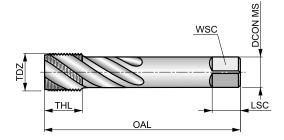
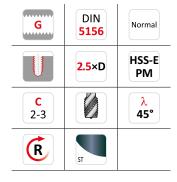
## EX41

HSS-E-PM Spiral Flute Machine Tap, G(BSP), DIN Standard Machine tap with spiral flute suited for blind holes. Steam tempered surface acts to retain cutting fluid and prevent chip to tool welding. The reduced shank increases the reach of the tap.







| P1.1 P2                | 2.2 | P2.3       | P3.2 | P3.3       | P4.1 P4. | 2 M1.1 | M1.2    | M2.1  | M2.2 | M3.1     | M3.2 | <mark>M3.3</mark> |
|------------------------|-----|------------|------|------------|----------|--------|---------|---|------|----------|------|-------------------|
| <b>Z</b> 21            | 115 | <b>1</b> 3 | 9    | <b>■</b> 8 | ∎7 🔼     | 5 🗖 8  | ⊠6      | <b> </b> 7  | ∎5   | ∎5       | ∎4   | ⊠3                |
| M4.1                   |     |            |      |            |          |        |         |   |      |          |      |                   |
| <b>∠</b> 3             |     |            |      |            |          |        |         |   |      |          |      |                   |
|                        |     |            |      |            |          |        |         |   |      |          |      |                   |
|                        |     | TDZ        | TPI  | TD         | OAL      | THL    | DCON MS | WSC   | LS   | c        | NOF  | PHD               |
| roduct                 |     | 102        |      | 10         | UNL      |        | Deon mb | with the second s | LJ   |          | nor  | 1110              |
|                        |     |            |      | [mm]       | [mm]     | [mm]   | [mm]    | [mm]  | [mr  | n]       |      | [mm]              |
| K411/8                 |     | 1/8        | 28   | 9.728      | 90.0     | 13     | 7.00    | 5.50  | 8    |          | 3    | 8.80              |
| K411/4                 |     | 1/4        | 19   | 13.157     | 100.0    | 15     | 11.00   | 9.00  | 1.   | 2        | 3    | 11.80             |
| (413/8                 |     | 3/8        | 19   | 16.662     | 100.0    | 15     | 12.00   | 9.00  | 12   | <u>)</u> | 4    | 15.25             |
| (411/2                 |     | 1/2        | 14   | 20.955     | 125.0    | 18     | 16.00   | 12.00   | 1    | 5        | 4    | 19.00             |
| K415/8                 |     | 5/8        | 14   | 22.911     | 125.0    | 18     | 18.00   | 14.50   | 1:   | 7        | 4    | 21.00             |
| K413/4                 |     | 3/4        | 14   | 26.441     | 140.0    | 20     | 20.00   | 16.00   | 19   | )        | 4    | 24.50             |
| X417/8                 |     | 7/8        | 14   | 30.201     | 150.0    | 20     | 22.00   | 18.00   | 2    | 1        | 4    | 28.25             |
| X411                   |     | 1″         | 11   | 33.249     | 160.0    | 22     | 25.00   | 20.00   | 23   | 3        | 4    | 30.75             |
| X411.1/8               |     | 1.1/8      | 11   | 37.897     | 170.0    | 22     | 28.00   | 22.00   | 2    | 5        | 4    | 35.00             |
| X411.1/4 <sup>1)</sup> |     | 1.1/4      | 11   | 41.910     | 170.0    | 22     | 32.00   | 24.00   | 27   | 7        | 4    | 39.50             |
| K411.1/2 <sup>1)</sup> |     | 1.1/2      | 11   | 47.803     | 190.0    | 23     | 36.00   | 29.00   | 32   | 2        | 4    | 45.00             |

<sup>1)</sup> HSS-E.

