.1.2 Unlegierter Stahl, vergütet, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB                           | 160   | 0,270               | 0,370 | 0,460 | 0,545 | 0,625 | 0,705 | 0,780 | 0,855 | 0,925 |       |
| P1.1.3 Unlegierter Stahl, gegläht, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                            | 160   | 0,270               | 0,370 | 0,460 | 0,545 | 0,625 | 0,705 | 0,780 | 0,855 | 0,925 |       |
| P1.1.4 Unlegierter Stahl, vergütet, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                           | 155   | 0,255               | 0,350 | 0,435 | 0,515 | 0,590 | 0,665 | 0,735 | 0,805 | 0,870 |       |
| P1.1.5 Unlegierter Stahl, vergütet, 0,45 % C, Rm 850 N/mm <sup>2</sup> , 250 HB                           | 155   | 0,255               | 0,350 | 0,435 | 0,515 | 0,590 | 0,665 | 0,735 | 0,805 | 0,870 |       |
| P1.1.6 Unlegierter Stahl, gegläht, 0,75 % C, Rm 915 N/mm <sup>2</sup> , 270 HB                            | 145   | 0,240               | 0,330 | 0,410 | 0,485 | 0,555 | 0,625 | 0,695 | 0,760 | 0,820 |       |
| P1.1.7 Unlegierter Stahl, vergütet, 0,75 % C, Rm 1020 N/mm <sup>2</sup> , 300 HB                          | 135   | 0,225               | 0,310 | 0,385 | 0,455 | 0,520 | 0,585 | 0,650 | 0,710 | 0,770 |       |
| P2.1.1 Niedriglegierter Stahl, gegläht, Rm 610 N/mm <sup>2</sup> , 180 HB                                 | 130   | 0,240               | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,750 | 0,815 |       |
| P2.1.2 Niedriglegierter Stahl, vergütet, Rm 930 N/mm <sup>2</sup> , 275 HB                                | 130   | 0,240               | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,750 | 0,815 |       |
| P2.1.3 Niedriglegierter Stahl, vergütet, Rm 1020 N/mm <sup>2</sup> , 300 HB                               | 110   | 0,205               | 0,275 | 0,345 | 0,410 | 0,470 | 0,525 | 0,585 | 0,640 | 0,690 |       |
| P2.1.4 Niedriglegierter Stahl, vergütet, Rm 1190 N/mm <sup>2</sup> , 350 HB                               | 100   | 0,180               | 0,245 | 0,305 | 0,360 | 0,415 | 0,465 | 0,515 | 0,565 | 0,610 |       |
| P3.1.1 Hochlegierter Stahl und Werkzeugstahl, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB                  | 90  | 0,190               | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,600 | 0,650 |       |
| P3.1.2 Hochlegierter Stahl und Werkzeugstahl, gehärtet und angelassen, Rm 1100 N/mm <sup>2</sup> , 325 HB | 75  | 0,165               | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,510 | 0,555 |       |
| M1.1.1 Nichtrostender Stahl, ferritisch/martensitisch, mit Zerspanungsadditiven                           | 60  | 0,095               | 0,130 | 0,160 | 0,190 | 0,220 | 0,250 | 0,275 | 0,300 | 0,325 |       |
| M1.1.2 Nichtrostender Stahl, ferritisch/martensitisch, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB         | 55  | 0,085               | 0,115 | 0,145 | 0,175 | 0,200 | 0,225 | 0,245 | 0,270 | 0,295 |       |
| M1.1.3 Nichtrostender Stahl, ferritisch/martensitisch, vergütet, Rm 810 N/mm <sup>2</sup> , 240 HB        | 50  | 0,080               | 0,110 | 0,140 | 0,165 | 0,185 | 0,210 | 0,235 | 0,255 | 0,275 |       |
| M2.1.1 Nichtrostender Stahl, austenitisch, abgeschreckt, 180 HB   |   |                     |       |       |       |       |       |       |       |       |       |
| M2.2.1 Duplexstahl, hochfeste nichtrostende Stähle  |   |                     |       |       |       |       |       |       |       |       |       |
| K1.1.1 Grauguss, perlitisch/ferritisch, 180 HB  | 130   | 0,240               | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,750 | 0,815 |       |
| K1.1.2 Grauguss, perlitisch/martensitisch, 260 HB   | 110   | 0,205               | 0,275 | 0,345 | 0,410 | 0,470 | 0,525 | 0,585 | 0,640 | 0,690 |       |
| K1.2.1 Gusseisen mit Kugelgraphit, ferritisch, 160 HB   | 110   | 0,205               | 0,275 | 0,345 | 0,410 | 0,470 | 0,525 | 0,585 | 0,640 | 0,690 |       |
| K1.2.2 Gusseisen mit Kugelgraphit, perlitisch, 250 HB   | 105   | 0,190               | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,600 | 0,650 |       |
| K1.3.1 Temperguss, ferritisch, 130 HB   | 105   | 0,190               | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,600 | 0,650 |       |
| K1.3.2 Temperguss, perlitisch, 230 HB   | 90  | 0,165               | 0,230 | 0,285 | 0,335 | 0,385 | 0,435 | 0,480 | 0,525 | 0,570 |       |
| K2.1.1 Gusseisen mit Vermiculargraphit (GJV)  | 100   | 0,240               | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,750 | 0,815 |       |
| K2.2.1 Austenitisch-ferritisches Gusseisen mit Kugelgraphit (ADI)   | 75  | 0,180               | 0,245 | 0,305 | 0,360 | 0,415 | 0,465 | 0,515 | 0,565 | 0,610 |       |
| N1.1.1 Aluminium-Knetlegierungen, nicht aushärtbar, 60 HB   | 200   | 0,240               | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,750 | 0,815 |       |
| N1.1.2 Aluminium-Knetlegierungen, ausgehärtet, 100 HB   | 200   | 0,240               | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,750 | 0,815 |       |
| N2.1.1 Aluminium-Gusslegierungen, nicht aushärtbar, ≤ 12 % Si, 75 HB                                      | 180   | 0,240               | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,750 | 0,815 |       |
| N2.1.2 Aluminium-Gusslegierungen, ausgehärtet, ≤ 12 % Si, 90 HB   | 180   | 0,240               | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,750 | 0,815 |       |
| N2.1.3 Aluminium-Gusslegierungen, nicht aushärtbar, > 12 % Si, 130 HB                                     | 155   | 0,205               | 0,275 | 0,345 | 0,410 | 0,470 | 0,525 | 0,585 | 0,640 | 0,690 |       |
| N3.1.1 Kupfer und Kupferlegierungen: Automatenlegierung, Pb > 1 %   |   |                     |       |       |       |       |       |       |       |       |       |
| N3.1.2 Kupfer und Kupferlegierungen: CuZn, CuSnZn   |   |                     |       |       |       |       |       |       |       |       |       |
| N3.1.3 Kupfer und Kupferlegierungen: CuSn, bleifreies Kupfer und Elektrolytkupfer                         |   |                     |       |       |       |       |       |       |       |       |       |
| N4.1.1 Nichtmetallische Werkstoffe: Duroplaste, Faserverstärkte Kunststoffe                               |   |                     |       |       |       |       |       |       |       |       |       |
| N4.1.2 Nichtmetallische Werkstoffe: Hartgummi, Holz usw.  |   |                     |       |       |       |       |       |       |       |       |       |
| N4.1.3 Nichtmetallische Werkstoffe: Graphit   |   |                     |       |       |       |       |       |       |       |       |       |
| S1.1.1 Warmfeste Legierungen, Fe-Basis, gegläht, 200 HB   | 40  | 0,075               | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,240 | 0,260 |       |
| S1.1.2 Warmfeste Legierungen, Fe-Basis, ausgehärtet, 280 HB   | 30  | 0,060               | 0,085 | 0,105 | 0,120 | 0,140 | 0,160 | 0,175 | 0,190 | 0,205 |       |
| S1.1.3 Warmfeste Legierungen, Ni- oder Co-Basis, gegläht, 250 HB  | 35  | 0,075               | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,240 | 0,260 |       |
| S1.1.4 Warmfeste Legierungen, Ni- oder Co-Basis, ausgehärtet, 350 HB                                      | 20  | 0,055               | 0,075 | 0,090 | 0,105 | 0,125 | 0,140 | 0,155 | 0,165 | 0,180 |       |
| S1.1.5 Warmfeste Legierungen, Ni- oder Co-Basis, gegossen, 320 HB   | 25  | 0,055               | 0,075 | 0,090 | 0,105 | 0,125 | 0,140 | 0,155 | 0,165 | 0,180 |       |
| S2.1.1 Titanlegierungen, Reintitan, Rm 400 N/mm <sup>2</sup>  | 40  | 0,075               | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,240 | 0,260 |       |
| S2.1.2 Titanlegierungen, Alpha- und Beta-Legierungen, ausgehärtet, Rm 1050 N/mm <sup>2</sup>              | 30  | 0,060               | 0,085 | 0,105 | 0,120 | 0,140 | 0,160 | 0,175 | 0,190 | 0,205 |       |
| H1.1.1 Gehärteter Stahl, gehärtet und angelassen, < 55 HRC  | 40  | 0,075               | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,240 | 0,260 |       |
| H1.1.2 Gehärteter Stahl, gehärtet und angelassen, < 60 HRC  |   |                     |       |       |       |       |       |       |       |       |       |
| H1.1.3 Gehärteter Stahl, gehärtet und angelassen, > 60 HRC  |   |                     |       |       |       |       |       |       |       |       |       |
| H2.1.1 Hartguss, gegossen, 400 HB   |   |                     |       |       |       |       |       |       |       |       |       |
| H2.1.2 Hartguss, gehärtet und angelassen, < 55 HRC  |   |                     |       |       |       |       |       |       |       |       |       |

