

**Phantom** 

**INTERNATIONAL  
TOOLS**

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**CHECK OUR INNOVATIONS ON PAGE 6**

■ Bij uitstek geschikt - Très approprié - Muy adecuado - Ideal geeignet  
 □ Beperkt geschikt - Approprié - Adecuado - Eingeschränkt geeignet

| ISO  | ISO   | NL   | FR   | ES   | DE   |
|--|---|--|--|--|--|
|    |    | <b>Ongelegerd en gelegeerd staal ≤600 N/mm<sup>2</sup></b><br>1.0037 (St37), 1.0038 (S235JR G2), 1.00402 (C22), 1.1178 (C30E)  | <b>Aciers non-alliés ou faiblement alliés ≤600 N/mm<sup>2</sup></b><br>1.0037 (A37), 1.0038 (E 24-2 Ne), 1.00402 (1C20), 1.1178 (1C30)   | <b>Acero no aleado ≤600 N/mm<sup>2</sup></b><br>1.0037 (S235JR), 1.0038 (S235JR G2), 1.0402 (F.112), 1.1178 (C30E)   | <b>Unlegierter und legierter Stahl ≤600 N/mm<sup>2</sup></b><br>1.0037 (St37), 1.0038 (S235JR G2), 1.00402 (C22), 1.1178 (C30E)  |
|    |    | <b>Ongelegerd en gelegeerd staal 600 - 850 N/mm<sup>2</sup></b><br>1.0050 (St50-2), 1.0070 (St70-2), 1.0301 (C10), 1.0503 (C45), 1.1121 (Ck10), 1.1191 (C45E), 1.0718 (11SMnPb30), 1.0736 (11SMn37)                                | <b>Aciers non-alliés ou faiblement alliés 600 - 850 N/mm<sup>2</sup></b><br>1.0050 (A50-2), 1.0070 (A70-2), 1.0301 (1C10), 1.0503 (1C45), 1.1121 (XC10), 1.1191 (2C45), 1.0718 (S250PB), 1.0736 (S300PB)                     | <b>Acero no aleado 600 - 850 N/mm<sup>2</sup></b><br>1.0050 (Fe490-2), 1.0070 (Fe690-2), 1.0301 (F.1151), 1.0503 (F.114), 1.1121 (F.1510-C10K), 1.1191 (C45K), 1.0718 (F.2112-11SMnPb28), 1.0736 (F.2113-11SMn37)                      | <b>Unlegierter und legierter Stahl 600 - 850 N/mm<sup>2</sup></b><br>1.0050 (St50-2), 1.0070 (St70-2), 1.0301 (C10), 1.0503 (C45), 1.1121 (Ck10), 1.1191 (C45E), 1.0718 (11SMnPb30), 1.0736 (11SMn37)                              |
|    |    | <b>Gelegeerd staal 850 - 1000 N/mm<sup>2</sup></b><br>1.0727 (46S20), 1.0728 (60S20), 1.0757 (46SPb20), 1.2080 (X210Cr12), 1.2083 (X42Cr13), 1.2767 (X45NiCrMo4), 1.5131 (50MnSi4), 1.7003 (38Cr2), 1.7030 (28Cr4), 1.7043 (38Cr4) | <b>Aciers alliés 850 - 1000 N/mm<sup>2</sup></b><br>1.0727 (45Mf4), 1.0728 (60S20), 1.0757 (46SPb20), 1.2080 (Z200C12), 1.2083 (Z40C14), 1.2767 (Y35NCD16), 1.5131 (50MnSi4), 1.7003 (38Cr2), 1.7030 (28Cr4), 1.7043 (38Cr4) | <b>Acero aleado 850 - 1000 N/mm<sup>2</sup></b><br>1.0727 (46S20), 1.0728 (60S20), 1.0757 (46SPb20), 1.2080 (F.5212-X210Cr12), 1.2083 (X42Cr13), 1.2767 (X45NiCrMo4), 1.5131 (50MnSi4), 1.7003 (38Cr2), 1.7030 (28Cr4), 1.7043 (38Cr4) | <b>Legierter Stahl 850 - 1000 N/mm<sup>2</sup></b><br>1.0727 (46S20), 1.0728 (60S20), 1.0757 (46SPb20), 1.2080 (X210Cr12), 1.2083 (X42Cr13), 1.2767 (X45NiCrMo4), 1.5131 (50MnSi4), 1.7003 (38Cr2), 1.7030 (28Cr4), 1.7043 (38Cr4) |