## WMG (WORK MATERIAL GROUP)

| 150 gi | roup                                   | WM   | G (Work Material Group)  |                                       | Hardness<br>(HB or HRC)  | Ultimate<br>Tensile Strength<br>(MPa)   |  |
|--------|--|--|--|---------------------------------------|--|---|--|
|        |  | P1.1   |  | Sulfurized                            | < 240 HB   | ≤ 830   |  |
| -      | P1                                     | P1.2   | Free machining steel   | Sulfurized and phosphorized           | < 180 HB   | ≤ 620   |  |
|        |  | P1.3   | (carbon steels with increased machinability)   | Sulfurized/phosphorized and leaded    | < 180 HB   | ≤ 620   |  |
|        |  | P2.1   |  |                                       |  |   |  |
|        |  |  | Plain carbon steel   | Containing <0.25 % C                  | < 180 HB   | ≤ 620   |  |
|        | P2                                     | P2.2   | (steels comprised of mainly iron and carbon)   | Containing <0.55 % C                  | < 240 HB   | ≤ 830   |  |
| Ρ      |  | P2.3   |  | Containing >0.55 % C                  | < 300 HB   | ≤ 1030  |  |
| Γ      |  | P3.1   |  | < 180 HB                              | ≤ 620  |   |  |
|        | P3                                     | P3.2   | Alloy steel  |                                       | 180 – 260 HB   | > 620 ≤ 900   |  |
|        |  | P3.3   | (carbon steels with an alloying content $\leq$ 10%)  | Hardened and tempered                 | 260 - 360 HB   | > 900 ≤ 1240  |  |
|        |  | P4.1   |  | Annealed                              | < 26 HRC   | ≤ 900   |  |
|        | P4                                     |  | Tool steel   | 26 – 39 HRC                           | > 900 ≤ 1240   |   |  |
|        | <b>r</b> 4                             | P4.2   | (special alloy steel for tools, dies and molds) Hardened and tempered  |                                       |  |   |  |
|        |  | P4.3   |  |                                       | 39 – 45 HRC  | > 1240 ≤ 1450   |  |
|        | M1                                     | M1.1   | Ferritic stainless steel   | < 160 HB                              | ≤ 520  |   |  |
|        | - Mil                                  | M1.2   | (straight chromium non-hardenable alloys)  |                                       | 160 – 220 HB   | > 520 ≤ 700   |  |
|        |  | M2.1   |  | Annealed                              |  |   |  |
|        | M2                                     | M2.2   | Martensitic stainless steel  | Quenched and tempered                 | 200 – 280 HB   | > 670 ≤ 950   |  |
|        |  | M2.3   | (straight chromium hardenable alloys)  | Precipitation-hardened                | 280 – 380 HB   | > 950 ≤ 1300  |  |
|        |  |  |  | < 200 HB                              | ≤ 750  |   |  |
|        |  | M3.1   | Austenitic stainless steel   |                                       |  |   |  |
|        | M3                                     | M3.2   | (chromium-nickel and chromium-nickel-manganese alloys)   | 200 – 260 HB                          | > 750 ≤ 870  |   |  |
|        |  | M3.3   |  | 260 – 300 HB                          | > 870 ≤ 1040   |   |  |
|        |  | M4.1   | Austenitic-ferritic (DUPLEX) or super-austenitic stainless steel   |                                       | < 300 HB   | ≤ 990   |  |
|        | M4                                     | M4.2   | Precipitation hardening austenitic stainless steel   |                                       | 300 – 380 HB   | ≤ 1320  |  |
|        |  | K1.1   |  | Ferritic or ferritic-pearlitic        | < 180 HB   | ≤ 190   |  |
|        | 1/1                                    |  | Gray iron or Automotive Gray iron (GG)   | · · · · · · · · · · · · · · · · · · · |  |   |  |