## TS-Drills, 3-schneidig, 5xD



| Zerspanungsgruppe  |      | f (mm/U) bei Nenn-Ø    |       |       |       |       |       |       |       |
|--|---|------------------------|-------|-------|-------|-------|-------|-------|-------|
|  |   | v <sub>c</sub> (m/min) | 3     | 6     | 8     | 10    | 12    | 14    | 16    |
|  | <b>P1.1.1</b> Unlegierter Stahl, gegläht, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB |                        | 180   | 0,245 | 0,410 | 0,510 | 0,605 | 0,695 | 0,785 |
| <b>P1.1.2</b> Unlegierter Stahl, vergütet, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB                           | 160   | 0,220                  | 0,370 | 0,460 | 0,545 | 0,625 | 0,705 | 0,780 | 0,925 |
| <b>P1.1.3</b> Unlegierter Stahl, gegläht, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                            | 160   | 0,220                  | 0,370 | 0,460 | 0,545 | 0,625 | 0,705 | 0,780 | 0,925 |
| <b>P1.1.4</b> Unlegierter Stahl, vergütet, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                           | 155   | 0,205                  | 0,350 | 0,435 | 0,515 | 0,590 | 0,665 | 0,735 | 0,870 |
| <b>P1.1.5</b> Unlegierter Stahl, vergütet, 0,45 % C, Rm 850 N/mm <sup>2</sup> , 250 HB                           | 155   | 0,205                  | 0,350 | 0,435 | 0,515 | 0,590 | 0,665 | 0,735 | 0,870 |
| <b>P1.1.6</b> Unlegierter Stahl, gegläht, 0,75 % C, Rm 915 N/mm <sup>2</sup> , 270 HB                            | 145   | 0,195                  | 0,330 | 0,410 | 0,485 | 0,555 | 0,625 | 0,695 | 0,820 |
| <b>P1.1.7</b> Unlegierter Stahl, vergütet, 0,75 % C, Rm 1020 N/mm <sup>2</sup> , 300 HB                          | 135   | 0,180                  | 0,310 | 0,385 | 0,455 | 0,520 | 0,585 | 0,650 | 0,770 |
| <b>P2.1.1</b> Niedriglegierter Stahl, gegläht, Rm 610 N/mm <sup>2</sup> , 180 HB                                 | 130   | 0,190                  | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,815 |
| <b>P2.1.2</b> Niedriglegierter Stahl, vergütet, Rm 930 N/mm <sup>2</sup> , 275 HB                                | 130   | 0,190                  | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,815 |
| <b>P2.1.3</b> Niedriglegierter Stahl, vergütet, Rm 1020 N/mm <sup>2</sup> , 300 HB                               | 110   | 0,165                  | 0,275 | 0,345 | 0,410 | 0,470 | 0,525 | 0,585 | 0,690 |
| <b>P2.1.4</b> Niedriglegierter Stahl, vergütet, Rm 1190 N/mm <sup>2</sup> , 350 HB                               | 100   | 0,145                  | 0,245 | 0,305 | 0,360 | 0,415 | 0,465 | 0,515 | 0,610 |
| <b>P3.1.1</b> Hochlegierter Stahl und Werkzeugstahl, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB                  | 90  | 0,155                  | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| <b>P3.1.2</b> Hochlegierter Stahl und Werkzeugstahl, gehärtet und angelassen, Rm 1100 N/mm <sup>2</sup> , 325 HB | 75  | 0,130                  | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| <b>M1.1.1</b> Nichtrostender Stahl, ferritisch/martensitisch, mit Zerspanungsadditiven                           | 60  | 0,075                  | 0,130 | 0,160 | 0,190 | 0,220 | 0,250 | 0,275 | 0,325 |
| <b>M1.1.2</b> Nichtrostender Stahl, ferritisch/martensitisch, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB         | 55  | 0,070                  | 0,115 | 0,145 | 0,175 | 0,200 | 0,225 | 0,245 | 0,295 |
| <b>M1.1.3</b> Nichtrostender Stahl, ferritisch/martensitisch, vergütet, Rm 810 N/mm <sup>2</sup> , 240 HB        | 50  | 0,065                  | 0,110 | 0,140 | 0,165 | 0,185 | 0,210 | 0,235 | 0,275 |
| <b>M2.1.1</b> Nichtrostender Stahl, austenitisch, abgeschreckt, 180 HB   |   |                        |       |       |       |       |       |       |       |
| <b>M2.2.1</b> Duplexstahl, hochfeste nichtrostende Stähle  |   |                        |       |       |       |       |       |       |       |
| <b>K1.1.1</b> Grauguss, perlitisch/ferritisch, 180 HB  | 130   | 0,190                  | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,815 |
| <b>K1.1.2</b> Grauguss, perlitisch/martensitisch, 260 HB   | 110   | 0,165                  | 0,275 | 0,345 | 0,410 | 0,470 | 0,525 | 0,585 | 0,690 |
| <b>K1.2.1</b> Gusseisen mit Kugelgraphit, ferritisch, 160 HB   | 110   | 0,165                  | 0,275 | 0,345 | 0,410 | 0,470 | 0,525 | 0,585 | 0,690 |
| <b>K1.2.2</b> Gusseisen mit Kugelgraphit, perlitisch, 250 HB   | 105   | 0,155                  | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| <b>K1.3.1</b> Temperguss, ferritisch, 130 HB   | 105   | 0,155                  | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| <b>K1.3.2</b> Temperguss, perlitisch, 230 HB   | 90  | 0,135                  | 0,230 | 0,285 | 0,335 | 0,385 | 0,435 | 0,480 | 0,570 |
| <b>K2.1.1</b> Gusseisen mit Vermiculargraphit (GJV)  | 100   | 0,190                  | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,815 |
| <b>K2.2.1</b> Austenitisch-ferritisches Gusseisen mit Kugelgraphit (ADI)   | 75  | 0,145                  | 0,245 | 0,305 | 0,360 | 0,415 | 0,465 | 0,515 | 0,610 |
| <b>N1.1.1</b> Aluminium-Knetlegierungen, nicht aushärtbar, 60 HB   | 200   | 0,190                  | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,815 |
| <b>N1.1.2</b> Aluminium-Knetlegierungen, ausgehärtet, 100 HB   | 200   | 0,190                  | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,815 |
| <b>N2.1.1</b> Aluminium-Gusslegierungen, nicht aushärtbar, ≤ 12 % Si, 75 HB                                      | 180   | 0,190                  | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,815 |
| <b>N2.1.2</b> Aluminium-Gusslegierungen, ausgehärtet, ≤ 12 % Si, 90 HB   | 180   | 0,190                  | 0,325 | 0,405 | 0,480 | 0,550 | 0,620 | 0,685 | 0,815 |
| <b>N2.1.3</b> Aluminium-Gusslegierungen, nicht aushärtbar, > 12 % Si, 130 HB                                     | 155   | 0,165                  | 0,275 | 0,345 | 0,410 | 0,470 | 0,525 | 0,585 | 0,690 |
| <b>N3.1.1</b> Kupfer und Kupferlegierungen: Automatenlegierung, Pb > 1 %   |   |                        |       |       |       |       |       |       |       |
| <b>N3.1.2</b> Kupfer und Kupferlegierungen: CuZn, CuSnZn   |   |                        |       |       |       |       |       |       |       |
| <b>N3.1.3</b> Kupfer und Kupferlegierungen: CuSn, bleifreies Kupfer und Elektrolytkupfer                         |   |                        |       |       |       |       |       |       |       |
| <b>N4.1.1</b> Nichtmetallische Werkstoffe: Duroplaste, Faserverstärkte Kunststoffe                               |   |                        |       |       |       |       |       |       |       |
| <b>N4.1.2</b> Nichtmetallische Werkstoffe: Hartgummi, Holz usw.  |   |                        |       |       |       |       |       |       |       |
| <b>N4.1.3</b> Nichtmetallische Werkstoffe: Graphit   |   |                        |       |       |       |       |       |       |       |
| <b>S1.1.1</b> Warmfeste Legierungen, Fe-Basis, gegläht, 200 HB   | 40  | 0,060                  | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| <b>S1.1.2</b> Warmfeste Legierungen, Fe-Basis, ausgehärtet, 280 HB   | 30  | 0,050                  | 0,085 | 0,105 | 0,120 | 0,140 | 0,160 | 0,175 | 0,205 |
| <b>S1.1.3</b> Warmfeste Legierungen, Ni- oder Co-Basis, gegläht, 250 HB  | 35  | 0,060                  | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| <b>S1.1.4</b> Warmfeste Legierungen, Ni- oder Co-Basis, ausgehärtet, 350 HB                                      | 20  | 0,045                  | 0,075 | 0,090 | 0,105 | 0,125 | 0,140 | 0,155 | 0,180 |
| <b>S1.1.5</b> Warmfeste Legierungen, Ni- oder Co-Basis, gegossen, 320 HB   | 25  | 0,045                  | 0,075 | 0,090 | 0,105 | 0,125 | 0,140 | 0,155 | 0,180 |
| <b>S2.1.1</b> Titanlegierungen, Reintitan, Rm 400 N/mm <sup>2</sup>  | 40  | 0,060                  | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| <b>S2.1.2</b> Titanlegierungen, Alpha- und Beta-Legierungen, ausgehärtet, Rm 1050 N/mm <sup>2</sup>              | 30  | 0,050                  | 0,085 | 0,105 | 0,120 | 0,140 | 0,160 | 0,175 | 0,205 |
| <b>H1.1.1</b> Gehärteter Stahl, gehärtet und angelassen, < 55 HRC  | 40  | 0,060                  | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| <b>H1.1.2</b> Gehärteter Stahl, gehärtet und angelassen, < 60 HRC  |   |                        |       |       |       |       |       |       |       |
| <b>H1.1.3</b> Gehärteter Stahl, gehärtet und angelassen, > 60 HRC  |   |                        |       |       |       |       |       |       |       |
| <b>H2.1.1</b> Hartguss, gegossen, 400 HB   |   |                        |       |       |       |       |       |       |       |
| <b>H2.1.2</b> Hartguss, gehärtet und angelassen, < 55 HRC  |   |                        |       |       |       |       |       |       |       |