|    |    | <b>Gelegeerd staal 1000 - 1400 N/mm<sup>2</sup></b><br>1.5710 (36NiCr6), 1.7035 (41Cr40), 1.7225 (42CrMo4), 1.8519 (31CrMoV9), 1.8550 (34CrAlNi7), 1.5752 (15NiCr13), 1.7131 (16MnCr5), 1.7264 (20CrMo5)                           | <b>Aciers alliés 1000 - 1400 N/mm<sup>2</sup></b><br>1.5710 (36NiCr6), 1.7035 (41Cr40), 1.7225 (42CrMo4), 1.8519 (31CrMoV9), 1.8550 (34CrAlNi7), 1.5752 (15NiCr13), 1.7131 (16MnCr5), 1.7264 (20CrMo5)                       | <b>Acero aleado 1000 - 1400 N/mm<sup>2</sup></b><br>1.5710 (36NiCr6), 1.7035 (41Cr40), 1.7225 (42CrMo4), 1.8519 (31CrMoV9), 1.8550 (34CrAlNi7), 1.5752 (15NiCr13), 1.7131 (16MnCr5), 1.7264 (20CrMo5)                                  | <b>Legierter Stahl 1000 - 1400 N/mm<sup>2</sup></b><br>1.5710 (36NiCr6), 1.7035 (41Cr40), 1.7225 (42CrMo4), 1.8519 (31CrMoV9), 1.8550 (34CrAlNi7), 1.5752 (15NiCr13), 1.7131 (16MnCr5), 1.7264 (20CrMo5)                           |
|    |    | <b>Gehard en inzetgehard staal 50 - 60 HRC</b><br>1.2344 (X40CrMoV5), 1.2767 (X45NiCrMo4), 1.2379 (X155CrVMo12-1), 1.2080 (X210Cr12), 1.3343 (S6-5-2)  | <b>Aciers trempés et Aciers de cémentation alliés 50 - 60 HRC</b><br>1.2344 (Z 40 CDV 5), 1.2767 (X45NiCrMo4), 1.2379 (D2), 1.2080 (Z200C12), 1.3343 (Z85WDCV)   | <b>Acero templado 50 - 60 HRC</b><br>1.2344 (X40CrMoV5), 1.2767 (X45NiCrMo4), 1.2379 (X155CrVMo12-1), 1.2080 (X210Cr12), 1.3343 (S6-5-2)   | <b>Gehärteter und einsatzgehärteter Stahl, 50-60 HRC</b><br>1.2344 (X40CrMoV5), 1.2767 (X45NiCrMo4), 1.2767 (X45NiCrMo4), 1.2379 (X155CrVMo12-1), 1.2080 (X210Cr12), 1.3343 (S6-5-2)   |
|    |    | <b>Roestvaststaal, INOX ≤850 N/mm<sup>2</sup></b><br>1.4005 (X12CrS13), 1.4104 (X14CrMos17), 1.4105 (X6CrMoS17), 1.4301 (XCrNi18-10)(304), 1.4305 (X8CrNiS18-9)(303)   | <b>Aciers inoxydables ≤850 N/mm<sup>2</sup></b><br>1.4005 (Z11CF13), 1.4104 (Z13CF17), 1.4105 (Z8CF17), 1.4301 (XCrNi18-10)(304), 1.4305 (X8CrNiS18-9)(303)  | <b>Acero inoxidable ≤850 N/mm<sup>2</sup></b><br>1.4006 (F.3401-X10Cr13), 1.4104 (F.3117-X10Cr17), 1.4301 (F.3504-X5CrNi18-10)(304), 1.4305 (F.3508-X10CrNiS18-09)(303)  | <b>Rostfreier Stahl, INOX ≤850 N/mm<sup>2</sup></b><br>1.4005 (X12CrS13), 1.4104 (X14CrMos17), 1.4105 (X6CrMoS17), 1.4301 (XCrNi18-10)(304), 1.4305 (X8CrNiS18-9)(303)   |
|   |   | <b>Roestvaststaal, INOX &gt;850 N/mm<sup>2</sup></b><br>1.4438 (X2CrNiMo18-15-4)(317), 1.4404 (X2CrNiMo17-12-2)(316L), 1.4571 (X6CrNiMoTi17-12-2)(316Ti)   | <b>Aciers inoxydables &gt;850 N/mm<sup>2</sup></b><br>1.4438 (X2CrNiMo18-15-4)(317), 1.4404 (X2CrNiMo17-12-2)(316L), 1.4571 (X6CrNiMoTi17-12-2)(316Ti)   | <b>Acero inoxidable &gt;850 N/mm<sup>2</sup></b><br>1.4438 (X2CrNiMo18-15-4)(317), 1.4404 (X2CrNiMo17-12-2)(316L), 1.4571 (F.3535-X6CrNiMoTi17-12-2)(316Ti)  | <b>Rostfreier Stahl, INOX &gt;850 N/mm<sup>2</sup></b><br>1.4438 (X2CrNiMo18-15-4)(317), 1.4404 (X2CrNiMo17-12-2)(316L), 1.4571 (X6CrNiMoTi17-12-2)(316Ti)   |