|        | K1                                     | K1.2   | (iron-carbon castings with a lamellar graphite microstructure)   | Ferritic-pearlictic or pearlitic      | 180 – 240 HB   | > 190 ≤ 310   |  |
| к      |  | K1.3   |  | Pearlitic                             | 240 – 280 HB   | > 310 ≤ 390   |  |
|        |  | K2.1   | Malleable iron (GTS/GTW)   | Ferritic                              | < 160 HB   | ≤ 400   |  |
|        | K2                                     | K2.2   | (iron-carbon castings with a graphite-free microstructure)   | Ferritic or pearlitic                 | 160 – 200 HB   | > 400 ≤ 550   |  |
|        |  | K2.3   | (non-carbon castings with a graphice-free microstructure)  | Pearlitic                             | 200 – 240 HB   | > 550 ≤ 660   |  |
|        |  | K3.1   |  | Ferritic                              | < 180 HB   | ≤ 560   |  |
|        | K3                                     | K3.2   | Ductile iron (GGG)   | Ferritic or pearlitic                 | 180 – 220 HB   | > 560 ≤ 680   |  |
|        | K.S                                    |  | (iron-carbon castings with a nodular graphite microstructure)  | Pearlitic                             |  |   |  |
|        |  | K3.3   |  | 220 – 260 HB                          | > 680 ≤ 800  |   |  |
| K      |  | K4.1   | Austenitic gray iron (ASTM A436)<br>(iron-carbon alloy castings with an austenitic lamellar graphite microstructure)   |                                       | < 180 HB   | ≤ 190   |  |
|        | K4                                     | K4.2   | Austenitic ductile iron (ASTM A439 or ASTM A571)<br>(iron-carbon alloy castings with an austenitic nodular graphite microstructure)  |                                       | < 240 HB   | ≤ 740   |  |
|        |  | K4.3   |  | < 280 HB                              | > 840 ≤ 980  |   |  |
|        |  | K4.4   | Austempered ductile iron (ASTM A897)   | 280 – 320 HB                          | > 980 ≤ 1130   |   |  |
|        |  | K4.5   | (iron-carbon alloy castings with an ausferrite microstructure)   | 320 – 360 HB                          | > 1130 ≤ 1280  |   |  |
|        |  |  |  | Ferritic                              |  |   |  |
|        |  | K5.1   | Compacted graphite iron CGI (ASTM A842)  |                                       | < 180 HB   | ≤ 400   |  |
|        | K5                                     | K5.2   | (iron-carbon castings with a vermicular graphite structure)  | Ferritic-pearlitic                    | 180 – 220 HB   | > 400 ≤ 450   |  |
|        |  | K5.3   |  | Pearlitic                             | 220 – 260 HB   | > 450 ≤ 500   |  |
|        |  | N1.1   | Commercially pure wrought aluminium  |                                       | < 60 HB  | ≤ 240   |  |
|        | N1                                     | N1.2   | Weinstein Leither Heine  | Half hard tempered                    | 60 - 100 HB  | > 240 ≤ 400   |  |
|        |  | N1.3   | Wrought aluminium alloys   | Full hard tempered                    | 100 – 150 HB   | > 400 ≤ 590   |  |
|        |  | N2.1   |  | < 75 HB                               | ≤ 240  |   |  |
| N2     | ND                                     |  | Cast aluminium allour  |                                       |  |   |  |
|        | N2                                     | N2.2   | Cast aluminium alloys  | 75 – 90 HB<br>90 – 140 HB             | > 240 ≤ 270<br>> 270 ≤ 440   |   |  |
|        |  | N2.3   |  |                                       |  |   |  |
| Ν      |  | N3.1   | Free-cutting copper-alloys materials with excellent machining properties   | -                                     | -  |   |  |
| • •    | N3                                     | N3.2   | Short-chip copper-alloys with good to moderate machining properties  |                                       | -  | -   |  |
|        |  | N3.3   | Electrolytic copper and long-chip copper-alloys with moderate to poor machining proper   | ties                                  | -  | -   |  |