## NC-Anbohrer





| Zerspanungsgruppe   | VHM                    |     | f (mm/U) bei Nenn-Ø |       |       |       |       |       |       |       |
|---|------------------------|-----|---------------------|-------|-------|-------|-------|-------|-------|-------|
|   | ⊕                      | ○   |                     |       |       |       |       |       |       |       |
|   | v <sub>c</sub> (m/min) |     | 1                   | 3     | 6     | 8     | 10    | 12    | 16    | 20    |
| P1.1.1 Unlegierter Stahl, gegläht, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB                            | 100                    | 75  | 0,030               | 0,095 | 0,165 | 0,205 | 0,240 | 0,275 | 0,345 | 0,405 |
| P1.1.2 Unlegierter Stahl, vergütet, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB                           | 90                     | 70  | 0,030               | 0,085 | 0,145 | 0,180 | 0,215 | 0,250 | 0,310 | 0,365 |
| P1.1.3 Unlegierter Stahl, gegläht, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                            | 90                     | 70  | 0,030               | 0,085 | 0,145 | 0,180 | 0,215 | 0,250 | 0,310 | 0,365 |
| P1.1.4 Unlegierter Stahl, vergütet, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                           | 85                     | 65  | 0,025               | 0,080 | 0,140 | 0,170 | 0,205 | 0,235 | 0,290 | 0,345 |
| P1.1.5 Unlegierter Stahl, vergütet, 0,45 % C, Rm 850 N/mm <sup>2</sup> , 250 HB                           | 85                     | 65  | 0,025               | 0,080 | 0,140 | 0,170 | 0,205 | 0,235 | 0,290 | 0,345 |
| P1.1.6 Unlegierter Stahl, gegläht, 0,75 % C, Rm 915 N/mm <sup>2</sup> , 270 HB                            | 80                     | 60  | 0,025               | 0,075 | 0,130 | 0,160 | 0,190 | 0,220 | 0,275 | 0,325 |
| P1.1.7 Unlegierter Stahl, vergütet, 0,75 % C, Rm 1020 N/mm <sup>2</sup> , 300 HB                          | 75                     | 55  | 0,025               | 0,070 | 0,120 | 0,150 | 0,180 | 0,205 | 0,255 | 0,305 |
| P2.1.1 Niedriglegierter Stahl, gegläht, Rm 610 N/mm <sup>2</sup> , 180 HB                                 | 55                     | 40  | 0,020               | 0,060 | 0,105 | 0,130 | 0,155 | 0,175 | 0,220 | 0,260 |
| P2.1.2 Niedriglegierter Stahl, vergütet, Rm 930 N/mm <sup>2</sup> , 275 HB                                | 55                     | 40  | 0,020               | 0,060 | 0,105 | 0,130 | 0,155 | 0,175 | 0,220 | 0,260 |
| P2.1.3 Niedriglegierter Stahl, vergütet, Rm 1020 N/mm <sup>2</sup> , 300 HB                               | 45                     | 30  | 0,015               | 0,050 | 0,090 | 0,110 | 0,130 | 0,150 | 0,185 | 0,220 |
| P2.1.4 Niedriglegierter Stahl, vergütet, Rm 1190 N/mm <sup>2</sup> , 350 HB                               | 40                     | 30  | 0,015               | 0,045 | 0,080 | 0,095 | 0,115 | 0,130 | 0,165 | 0,195 |
| P3.1.1 Hochlegierter Stahl und Werkzeugstahl, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB                  | 55                     | 40  | 0,020               | 0,060 | 0,105 | 0,130 | 0,155 | 0,175 | 0,220 | 0,260 |
| P3.1.2 Hochlegierter Stahl und Werkzeugstahl, gehärtet und angelassen, Rm 1100 N/mm <sup>2</sup> , 325 HB | 45                     | 35  | 0,015               | 0,050 | 0,090 | 0,110 | 0,130 | 0,150 | 0,185 | 0,220 |
| M1.1.1 Nichtrostender Stahl, ferritisch/martensitisch, mit Zerspanungsadditiven                           | 35                     | 25  | 0,015               | 0,050 | 0,080 | 0,100 | 0,120 | 0,140 | 0,175 | 0,205 |
| M1.1.2 Nichtrostender Stahl, ferritisch/martensitisch, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB         | 30                     | 25  | 0,015               | 0,045 | 0,075 | 0,090 | 0,110 | 0,125 | 0,155 | 0,185 |
| M1.1.3 Nichtrostender Stahl, ferritisch/martensitisch, vergütet, Rm 810 N/mm <sup>2</sup> , 240 HB        | 30                     | 20  | 0,015               | 0,040 | 0,070 | 0,085 | 0,105 | 0,120 | 0,145 | 0,175 |
| M2.1.1 Nichtrostender Stahl, austenitisch, abgeschreckt, 180 HB   | 25                     | 20  | 0,015               | 0,050 | 0,080 | 0,100 | 0,120 | 0,140 | 0,175 | 0,205 |
| M2.2.1 Duplexstahl, hochfeste nichtrostende Stähle  | 20                     | 15  | 0,015               | 0,040 | 0,070 | 0,085 | 0,105 | 0,120 | 0,145 | 0,175 |
| K1.1.1 Grauguss, perlitisch/ferritisch, 180 HB  | 90                     | 80  | 0,040               | 0,125 | 0,210 | 0,260 | 0,305 | 0,355 | 0,440 | 0,520 |
| K1.1.2 Grauguss, perlitisch/martensitisch, 260 HB   | 75                     | 70  | 0,035               | 0,105 | 0,175 | 0,220 | 0,260 | 0,300 | 0,375 | 0,440 |
| K1.2.1 Gusseisen mit Kugelgraphit, ferritisch, 160 HB   | 75                     | 70  | 0,035               | 0,105 | 0,175 | 0,220 | 0,260 | 0,300 | 0,375 | 0,440 |