|  |  | <b>Grijs gietijzer GG &lt;260 HB30</b><br>0.6015 (GG 15), 0.6025 (GG 25), 0.6040 (GG 40)   | <b>Fontes &lt;260 HB30</b><br>0.6015 (GG 15), 0.6025 (GG 25), 0.6040 (GG 40)   | <b>Fundición gris con grafito laminado GG &lt;260 HB30</b><br>0.6015 (FG15), 0.6025 (FG25), 0.6040 (FG40)  | <b>Grauguss GG &lt;260 HB30</b><br>0.6015 (GG 15), 0.6025 (GG 25), 0.6040 (GG 40)  |
|  |  | <b>Smeedbaar en Nodulair gietijzer &lt;260 HB30</b><br>0.8145 (GTS-45), 0.8170 (GTS-70-02), 0.7040 (GGG 40), 0.7070 (GGG 70)   | <b>Fontes à graphites et malléables &lt;260 HB30</b><br>0.8145 (GTS-45), 0.8170 (GTS-70-02), 0.7040 (GGG 40), 0.7070 (GGG 70)  | <b>Fundición gris con grafito esferoidal &lt;260 HB30</b><br>0.8145 (GTS-45), 0.8170 (GTS-70-02), 0.7040 (GGG 40), 0.7070 (GGG 70)   | <b>Formbar und dehnbares Gusseisen &lt;260 HB30</b><br>0.8145 (GTS-45), 0.8170 (GTS-70-02), 0.7040 (GGG 40), 0.7070 (GGG 70)   |
|  |  | <b>Aluminium en Aluminiumlegeringen</b><br>3.0255 (Al99.5), 3.2315 (AlMgSi1), 3.3515 (AlMg1)   | <b>Aluminium et Alliages d'Aluminium</b><br>3.0255 (A59050C), 3.2315 (AlMgSi1), 3.3515 (AlMg1)   | <b>Aluminio y aleaciones de Aluminio</b><br>3.0255 (Al99.5), 3.2315 (AlMgSi1), 3.3515 (AlMg1)  | <b>Aluminium und Aluminiumlegeringen</b><br>3.0255 (Al99.5), 3.2315 (AlMgSi1), 3.3515 (AlMg1)  |
|  |  | <b>Gietaluminium Si 10 - 24%</b><br>3.2131 (G-AISi5Cu1), 3.2153 (G-AISi7Cu3), (3.2573 G-AISi9), 3.2581 (G-AISi12), 3.2583 (G-AISi12Cu)   | <b>Alliages d'Aluminium Si 10 - 24%</b><br>3.2131 (G-AISi5Cu1), 3.2153 (G-AISi7Cu3), (3.2573 G-AISi9), 3.2581 (G-AISi12), 3.2583 (G-AISi12Cu)  | <b>Fundición de Aluminio aleada Si 10 - 24%</b><br>3.2131 (G-AISi5Cu1), 3.2153 (G-AISi7Cu3), (3.2573 G-AISi9), 3.2581 (L-2520,21), 3.2583 (L2530)  | <b>Druckguss Si 10 - 24%</b><br>3.2131 (G-AISi5Cu1), 3.2153 (G-AISi7Cu3), (3.2573 G-AISi9), 3.2581 (G-AISi12), 3.2583 (G-AISi12Cu)   |
|  |  | <b>Magnesiumlegeringen</b><br>3.5200 (MgMn2), 3.5812 (G-MgAl8Zn1), 3.5612 (G-MgAl6Zn1)   | <b>Alliages de Magnésium</b><br>3.5200 (MgMn2), 3.5812 (AZ81hp), 3.5612 (AZ61)   | <b>Aleaciones de Magnesio</b><br>3.5200 (MgMn2), 3.5812 (AZ81hp), 3.5612 (AZ61)  | <b>Magnesiumlegeringen</b><br>3.5200 (MgMn2), 3.5812 (G-MgAl8Zn1), 3.5612 (G-MgAl6Zn1)   |