|        |  | N4.1   | Thermoplastic polymers   |                                       | -  | -   |  |
|        | N4                                     | N4.2   | Thermosetting polymers   |                                       | -  | -   |  |
|        |  | N4.3   | Reinforced polymers or composites  |                                       | _  | _   |  |
|        | 114                                    |  | Graphite   |                                       | _  | _   |  |
|        |  |  |  |                                       | < 200 HB   | _<br>≤ 660  |  |
|        | N5                                     | N5.1   |  |                                       |  |   |  |
|        | N5                                     | N5.1<br>S1.1   |  |                                       |  |   |  |
|        |  | N5.1<br>S1.1<br>S1.2   | Titanium or titanium alloys  |                                       | 200 – 280 HB   | > 660 ≤ 950   |  |
|        | N5                                     | N5.1<br>S1.1<br>S1.2<br>S1.3   |  |                                       | 200 – 280 HB<br>280 – 360 HB   | > 660 ≤ 950<br>> 950 ≤ 1200   |  |
|        | N5<br>S1                               | N5.1<br>S1.1<br>S1.2<br>S1.3<br>S2.1   | Titanium or titanium alloys  |                                       | 200 – 280 HB<br>280 – 360 HB<br>< 200 HB   | > 660 ≤ 950   |  |
| ς      | N5                                     | N5.1<br>S1.1<br>S1.2<br>S1.3   |  |                                       | 200 – 280 HB<br>280 – 360 HB   | > 660 ≤ 950<br>> 950 ≤ 1200   |  |
| S      | N5<br>S1<br>S2                         | N5.1<br>S1.1<br>S1.2<br>S1.3<br>S2.1<br>S2.2   | Titanium or titanium alloys<br>Fe-based high-temperature alloys  |                                       | 200 – 280 HB<br>280 – 360 HB<br>< 200 HB   | $> 660 \le 950$<br>$> 950 \le 1200$<br>$\le 690$  |  |
| S      | N5<br>S1                               | N5.1<br>S1.1<br>S1.2<br>S1.3<br>S2.1<br>S2.2<br>S3.1   | Titanium or titanium alloys  |                                       | 200 – 280 HB<br>280 – 360 HB<br>< 200 HB<br>200 – 280 HB<br>< 280 HB   | $> 660 \le 950$<br>> 950 \le 1200<br>\$\le 690\$<br>> 690 \le 970<br>\$\le 940\$  |  |
| S      | N5<br>S1<br>S2<br>S3                   | N5.1<br>S1.2<br>S1.3<br>S2.1<br>S2.2<br>S3.1<br>S3.2   | Titanium or titanium alloys<br>Fe-based high-temperature alloys  |                                       | 200 – 280 HB<br>280 – 360 HB<br>< 200 HB<br>200 – 280 HB<br>< 280 HB<br>280 – 360 HB   | $> 660 \le 950$<br>$> 950 \le 1200$<br>$\le 690$<br>$> 690 \le 970$<br>$\le 940$<br>$> 940 \le 1200$  |  |
| S      | N5<br>S1<br>S2                         | N5.1<br>51.2<br>51.3<br>52.1<br>52.2<br>53.1<br>53.2<br>54.1   | Titanium or titanium alloys<br>Fe-based high-temperature alloys  |                                       | 200 - 280 HB<br>280 - 360 HB<br>200 - 280 HB<br>200 - 280 HB<br>280 - 360 HB<br>280 - 360 HB<br>< 240 HB   | $> 660 \le 950$<br>> 950 \le 1200<br>\$\le 690\$<br>> 690 \le 970<br>\$\le 940\$<br>> 940 \le 1200<br>\$\le 800\$   |  |
| S      | N5<br>S1<br>S2<br>S3<br>S4             | N5.1<br>S1.1<br>S1.2<br>S1.3<br>S2.1<br>S2.2<br>S3.1<br>S3.2<br>S4.1<br>S4.2                         | Titanium or titanium alloys<br>Fe-based high-temperature alloys<br>Ni-based high-temperature alloys<br>Co-based high-temperature alloys  |                                       | 200 - 280 HB<br>280 - 360 HB<br>200 - 280 HB<br>200 - 280 HB<br>280 - 360 HB<br>280 - 360 HB<br>240 - 320 HB   | $> 660 \le 950$<br>$> 950 \le 1200$<br>$\le 690$<br>$> 690 \le 970$<br>$\le 940$<br>$> 940 \le 1200$<br>$\le 800$<br>$> 800 \le 1070$                     |  |