| K1.2.2 Gusseisen mit Kugelgraphit, perlitisch, 250 HB   | 70                     | 65  | 0,035               | 0,100 | 0,165 | 0,205 | 0,245 | 0,280 | 0,350 | 0,415 |
| K1.3.1 Temperguss, ferritisch, 130 HB   | 70                     | 65  | 0,035               | 0,100 | 0,165 | 0,205 | 0,245 | 0,280 | 0,350 | 0,415 |
| K1.3.2 Temperguss, perlitisch, 230 HB   | 65                     | 55  | 0,030               | 0,085 | 0,145 | 0,180 | 0,215 | 0,245 | 0,305 | 0,365 |
| K2.1.1 Gusseisen mit Vermiculargraphit (GJV)  | 70                     |     | 0,040               | 0,125 | 0,210 | 0,260 | 0,305 | 0,355 | 0,440 | 0,520 |
| K2.2.1 Austenitisch-ferritisches Gusseisen mit Kugelgraphit (ADI)   | 55                     |     | 0,030               | 0,090 | 0,155 | 0,195 | 0,230 | 0,265 | 0,330 | 0,390 |
| N1.1.1 Aluminium-Knetlegierungen, nicht aushärtbar, 60 HB   | 165                    | 160 | 0,040               | 0,125 | 0,210 | 0,260 | 0,305 | 0,355 | 0,440 | 0,520 |
| N1.1.2 Aluminium-Knetlegierungen, ausgehärtet, 100 HB   | 165                    | 160 | 0,040               | 0,125 | 0,210 | 0,260 | 0,305 | 0,355 | 0,440 | 0,520 |
| N2.1.1 Aluminium-Gusslegierungen, nicht aushärtbar, ≤ 12 % Si, 75 HB                                      | 150                    | 140 | 0,040               | 0,125 | 0,210 | 0,260 | 0,305 | 0,355 | 0,440 | 0,520 |
| N2.1.2 Aluminium-Gusslegierungen, ausgehärtet, ≤ 12 % Si, 90 HB   | 150                    | 140 | 0,040               | 0,125 | 0,210 | 0,260 | 0,305 | 0,355 | 0,440 | 0,520 |
| N2.1.3 Aluminium-Gusslegierungen, nicht aushärtbar, > 12 % Si, 130 HB                                     | 130                    | 120 | 0,035               | 0,105 | 0,175 | 0,220 | 0,260 | 0,300 | 0,375 | 0,440 |
| N3.1.1 Kupfer und Kupferlegierungen: Automatenlegierung, Pb > 1 %   | 110                    | 80  | 0,030               | 0,095 | 0,165 | 0,205 | 0,240 | 0,275 | 0,345 | 0,405 |
| N3.1.2 Kupfer und Kupferlegierungen: CuZn, CuSnZn   | 95                     | 70  | 0,025               | 0,080 | 0,140 | 0,170 | 0,205 | 0,235 | 0,290 | 0,345 |
| N3.1.3 Kupfer und Kupferlegierungen: CuSn, bleifreies Kupfer und Elektrolytkupfer                         | 90                     | 65  | 0,025               | 0,075 | 0,130 | 0,160 | 0,190 | 0,220 | 0,275 | 0,325 |
| N4.1.1 Nichtmetallische Werkstoffe: Duroplaste, Faserverstärkte Kunststoffe                               | 55                     | 50  | 0,015               | 0,040 | 0,065 | 0,080 | 0,095 | 0,110 | 0,135 | 0,165 |
| N4.1.2 Nichtmetallische Werkstoffe: Hartgummi, Holz usw.  | 55                     | 50  | 0,015               | 0,040 | 0,065 | 0,080 | 0,095 | 0,110 | 0,135 | 0,165 |
| N4.1.3 Nichtmetallische Werkstoffe: Graphit   |                        |     |                     |       |       |       |       |       |       |       |
| S1.1.1 Warmfeste Legierungen, Fe-Basis, gegläht, 200 HB   | 35                     | 25  | 0,015               | 0,040 | 0,065 | 0,080 | 0,095 | 0,110 | 0,135 | 0,165 |
| S1.1.2 Warmfeste Legierungen, Fe-Basis, ausgehärtet, 280 HB   | 30                     | 20  | 0,010               | 0,030 | 0,050 | 0,065 | 0,075 | 0,090 | 0,110 | 0,130 |
| S1.1.3 Warmfeste Legierungen, Ni- oder Co-Basis, gegläht, 250 HB  | 30                     | 20  | 0,015               | 0,040 | 0,065 | 0,080 | 0,095 | 0,110 | 0,135 | 0,165 |
| S1.1.4 Warmfeste Legierungen, Ni- oder Co-Basis, ausgehärtet, 350 HB                                      | 20                     | 15  | 0,010               | 0,025 | 0,045 | 0,055 | 0,065 | 0,075 | 0,095 | 0,115 |
| S1.1.5 Warmfeste Legierungen, Ni- oder Co-Basis, gegossen, 320 HB   | 20                     | 15  | 0,010               | 0,025 | 0,045 | 0,055 | 0,065 | 0,075 | 0,095 | 0,115 |
| S2.1.1 Titanlegierungen, Reintitan, Rm 400 N/mm <sup>2</sup>  | 25                     | 15  | 0,010               | 0,030 | 0,050 | 0,065 | 0,075 | 0,090 | 0,110 | 0,130 |
| S2.1.2 Titanlegierungen, Alpha- und Beta-Legierungen, ausgehärtet, Rm 1050 N/mm <sup>2</sup>              | 20                     | 10  | 0,010               | 0,025 | 0,040 | 0,050 | 0,060 | 0,070 | 0,090 | 0,105 |
| H1.1.1 Gehärteter Stahl, gehärtet und angelassen, < 55 HRC  | 25                     | 20  | 0,015               | 0,040 | 0,065 | 0,080 | 0,095 | 0,110 | 0,135 | 0,165 |
| H1.1.2 Gehärteter Stahl, gehärtet und angelassen, < 60 HRC  |                        |     |                     |       |       |       |       |       |       |       |
| H1.1.3 Gehärteter Stahl, gehärtet und angelassen, > 60 HRC  |                        |     |                     |       |       |       |       |       |       |       |
| H2.1.1 Hartguss, gegossen, 400 HB   |                        |     |                     |       |       |       |       |       |       |       |
| H2.1.2 Hartguss, gehärtet und angelassen, < 55 HRC  |                        |     |                     |       |       |       |       |       |       |       |





## TS-Drills mit Innenkühlung, 3xD



| Zerspanungsgruppe   |  | f (mm/U) bei Nenn-Ø   |       |       |       |       |       |       |       |
|---|---|---|-------|-------|-------|-------|-------|-------|-------|
|   |   |  | 3     | 6     | 8     | 10    | 12    | 14    | 16    |
|   | $v_c$ (m/min)   |   |       |       |       |       |       |       |       |
| P1.1.1 Unlegierter Stahl, gegläht, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB                            | 145   | 0,155   | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| P1.1.2 Unlegierter Stahl, vergütet, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB                           | 130   | 0,140   | 0,235 | 0,290 | 0,345 | 0,395 | 0,445 | 0,495 | 0,585 |
| P1.1.3 Unlegierter Stahl, gegläht, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                            | 130   | 0,140   | 0,235 | 0,290 | 0,345 | 0,395 | 0,445 | 0,495 | 0,585 |
| P1.1.4 Unlegierter Stahl, vergütet, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                           | 125   | 0,130   | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| P1.1.5 Unlegierter Stahl, vergütet, 0,45 % C, Rm 850 N/mm <sup>2</sup> , 250 HB                           | 125   | 0,130   | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| P1.1.6 Unlegierter Stahl, gegläht, 0,75 % C, Rm 915 N/mm <sup>2</sup> , 270 HB                            | 115   | 0,125   | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| P1.1.7 Unlegierter Stahl, vergütet, 0,75 % C, Rm 1020 N/mm <sup>2</sup> , 300 HB                          | 110   | 0,115   | 0,195 | 0,245 | 0,290 | 0,330 | 0,370 | 0,410 | 0,490 |
| P2.1.1 Niedriglegierter Stahl, gegläht, Rm 610 N/mm <sup>2</sup> , 180 HB                                 | 120   | 0,125   | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| P2.1.2 Niedriglegierter Stahl, vergütet, Rm 930 N/mm <sup>2</sup> , 275 HB                                | 120   | 0,125   | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| P2.1.3 Niedriglegierter Stahl, vergütet, Rm 1020 N/mm <sup>2</sup> , 300 HB                               | 100   | 0,105   | 0,175 | 0,220 | 0,260 | 0,300 | 0,335 | 0,375 | 0,440 |
| P2.1.4 Niedriglegierter Stahl, vergütet, Rm 1190 N/mm <sup>2</sup> , 350 HB                               | 90  | 0,090   | 0,155 | 0,195 | 0,230 | 0,265 | 0,295 | 0,330 | 0,390 |
| P3.1.1 Hochlegierter Stahl und Werkzeugstahl, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB                  | 80  | 0,095   | 0,165 | 0,205 | 0,240 | 0,275 | 0,310 | 0,345 | 0,405 |
| P3.1.2 Hochlegierter Stahl und Werkzeugstahl, gehärtet und angelassen, Rm 1100 N/mm <sup>2</sup> , 325 HB | 70  | 0,080   | 0,140 | 0,170 | 0,205 | 0,235 | 0,265 | 0,290 | 0,345 |
| M1.1.1 Nichtrostender Stahl, ferritisch/martensitisch, mit Zerspanungsadditiven                           | 60  | 0,075   | 0,130 | 0,160 | 0,190 | 0,220 | 0,250 | 0,275 | 0,325 |
| M1.1.2 Nichtrostender Stahl, ferritisch/martensitisch, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB         | 55  | 0,070   | 0,115 | 0,145 | 0,175 | 0,200 | 0,225 | 0,245 | 0,295 |
| M1.1.3 Nichtrostender Stahl, ferritisch/martensitisch, vergütet, Rm 810 N/mm <sup>2</sup> , 240 HB        | 50  | 0,065   | 0,110 | 0,140 | 0,165 | 0,185 | 0,210 | 0,235 | 0,275 |
| M2.1.1 Nichtrostender Stahl, austenitisch, abgeschreckt, 180 HB   | 55  | 0,040   | 0,065 | 0,080 | 0,095 | 0,110 | 0,125 | 0,135 | 0,165 |
| M2.2.1 Duplexstahl, hochfeste nichtrostende Stähle  | 45  | 0,035   | 0,055 | 0,070 | 0,080 | 0,095 | 0,105 | 0,115 | 0,140 |
| K1.1.1 Grauguss, perlitisch/ferritisch, 180 HB  | 110   | 0,155   | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| K1.1.2 Grauguss, perlitisch/martensitisch, 260 HB   | 95  | 0,130   | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| K1.2.1 Gusseisen mit Kugelgraphit, ferritisch, 160 HB   | 95  | 0,130   | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| K1.2.2 Gusseisen mit Kugelgraphit, perlitisch, 250 HB   | 90  | 0,125   | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| K1.3.1 Temperguss, ferritisch, 130 HB   | 90  | 0,125   | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| K1.3.2 Temperguss, perlitisch, 230 HB   | 75  | 0,110   | 0,180 | 0,225 | 0,270 | 0,310 | 0,345 | 0,385 | 0,455 |
| K2.1.1 Gusseisen mit Vermiculargraphit (GJV)  | 90  | 0,155   | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| K2.2.1 Austenitisch-ferritisches Gusseisen mit Kugelgraphit (ADI)   | 70  | 0,115   | 0,195 | 0,245 | 0,290 | 0,330 | 0,370 | 0,410 | 0,490 |
| N1.1.1 Aluminium-Knetlegierungen, nicht aushärtbar, 60 HB   | 185   | 0,155   | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| N1.1.2 Aluminium-Knetlegierungen, ausgehärtet, 100 HB   | 185   | 0,155   | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| N2.1.1 Aluminium-Gusslegierungen, nicht aushärtbar, ≤ 12 % Si, 75 HB                                      | 170   | 0,155   | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| N2.1.2 Aluminium-Gusslegierungen, ausgehärtet, ≤ 12 % Si, 90 HB   | 170   | 0,155   | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| N2.1.3 Aluminium-Gusslegierungen, nicht aushärtbar, > 12 % Si, 130 HB                                     | 145   | 0,130   | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| N3.1.1 Kupfer und Kupferlegierungen: Automatenlegierung, Pb > 1 %   | 130   | 0,125   | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| N3.1.2 Kupfer und Kupferlegierungen: CuZn, CuSnZn   | 110   | 0,105   | 0,175 | 0,220 | 0,260 | 0,300 | 0,335 | 0,375 | 0,440 |
| N3.1.3 Kupfer und Kupferlegierungen: CuSn, bleifreies Kupfer und Elektrolytkupfer                         | 105   | 0,100   | 0,165 | 0,205 | 0,245 | 0,280 | 0,315 | 0,350 | 0,415 |
| N4.1.1 Nichtmetallische Werkstoffe: Duroplaste, Faserverstärkte Kunststoffe                               |   |   |       |       |       |       |       |       |       |
| N4.1.2 Nichtmetallische Werkstoffe: Hartgummi, Holz usw.  |   |   |       |       |       |       |       |       |       |
| N4.1.3 Nichtmetallische Werkstoffe: Graphit   |   |   |       |       |       |       |       |       |       |
| S1.1.1 Warmfeste Legierungen, Fe-Basis, gegläht, 200 HB   | 40  | 0,060   | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| S1.1.2 Warmfeste Legierungen, Fe-Basis, ausgehärtet, 280 HB   | 30  | 0,050   | 0,085 | 0,105 | 0,120 | 0,140 | 0,160 | 0,175 | 0,205 |
| S1.1.3 Warmfeste Legierungen, Ni- oder Co-Basis, gegläht, 250 HB  | 35  | 0,060   | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| S1.1.4 Warmfeste Legierungen, Ni- oder Co-Basis, ausgehärtet, 350 HB                                      | 20  | 0,045   | 0,075 | 0,090 | 0,105 | 0,125 | 0,140 | 0,155 | 0,180 |
| S1.1.5 Warmfeste Legierungen, Ni- oder Co-Basis, gegossen, 320 HB   | 25  | 0,045   | 0,075 | 0,090 | 0,105 | 0,125 | 0,140 | 0,155 | 0,180 |
| S2.1.1 Titanlegierungen, Reintitan, Rm 400 N/mm <sup>2</sup>  | 40  | 0,060   | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| S2.1.2 Titanlegierungen, Alpha- und Beta-Legierungen, ausgehärtet, Rm 1050 N/mm <sup>2</sup>              | 30  | 0,050   | 0,085 | 0,105 | 0,120 | 0,140 | 0,160 | 0,175 | 0,205 |
| H1.1.1 Gehärteter Stahl, gehärtet und angelassen, < 55 HRC  | 50  | 0,040   | 0,065 | 0,080 | 0,095 | 0,110 | 0,125 | 0,135 | 0,165 |
| H1.1.2 Gehärteter Stahl, gehärtet und angelassen, < 60 HRC  | 35  | 0,030   | 0,050 | 0,065 | 0,075 | 0,090 | 0,100 | 0,110 | 0,130 |
| H1.1.3 Gehärteter Stahl, gehärtet und angelassen, > 60 HRC  | 30  | 0,030   | 0,050 | 0,060 | 0,070 | 0,085 | 0,095 | 0,105 | 0,120 |
| H2.1.1 Hartguss, gegossen, 400 HB   | 40  | 0,050   | 0,080 | 0,100 | 0,120 | 0,140 | 0,155 | 0,175 | 0,205 |
| H2.1.2 Hartguss, gehärtet und angelassen, < 55 HRC  | 30  | 0,035   | 0,055 | 0,070 | 0,085 | 0,095 | 0,110 | 0,120 | 0,145 |