| S      | N5<br>S1<br>S2<br>S3                   | N5.1<br>51.2<br>51.3<br>52.1<br>52.2<br>53.1<br>53.2<br>54.1<br>54.2<br>H1.1                         | Titanium or titanium alloys<br>Fe-based high-temperature alloys<br>Ni-based high-temperature alloys  |                                       | 200 - 280 HB<br>280 - 360 HB<br>200 - 280 HB<br>200 - 280 HB<br>280 - 360 HB<br>280 - 360 HB<br>240 - 320 HB<br>240 - 320 HB                                       | $> 660 \le 950$<br>> 950 \le 1200<br>\$\le 690\$<br>> 690 \le 970<br>\$\le 940\$<br>> 940 \le 1200<br>\$\le 800\$   |  |
| S      | N5<br>S1<br>S2<br>S3<br>S4<br>H1       | N5.1<br>51.2<br>51.3<br>52.2<br>53.1<br>53.2<br>54.1<br>54.2<br>H1.1<br>H2.1                         | Titanium or titanium alloys<br>Fe-based high-temperature alloys<br>Ni-based high-temperature alloys<br>Co-based high-temperature alloys<br>Chilled cast iron                       |                                       | 200 - 280 HB<br>280 - 360 HB<br>200 - 280 HB<br>200 - 280 HB<br>280 - 360 HB<br>280 - 360 HB<br>240 - 320 HB   | $> 660 \le 950$<br>$> 950 \le 1200$<br>$\le 690$<br>$> 690 \le 970$<br>$\le 940$<br>$> 940 \le 1200$<br>$\le 800$<br>$> 800 \le 1070$                     |  |
| S      | N5<br>S1<br>S2<br>S3<br>S4             | N5.1<br>51.2<br>51.3<br>52.1<br>52.2<br>53.1<br>53.2<br>54.1<br>54.2<br>H1.1                         | Titanium or titanium alloys<br>Fe-based high-temperature alloys<br>Ni-based high-temperature alloys<br>Co-based high-temperature alloys  |                                       | 200 - 280 HB<br>280 - 360 HB<br>200 - 280 HB<br>200 - 280 HB<br>280 - 360 HB<br>280 - 360 HB<br>240 - 320 HB<br>240 - 320 HB                                       | $> 660 \le 950$<br>$> 950 \le 1200$<br>$\le 690$<br>$> 690 \le 970$<br>$\le 940$<br>$> 940 \le 1200$<br>$\le 800$<br>$> 800 \le 1070$<br>-                |  |
| S      | N5<br>S1<br>S2<br>S3<br>S4<br>H1<br>H2 | N5.1<br>51.2<br>51.3<br>52.1<br>52.2<br>53.1<br>53.2<br>54.1<br>54.2<br>H1.1<br>H2.1<br>H2.2         | Titanium or titanium alloys<br>Fe-based high-temperature alloys<br>Ni-based high-temperature alloys<br>Co-based high-temperature alloys<br>Chilled cast iron<br>Hardened cast iron |                                       | 200 - 280 HB<br>280 - 360 HB<br>< 200 HB<br>200 - 280 HB<br>< 280 HB<br>280 - 360 HB<br>280 - 360 HB<br>240 HB<br>240 - 320 HB<br>< 440 HB<br>< 55 HRC<br>> 55 HRC | $> 660 \le 950$ $> 950 \le 1200$ $\le 690$ $> 690 \le 970$ $\le 940$ $> 940 \le 1200$ $\le 800$ $> 800 \le 1070$ $-$                                      |  |
| S<br>H | N5<br>S1<br>S2<br>S3<br>S4<br>H1       | N5.1<br>S1.2<br>S1.3<br>S2.1<br>S2.2<br>S3.1<br>S3.2<br>S4.1<br>S4.2<br>H1.1<br>H2.1<br>H2.2<br>H3.1 | Titanium or titanium alloys<br>Fe-based high-temperature alloys<br>Ni-based high-temperature alloys<br>Co-based high-temperature alloys<br>Chilled cast iron                       |                                       | 200 - 280 HB<br>280 - 360 HB<br>< 200 HB<br>200 - 280 HB<br>280 - 360 HB<br>280 - 360 HB<br>240 - 320 HB<br>240 - 320 HB<br>< 55 HRC<br>> 55 HRC<br>< 51 HRC       | $> 660 \le 950$<br>$> 950 \le 1200$<br>$\le 690$<br>$> 690 \le 970$<br>$\le 940$<br>$> 940 \le 1200$<br>$\le 800$<br>$> 800 \le 1070$<br>-<br>-<br>-      |  |
| S<br>H | N5<br>S1<br>S2<br>S3<br>S4<br>H1<br>H2 | N5.1<br>51.2<br>51.3<br>52.1<br>52.2<br>53.1<br>53.2<br>54.1<br>54.2<br>H1.1<br>H2.1<br>H2.2         | Titanium or titanium alloys<br>Fe-based high-temperature alloys<br>Ni-based high-temperature alloys<br>Co-based high-temperature alloys<br>Chilled cast iron<br>Hardened cast iron |                                       | 200 - 280 HB<br>280 - 360 HB<br>< 200 HB<br>200 - 280 HB<br>< 280 HB<br>280 - 360 HB<br>280 - 360 HB<br>240 HB<br>240 - 320 HB<br>< 440 HB<br>< 55 HRC<br>> 55 HRC | $> 660 \le 950$<br>$> 950 \le 1200$<br>$\le 690$<br>$> 690 \le 970$<br>$\le 940$<br>$> 940 \le 1200$<br>$\le 800$<br>$> 800 \le 1070$<br>-<br>-<br>-<br>- |  |