## TS-Drills mit Innenkühlung, 5xD



| Zerspanungsgruppe   |  | f (mm/U) bei Nenn-Ø    |       |       |       |       |       |       |       |
|---|---|------------------------|-------|-------|-------|-------|-------|-------|-------|
|   |   | v <sub>c</sub> (m/min) | 3     | 6     | 8     | 10    | 12    | 14    | 16    |
|   |  |                        |       |       |       |       |       |       |       |
| P1.1.1 Unlegierter Stahl, gegläht, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB                            | 145   | 0,155                  | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| P1.1.2 Unlegierter Stahl, vergütet, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB                           | 130   | 0,140                  | 0,235 | 0,290 | 0,345 | 0,395 | 0,445 | 0,495 | 0,585 |
| P1.1.3 Unlegierter Stahl, gegläht, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                            | 130   | 0,140                  | 0,235 | 0,290 | 0,345 | 0,395 | 0,445 | 0,495 | 0,585 |
| P1.1.4 Unlegierter Stahl, vergütet, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                           | 125   | 0,130                  | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| P1.1.5 Unlegierter Stahl, vergütet, 0,45 % C, Rm 850 N/mm <sup>2</sup> , 250 HB                           | 125   | 0,130                  | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| P1.1.6 Unlegierter Stahl, gegläht, 0,75 % C, Rm 915 N/mm <sup>2</sup> , 270 HB                            | 115   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| P1.1.7 Unlegierter Stahl, vergütet, 0,75 % C, Rm 1020 N/mm <sup>2</sup> , 300 HB                          | 110   | 0,115                  | 0,195 | 0,245 | 0,290 | 0,330 | 0,370 | 0,410 | 0,490 |
| P2.1.1 Niedriglegierter Stahl, gegläht, Rm 610 N/mm <sup>2</sup> , 180 HB                                 | 120   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| P2.1.2 Niedriglegierter Stahl, vergütet, Rm 930 N/mm <sup>2</sup> , 275 HB                                | 120   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| P2.1.3 Niedriglegierter Stahl, vergütet, Rm 1020 N/mm <sup>2</sup> , 300 HB                               | 100   | 0,105                  | 0,175 | 0,220 | 0,260 | 0,300 | 0,335 | 0,375 | 0,440 |
| P2.1.4 Niedriglegierter Stahl, vergütet, Rm 1190 N/mm <sup>2</sup> , 350 HB                               | 90  | 0,090                  | 0,155 | 0,195 | 0,230 | 0,265 | 0,295 | 0,330 | 0,390 |
| P3.1.1 Hochlegierter Stahl und Werkzeugstahl, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB                  | 70  | 0,095                  | 0,165 | 0,205 | 0,240 | 0,275 | 0,310 | 0,345 | 0,405 |
| P3.1.2 Hochlegierter Stahl und Werkzeugstahl, gehärtet und angelassen, Rm 1100 N/mm <sup>2</sup> , 325 HB | 60  | 0,080                  | 0,140 | 0,170 | 0,205 | 0,235 | 0,265 | 0,290 | 0,345 |
| M1.1.1 Nichtrostender Stahl, ferritisch/martensitisch, mit Zerspanungsadditiven                           | 60  | 0,075                  | 0,130 | 0,160 | 0,190 | 0,220 | 0,250 | 0,275 | 0,325 |
| M1.1.2 Nichtrostender Stahl, ferritisch/martensitisch, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB         | 55  | 0,070                  | 0,115 | 0,145 | 0,175 | 0,200 | 0,225 | 0,245 | 0,295 |
| M1.1.3 Nichtrostender Stahl, ferritisch/martensitisch, vergütet, Rm 810 N/mm <sup>2</sup> , 240 HB        | 50  | 0,065                  | 0,110 | 0,140 | 0,165 | 0,185 | 0,210 | 0,235 | 0,275 |
| M2.1.1 Nichtrostender Stahl, austenitisch, abgeschreckt, 180 HB   | 55  | 0,040                  | 0,065 | 0,080 | 0,095 | 0,110 | 0,125 | 0,135 | 0,165 |
| M2.2.1 Duplexstahl, hochfeste nichtrostende Stähle  | 45  | 0,035                  | 0,055 | 0,070 | 0,080 | 0,095 | 0,105 | 0,115 | 0,140 |
| K1.1.1 Grauguss, perlitisch/ferritisch, 180 HB  | 110   | 0,155                  | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| K1.1.2 Grauguss, perlitisch/martensitisch, 260 HB   | 95  | 0,130                  | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| K1.2.1 Gusseisen mit Kugelgraphit, ferritisch, 160 HB   | 95  | 0,130                  | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| K1.2.2 Gusseisen mit Kugelgraphit, perlitisch, 250 HB   | 90  | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| K1.3.1 Temperguss, ferritisch, 130 HB   | 90  | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| K1.3.2 Temperguss, perlitisch, 230 HB   | 75  | 0,110                  | 0,180 | 0,225 | 0,270 | 0,310 | 0,345 | 0,385 | 0,455 |
| K2.1.1 Gusseisen mit Vermiculargraphit (GJV)  | 90  | 0,155                  | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| K2.2.1 Austenitisch-ferritisches Gusseisen mit Kugelgraphit (ADI)   | 70  | 0,115                  | 0,195 | 0,245 | 0,290 | 0,330 | 0,370 | 0,410 | 0,490 |
| N1.1.1 Aluminium-Knetlegierungen, nicht aushärtbar, 60 HB   | 185   | 0,155                  | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| N1.1.2 Aluminium-Knetlegierungen, ausgehärtet, 100 HB   | 185   | 0,155                  | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| N2.1.1 Aluminium-Gusslegierungen, nicht aushärtbar, ≤ 12 % Si, 75 HB                                      | 170   | 0,155                  | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| N2.1.2 Aluminium-Gusslegierungen, ausgehärtet, ≤ 12 % Si, 90 HB   | 170   | 0,155                  | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| N2.1.3 Aluminium-Gusslegierungen, nicht aushärtbar, > 12 % Si, 130 HB                                     | 145   | 0,130                  | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| N3.1.1 Kupfer und Kupferlegierungen: Automatenlegierung, Pb > 1 %   | 130   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| N3.1.2 Kupfer und Kupferlegierungen: CuZn, CuSnZn   | 110   | 0,105                  | 0,175 | 0,220 | 0,260 | 0,300 | 0,335 | 0,375 | 0,440 |
| N3.1.3 Kupfer und Kupferlegierungen: CuSn, bleifreies Kupfer und Elektrolytkupfer                         | 105   | 0,100                  | 0,165 | 0,205 | 0,245 | 0,280 | 0,315 | 0,350 | 0,415 |
| N4.1.1 Nichtmetallische Werkstoffe: Duroplaste, Faserverstärkte Kunststoffe                               |   |                        |       |       |       |       |       |       |       |
| N4.1.2 Nichtmetallische Werkstoffe: Hartgummi, Holz usw.  |   |                        |       |       |       |       |       |       |       |
| N4.1.3 Nichtmetallische Werkstoffe: Graphit   |   |                        |       |       |       |       |       |       |       |
| S1.1.1 Warmfeste Legierungen, Fe-Basis, gegläht, 200 HB   | 40  | 0,060                  | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| S1.1.2 Warmfeste Legierungen, Fe-Basis, ausgehärtet, 280 HB   | 30  | 0,050                  | 0,085 | 0,105 | 0,120 | 0,140 | 0,160 | 0,175 | 0,205 |
| S1.1.3 Warmfeste Legierungen, Ni- oder Co-Basis, gegläht, 250 HB  | 35  | 0,060                  | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| S1.1.4 Warmfeste Legierungen, Ni- oder Co-Basis, ausgehärtet, 350 HB                                      | 20  | 0,045                  | 0,075 | 0,090 | 0,105 | 0,125 | 0,140 | 0,155 | 0,180 |
| S1.1.5 Warmfeste Legierungen, Ni- oder Co-Basis, gegossen, 320 HB   | 25  | 0,045                  | 0,075 | 0,090 | 0,105 | 0,125 | 0,140 | 0,155 | 0,180 |
| S2.1.1 Titanlegierungen, Reintitan, Rm 400 N/mm <sup>2</sup>  | 40  | 0,060                  | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| S2.1.2 Titanlegierungen, Alpha- und Beta-Legierungen, ausgehärtet, Rm 1050 N/mm <sup>2</sup>              | 30  | 0,050                  | 0,085 | 0,105 | 0,120 | 0,140 | 0,160 | 0,175 | 0,205 |
| H1.1.1 Gehärteter Stahl, gehärtet und angelassen, < 55 HRC  | 50  | 0,040                  | 0,065 | 0,080 | 0,095 | 0,110 | 0,125 | 0,135 | 0,165 |
| H1.1.2 Gehärteter Stahl, gehärtet und angelassen, < 60 HRC  | 35  | 0,030                  | 0,050 | 0,065 | 0,075 | 0,090 | 0,100 | 0,110 | 0,130 |
| H1.1.3 Gehärteter Stahl, gehärtet und angelassen, > 60 HRC  | 30  | 0,030                  | 0,050 | 0,060 | 0,070 | 0,085 | 0,095 | 0,105 | 0,120 |
| H2.1.1 Hartguss, gegossen, 400 HB   | 40  | 0,050                  | 0,080 | 0,100 | 0,120 | 0,140 | 0,155 | 0,175 | 0,205 |
| H2.1.2 Hartguss, gehärtet und angelassen, < 55 HRC  | 30  | 0,035                  | 0,055 | 0,070 | 0,085 | 0,095 | 0,110 | 0,120 | 0,145 |



## TS-Drills ohne Innenkühlung, 3xD



| Zerspanungsgruppe  |      | f (mm/U) bei Nenn-Ø    |       |       |       |       |       |       |       |
|--|---|------------------------|-------|-------|-------|-------|-------|-------|-------|
|  |   | v <sub>c</sub> (m/min) | 3     | 6     | 8     | 10    | 12    | 14    | 16    |
|  | <b>P1.1.1</b> Unlegierter Stahl, gegläht, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB |                        | 130   | 0,155 | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 |
| <b>P1.1.2</b> Unlegierter Stahl, vergütet, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB                           | 115   | 0,140                  | 0,235 | 0,290 | 0,345 | 0,395 | 0,445 | 0,495 | 0,585 |
| <b>P1.1.3</b> Unlegierter Stahl, gegläht, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                            | 115   | 0,140                  | 0,235 | 0,290 | 0,345 | 0,395 | 0,445 | 0,495 | 0,585 |
| <b>P1.1.4</b> Unlegierter Stahl, vergütet, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                           | 110   | 0,130                  | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| <b>P1.1.5</b> Unlegierter Stahl, vergütet, 0,45 % C, Rm 850 N/mm <sup>2</sup> , 250 HB                           | 110   | 0,130                  | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| <b>P1.1.6</b> Unlegierter Stahl, gegläht, 0,75 % C, Rm 915 N/mm <sup>2</sup> , 270 HB                            | 105   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| <b>P1.1.7</b> Unlegierter Stahl, vergütet, 0,75 % C, Rm 1020 N/mm <sup>2</sup> , 300 HB                          | 100   | 0,115                  | 0,195 | 0,245 | 0,290 | 0,330 | 0,370 | 0,410 | 0,490 |
| <b>P2.1.1</b> Niedriglegierter Stahl, gegläht, Rm 610 N/mm <sup>2</sup> , 180 HB                                 | 105   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| <b>P2.1.2</b> Niedriglegierter Stahl, vergütet, Rm 930 N/mm <sup>2</sup> , 275 HB                                | 105   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| <b>P2.1.3</b> Niedriglegierter Stahl, vergütet, Rm 1020 N/mm <sup>2</sup> , 300 HB                               | 90  | 0,105                  | 0,175 | 0,220 | 0,260 | 0,300 | 0,335 | 0,375 | 0,440 |
| <b>P2.1.4</b> Niedriglegierter Stahl, vergütet, Rm 1190 N/mm <sup>2</sup> , 350 HB                               | 80  | 0,090                  | 0,155 | 0,195 | 0,230 | 0,265 | 0,295 | 0,330 | 0,390 |
| <b>P3.1.1</b> Hochlegierter Stahl und Werkzeugstahl, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB                  | 65  | 0,095                  | 0,165 | 0,205 | 0,240 | 0,275 | 0,310 | 0,345 | 0,405 |
| <b>P3.1.2</b> Hochlegierter Stahl und Werkzeugstahl, gehärtet und angelassen, Rm 1100 N/mm <sup>2</sup> , 325 HB | 55  | 0,080                  | 0,140 | 0,170 | 0,205 | 0,235 | 0,265 | 0,290 | 0,345 |
| <b>M1.1.1</b> Nichtrostender Stahl, ferritisch/martensitisch, mit Zerspanungsadditiven                           | 40  | 0,040                  | 0,065 | 0,080 | 0,095 | 0,110 | 0,125 | 0,135 | 0,165 |
| <b>M1.1.2</b> Nichtrostender Stahl, ferritisch/martensitisch, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB         | 35  | 0,035                  | 0,060 | 0,075 | 0,085 | 0,100 | 0,110 | 0,125 | 0,145 |
| <b>M1.1.3</b> Nichtrostender Stahl, ferritisch/martensitisch, vergütet, Rm 810 N/mm <sup>2</sup> , 240 HB        | 35  | 0,035                  | 0,055 | 0,070 | 0,080 | 0,095 | 0,105 | 0,115 | 0,140 |
| <b>M2.1.1</b> Nichtrostender Stahl, austenitisch, abgeschreckt, 180 HB   | 25  | 0,030                  | 0,050 | 0,065 | 0,075 | 0,090 | 0,100 | 0,110 | 0,130 |
| <b>M2.2.1</b> Duplexstahl, hochfeste nichtrostende Stähle  | 20  | 0,025                  | 0,045 | 0,055 | 0,065 | 0,075 | 0,085 | 0,095 | 0,110 |
| <b>K1.1.1</b> Grauguss, perlitisch/ferritisch, 180 HB  | 90  | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| <b>K1.1.2</b> Grauguss, perlitisch/martensitisch, 260 HB   | 75  | 0,105                  | 0,175 | 0,220 | 0,260 | 0,300 | 0,335 | 0,375 | 0,440 |
| <b>K1.2.1</b> Gusseisen mit Kugelgraphit, ferritisch, 160 HB   | 75  | 0,105                  | 0,175 | 0,220 | 0,260 | 0,300 | 0,335 | 0,375 | 0,440 |
| <b>K1.2.2</b> Gusseisen mit Kugelgraphit, perlitisch, 250 HB   | 70  | 0,100                  | 0,165 | 0,205 | 0,245 | 0,280 | 0,315 | 0,350 | 0,415 |
| <b>K1.3.1</b> Temperguss, ferritisch, 130 HB   | 70  | 0,100                  | 0,165 | 0,205 | 0,245 | 0,280 | 0,315 | 0,350 | 0,415 |
| <b>K1.3.2</b> Temperguss, perlitisch, 230 HB   | 65  | 0,085                  | 0,145 | 0,180 | 0,215 | 0,245 | 0,280 | 0,305 | 0,365 |
| <b>K2.1.1</b> Gusseisen mit Vermiculargraphit (GJV)  | 70  | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| <b>K2.2.1</b> Austenitisch-ferritisches Gusseisen mit Kugelgraphit (ADI)   | 55  | 0,090                  | 0,155 | 0,195 | 0,230 | 0,265 | 0,295 | 0,330 | 0,390 |
| <b>N1.1.1</b> Aluminium-Knetlegierungen, nicht aushärtbar, 60 HB   | 165   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| <b>N1.1.2</b> Aluminium-Knetlegierungen, ausgehärtet, 100 HB   | 165   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| <b>N2.1.1</b> Aluminium-Gusslegierungen, nicht aushärtbar, ≤ 12 % Si, 75 HB                                      | 150   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| <b>N2.1.2</b> Aluminium-Gusslegierungen, ausgehärtet, ≤ 12 % Si, 90 HB   | 150   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| <b>N2.1.3</b> Aluminium-Gusslegierungen, nicht aushärtbar, > 12 % Si, 130 HB                                     | 130   | 0,105                  | 0,175 | 0,220 | 0,260 | 0,300 | 0,335 | 0,375 | 0,440 |
| <b>N3.1.1</b> Kupfer und Kupferlegierungen: Automatenlegierung, Pb > 1 %   | 110   | 0,095                  | 0,165 | 0,205 | 0,240 | 0,275 | 0,310 | 0,345 | 0,405 |
| <b>N3.1.2</b> Kupfer und Kupferlegierungen: CuZn, CuSnZn   | 95  | 0,080                  | 0,140 | 0,170 | 0,205 | 0,235 | 0,265 | 0,290 | 0,345 |
| <b>N3.1.3</b> Kupfer und Kupferlegierungen: CuSn, bleifreies Kupfer und Elektrolytkupfer                         | 90  | 0,075                  | 0,130 | 0,160 | 0,190 | 0,220 | 0,250 | 0,275 | 0,325 |
| <b>N4.1.1</b> Nichtmetallische Werkstoffe: Duroplaste, Faserverstärkte Kunststoffe                               |   |                        |       |       |       |       |       |       |       |
| <b>N4.1.2</b> Nichtmetallische Werkstoffe: Hartgummi, Holz usw.  |   |                        |       |       |       |       |       |       |       |
| <b>N4.1.3</b> Nichtmetallische Werkstoffe: Graphit   |   |                        |       |       |       |       |       |       |       |
| <b>S1.1.1</b> Warmfeste Legierungen, Fe-Basis, gegläht, 200 HB   | 30  | 0,060                  | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| <b>S1.1.2</b> Warmfeste Legierungen, Fe-Basis, ausgehärtet, 280 HB   | 25  | 0,050                  | 0,085 | 0,105 | 0,120 | 0,140 | 0,160 | 0,175 | 0,205 |
| <b>S1.1.3</b> Warmfeste Legierungen, Ni- oder Co-Basis, gegläht, 250 HB  | 25  | 0,060                  | 0,105 | 0,130 | 0,155 | 0,175 | 0,200 | 0,220 | 0,260 |
| <b>S1.1.4</b> Warmfeste Legierungen, Ni- oder Co-Basis, ausgehärtet, 350 HB                                      | 15  | 0,045                  | 0,075 | 0,090 | 0,105 | 0,125 | 0,140 | 0,155 | 0,180 |
| <b>S1.1.5</b> Warmfeste Legierungen, Ni- oder Co-Basis, gegossen, 320 HB   | 20  | 0,045                  | 0,075 | 0,090 | 0,105 | 0,125 | 0,140 | 0,155 | 0,180 |
| <b>S2.1.1</b> Titanlegierungen, Reintitan, Rm 400 N/mm <sup>2</sup>  | 15  | 0,030                  | 0,050 | 0,065 | 0,075 | 0,090 | 0,100 | 0,110 | 0,130 |
| <b>S2.1.2</b> Titanlegierungen, Alpha- und Beta-Legierungen, ausgehärtet, Rm 1050 N/mm <sup>2</sup>              | 10  | 0,025                  | 0,040 | 0,050 | 0,060 | 0,070 | 0,080 | 0,090 | 0,105 |
| <b>H1.1.1</b> Gehärteter Stahl, gehärtet und angelassen, < 55 HRC  | 35  | 0,030                  | 0,050 | 0,065 | 0,075 | 0,090 | 0,100 | 0,110 | 0,130 |
| <b>H1.1.2</b> Gehärteter Stahl, gehärtet und angelassen, < 60 HRC  | 25  | 0,025                  | 0,040 | 0,050 | 0,060 | 0,070 | 0,080 | 0,090 | 0,105 |
| <b>H1.1.3</b> Gehärteter Stahl, gehärtet und angelassen, > 60 HRC  | 20  | 0,025                  | 0,040 | 0,050 | 0,060 | 0,065 | 0,075 | 0,085 | 0,100 |
| <b>H2.1.1</b> Hartguss, gegossen, 400 HB   | 25  | 0,040                  | 0,065 | 0,080 | 0,095 | 0,110 | 0,125 | 0,135 | 0,165 |
| <b>H2.1.2</b> Hartguss, gehärtet und angelassen, < 55 HRC  | 20  | 0,025                  | 0,045 | 0,055 | 0,065 | 0,075 | 0,085 | 0,095 | 0,115 |

## TS-Drills ohne Innenkühlung, 5xD



| Zerspanungsgruppe   |  | f (mm/U) bei Nenn-Ø    |       |       |       |       |       |       |       |
|---|---|------------------------|-------|-------|-------|-------|-------|-------|-------|
|   |   | v <sub>c</sub> (m/min) | 3     | 6     | 8     | 10    | 12    | 14    | 16    |
|   |  |                        |       |       |       |       |       |       |       |
| P1.1.1 Unlegierter Stahl, gegläht, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB                            | 130   | 0,155                  | 0,260 | 0,325 | 0,385 | 0,440 | 0,495 | 0,550 | 0,650 |
| P1.1.2 Unlegierter Stahl, vergütet, 0,15 % C, Rm 420 N/mm <sup>2</sup> , 125 HB                           | 115   | 0,140                  | 0,235 | 0,290 | 0,345 | 0,395 | 0,445 | 0,495 | 0,585 |
| P1.1.3 Unlegierter Stahl, gegläht, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                            | 115   | 0,140                  | 0,235 | 0,290 | 0,345 | 0,395 | 0,445 | 0,495 | 0,585 |
| P1.1.4 Unlegierter Stahl, vergütet, 0,45 % C, Rm 640 N/mm <sup>2</sup> , 190 HB                           | 110   | 0,130                  | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| P1.1.5 Unlegierter Stahl, vergütet, 0,45 % C, Rm 850 N/mm <sup>2</sup> , 250 HB                           | 110   | 0,130                  | 0,220 | 0,275 | 0,325 | 0,375 | 0,420 | 0,465 | 0,555 |
| P1.1.6 Unlegierter Stahl, gegläht, 0,75 % C, Rm 915 N/mm <sup>2</sup> , 270 HB                            | 105   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| P1.1.7 Unlegierter Stahl, vergütet, 0,75 % C, Rm 1020 N/mm <sup>2</sup> , 300 HB                          | 100   | 0,115                  | 0,195 | 0,245 | 0,290 | 0,330 | 0,370 | 0,410 | 0,490 |
| P2.1.1 Niedriglegierter Stahl, gegläht, Rm 610 N/mm <sup>2</sup> , 180 HB                                 | 105   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| P2.1.2 Niedriglegierter Stahl, vergütet, Rm 930 N/mm <sup>2</sup> , 275 HB                                | 105   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| P2.1.3 Niedriglegierter Stahl, vergütet, Rm 1020 N/mm <sup>2</sup> , 300 HB                               | 90  | 0,105                  | 0,175 | 0,220 | 0,260 | 0,300 | 0,335 | 0,375 | 0,440 |
| P2.1.4 Niedriglegierter Stahl, vergütet, Rm 1190 N/mm <sup>2</sup> , 350 HB                               | 80  | 0,090                  | 0,155 | 0,195 | 0,230 | 0,265 | 0,295 | 0,330 | 0,390 |
| P3.1.1 Hochlegierter Stahl und Werkzeugstahl, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB                  | 65  | 0,095                  | 0,165 | 0,205 | 0,240 | 0,275 | 0,310 | 0,345 | 0,405 |
| P3.1.2 Hochlegierter Stahl und Werkzeugstahl, gehärtet und angelassen, Rm 1100 N/mm <sup>2</sup> , 325 HB | 55  | 0,080                  | 0,140 | 0,170 | 0,205 | 0,235 | 0,265 | 0,290 | 0,345 |
| M1.1.1 Nichtrostender Stahl, ferritisch/martensitisch, mit Zerspanungsadditiven                           | 45  | 0,040                  | 0,065 | 0,080 | 0,095 | 0,110 | 0,125 | 0,135 | 0,165 |
| M1.1.2 Nichtrostender Stahl, ferritisch/martensitisch, gegläht, Rm 680 N/mm <sup>2</sup> , 200 HB         | 40  | 0,035                  | 0,060 | 0,075 | 0,085 | 0,100 | 0,110 | 0,125 | 0,145 |
| M1.1.3 Nichtrostender Stahl, ferritisch/martensitisch, vergütet, Rm 810 N/mm <sup>2</sup> , 240 HB        | 40  | 0,035                  | 0,055 | 0,070 | 0,080 | 0,095 | 0,105 | 0,115 | 0,140 |
| M2.1.1 Nichtrostender Stahl, austenitisch, abgeschreckt, 180 HB   | 25  | 0,030                  | 0,050 | 0,065 | 0,075 | 0,090 | 0,100 | 0,110 | 0,130 |
| M2.2.1 Duplexstahl, hochfeste nichtrostende Stähle  | 20  | 0,025                  | 0,045 | 0,055 | 0,065 | 0,075 | 0,085 | 0,095 | 0,110 |
| K1.1.1 Grauguss, perlitisch/ferritisch, 180 HB  | 90  | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| K1.1.2 Grauguss, perlitisch/martensitisch, 260 HB   | 75  | 0,105                  | 0,175 | 0,220 | 0,260 | 0,300 | 0,335 | 0,375 | 0,440 |
| K1.2.1 Gusseisen mit Kugelgraphit, ferritisch, 160 HB   | 75  | 0,105                  | 0,175 | 0,220 | 0,260 | 0,300 | 0,335 | 0,375 | 0,440 |
| K1.2.2 Gusseisen mit Kugelgraphit, perlitisch, 250 HB   | 70  | 0,100                  | 0,165 | 0,205 | 0,245 | 0,280 | 0,315 | 0,350 | 0,415 |
| K1.3.1 Temperguss, ferritisch, 130 HB   | 70  | 0,100                  | 0,165 | 0,205 | 0,245 | 0,280 | 0,315 | 0,350 | 0,415 |
| K1.3.2 Temperguss, perlitisch, 230 HB   | 65  | 0,085                  | 0,145 | 0,180 | 0,215 | 0,245 | 0,280 | 0,305 | 0,365 |
| K2.1.1 Gusseisen mit Vermiculargraphit (GJV)  | 70  | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| K2.2.1 Austenitisch-ferritisches Gusseisen mit Kugelgraphit (ADI)   | 55  | 0,090                  | 0,155 | 0,195 | 0,230 | 0,265 | 0,295 | 0,330 | 0,390 |
| N1.1.1 Aluminium-Knetlegierungen, nicht aushärtbar, 60 HB   | 165   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| N1.1.2 Aluminium-Knetlegierungen, ausgehärtet, 100 HB   | 165   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| N2.1.1 Aluminium-Gusslegierungen, nicht aushärtbar, ≤ 12 % Si, 75 HB                                      | 150   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| N2.1.2 Aluminium-Gusslegierungen, ausgehärtet, ≤ 12 % Si, 90 HB   | 150   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| N2.1.3 Aluminium-Gusslegierungen, nicht aushärtbar, > 12 % Si, 130 HB                                     | 130   | 0,105                  | 0,175 | 0,220 | 0,260 | 0,300 | 0,335 | 0,375 | 0,440 |
| N3.1.1 Kupfer und Kupferlegierungen: Automatenlegierung, Pb > 1 %   | 130   | 0,125                  | 0,210 | 0,260 | 0,305 | 0,355 | 0,395 | 0,440 | 0,520 |
| N3.1.2 Kupfer und Kupferlegierungen: CuZn, CuSnZn   | 110   | 0,105                  | 0,175 | 0,220 | 0,260 | 0,300 | 0,335 | 0,375 | 0,440 |
| N3.1.3 Kupfer und Kupferlegierungen: CuSn, bleifreies Kupfer und Elektrolytkupfer                         | 105   | 0,100                  | 0,165 | 0,205 | 0,245 | 0,280 | 0,315 | 0,350 | 0,415 |
| N4.1.1 Nichtmetallische Werkstoffe: Duroplaste, Faserverstärkte Kunststoffe                               |   |                        |       |       |       |       |       |       |       |
| N4.1.2 Nichtmetallische Werkstoffe: Hartgummi, Holz usw.  |   |                        |       |       |       |       |       |       |       |
| N4.1.3 Nichtmetallische Werkstoffe: Graphit   |   |                        |       |       |       |       |       |       |       |
| S1.1.1 Warmfeste Legierungen, Fe-Basis, gegläht, 200 HB   | 30  | 0,050                  | 0,080 | 0,100 | 0,120 | 0,140 | 0,155 | 0,175 | 0,205 |
| S1.1.2 Warmfeste Legierungen, Fe-Basis, ausgehärtet, 280 HB   | 25  | 0,040                  | 0,065 | 0,080 | 0,095 | 0,110 | 0,125 | 0,140 | 0,165 |
| S1.1.3 Warmfeste Legierungen, Ni- oder Co-Basis, gegläht, 250 HB  | 25  | 0,050                  | 0,080 | 0,100 | 0,120 | 0,140 | 0,155 | 0,175 | 0,205 |
| S1.1.4 Warmfeste Legierungen, Ni- oder Co-Basis, ausgehärtet, 350 HB                                      | 15  | 0,035                  | 0,055 | 0,070 | 0,085 | 0,095 | 0,110 | 0,120 | 0,145 |
| S1.1.5 Warmfeste Legierungen, Ni- oder Co-Basis, gegossen, 320 HB   | 20  | 0,035                  | 0,055 | 0,070 | 0,085 | 0,095 | 0,110 | 0,120 | 0,145 |
| S2.1.1 Titanlegierungen, Reintitan, Rm 400 N/mm <sup>2</sup>  | 15  | 0,030                  | 0,050 | 0,065 | 0,075 | 0,090 | 0,100 | 0,110 | 0,130 |
| S2.1.2 Titanlegierungen, Alpha- und Beta-Legierungen, ausgehärtet, Rm 1050 N/mm <sup>2</sup>              | 10  | 0,025                  | 0,040 | 0,050 | 0,060 | 0,070 | 0,080 | 0,090 | 0,105 |
| H1.1.1 Gehärteter Stahl, gehärtet und angelassen, < 55 HRC  | 35  | 0,030                  | 0,050 | 0,065 | 0,075 | 0,090 | 0,100 | 0,110 | 0,130 |
| H1.1.2 Gehärteter Stahl, gehärtet und angelassen, < 60 HRC  | 25  | 0,025                  | 0,040 | 0,050 | 0,060 | 0,070 | 0,080 | 0,090 | 0,105 |
| H1.1.3 Gehärteter Stahl, gehärtet und angelassen, > 60 HRC  | 20  | 0,025                  | 0,040 | 0,050 | 0,060 | 0,065 | 0,075 | 0,085 | 0,100 |
| H2.1.1 Hartguss, gegossen, 400 HB   | 25  | 0,040                  | 0,065 | 0,080 | 0,095 | 0,110 | 0,125 | 0,135 | 0,165 |
| H2.1.2 Hartguss, gehärtet und angelassen, < 55 HRC  | 20  | 0,025                  | 0,045 | 0,055 | 0,065 | 0,075 | 0,085 | 0,095 | 0,115 |







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## HARTNER GMBH

Postfach 10 04 27 | 72425 Albstadt | Deutschland  
Telefon +49 74 31 125-0 | Fax +49 74 31 125-21 547

[www.hartner.de](http://www.hartner.de)

**Schnyder + Minder AG**  
Zielmattenring 11  
CH-4563 Gerlafingen  
Phone: +41 31 832 77 00  
[info@smtools.ch](mailto:info@smtools.ch)

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