|  |  | <b>Koper en Koperlegeringen</b><br>2.0070 (SE-Cu), 2.1020 (CuSn6), 2.1096 (G-CuSn5ZnPB), 2.0380 (CuZn39Pb2), 2.0401 (CuZn39Pb3), 2.0250 (CuZn20), 2.0280 (CuZn33), 2.0332 (CuZn37Pb0,5)  | <b>Cuivres et Alliages de cuivres</b><br>2.0070 (SE-Cu), 2.1020 (CuSn6), 2.1096 (G-CuSn5ZnPB), 2.0380 (CuZn40), 2.0401 (CuZn39Pb3), 2.0250 (CuZn20), 2.0280 (CuZn33), 2.0332 (CuZn37Pb0,5)                                   | <b>Cobre y aleaciones de cobre</b><br>2.0070 (SE-Cu), 2.1020 (CuSn6), 2.1096 (G-CuSn5ZnPB), 2.0380 (CuZn39Pb2), 2.0401 (CuZn39Pb3), 2.0250 (CuZn20), 2.0280 (CuZn33), 2.0332 (CuZn37Pb0,5)   | <b>Kupfer und Kupferlegeringen</b><br>2.0070 (SE-Cu), 2.1020 (CuSn6), 2.1096 (G-CuSn5ZnPB), 2.0380 (CuZn39Pb2), 2.0401 (CuZn39Pb3), 2.0250 (CuZn20), 2.0280 (CuZn33), 2.0332 (CuZn37Pb0,5)   |
|  |  | <b>Koper- en Aluminiumlegering</b><br>2.0916 (CuAl5), 2.0960 (CuAl9Mn), 2.1050 (CuSn10), 2.0980 (CuAl11Ni), 2.1247 (CuBe2) AMPCO® 8, AMPCO® 8 15, AMPCO® 18  | <b>Cuivre et Alliages d'Aluminium</b><br>2.0916 (CuAl5), 2.0960 (CuAl9Mn), 2.1050 (CuSn10), 2.0980 (CuAl11Ni), 2.1247 (CuBe1.9) AMPCO® 8, AMPCO® 8 15, AMPCO® 18   | <b>Cobre y aleaciones de Aluminio</b><br>2.0916 (CuAl5), 2.0960 (CuAl9Mn), 2.1050 (CuSn10), 2.0980 (CuAl11Ni), 2.1247 (CuBe2) AMPCO® 8, AMPCO® 8 15, AMPCO® 18   | <b>Kupfer- und Aluminiumlegeringen</b><br>2.0916 (CuAl5), 2.0960 (CuAl9Mn), 2.1050 (CuSn10), 2.0980 (CuAl11Ni), 2.1247 (Cu-Be2) AMPCO® 8, AMPCO® 8 15, AMPCO® 18   |
|  |  | <b>Duroplastic en Thermoplastic</b><br>PMMA, PVC, PE, PP, PTFE   | <b>Duroplastiques et Thermoplastiques</b><br>PMMA, PVC, PE, PP, PTFE   | <b>Duroplásticos en Termoplásticos</b><br>PMMA, PVC, PE, PP, PTFE  | <b>Duroplaste und Thermoplaste</b><br>PMMA, PVC, PE, PP, PTFE  |
|  |  | <b>Versterkte kunststoffen</b><br>GFK, CFK   | <b>Plastiques réinforcés</b><br>GFK, CFK   | <b>Plásticos reforzados</b><br>GFK, CFK  | <b>Verstärkte Kunststoffe</b><br>GFK, CFK  |
|  |  | <b>Nikkel- en Cobaltlegeringen</b><br>Hastelloy, Inconel, Nimonic, Jetalloy  | <b>Alliages de Nickel et de Cobalt</b><br>Hastelloy, Inconel, Nimonic, Jetalloy  | <b>Aleaciones de Níquel y Cobalto</b><br>Hastelloy, Inconel, Nimonic, Jetalloy   | <b>Nickel und Kobaltlegeringen</b><br>Hastelloy, Inconel, Nimonic, Jetalloy  |
|  |  | <b>Titaniumlegeringen</b><br>3.7024 (Ti99.5), 3.7114 (TiAl5Sn2.5), 3.7124 (TiCu2), 3.7154 (TiAl6Zr5), 3.7165 (TiAl6V4), 3.7184 (TiAl4Mo4Sn2.5)   | <b>Alliages de Titane</b><br>3.7024 (T35), 3.7114 (TiAl5Sn2.5), 3.7124 (T-U2), 3.7154 (TiAl6Zr5), 3.7165 (TiAl6V4), 3.7184 (TiAl4Mo4Sn2.5)   | <b>Titanio aleado</b><br>3.7024 (Ti99.5), 3.7114 (TiAl5Sn2.5), 3.7124 (TiCu2), 3.7154 (TiAl6Zr5), 3.7165 (TiAl6V4), 3.7184 (TiAl4Mo4Sn2.5)   | <b>Titanlegeringen</b><br>3.7024 (Ti99.5), 3.7114 (TiAl5Sn2.5), 3.7124 (TiCu2), 3.7154 (TiAl6Zr5), 3.7165 (TiAl6V4), 3.7184 (TiAl4Mo4Sn2.5)  |

**Phantom**

**INTERNATIONAL  
TOOLS**



**COMMITTED, DEDICATED SPECIALISTS  
WITH MORE THAN 67 YEARS  
OF EXPERIENCE**

> **SINCE 1952**   > **PASSIONATE PEOPLE**   > **99,9% ERROR FREE**



# Phantom

## RELIABLE, INNOVATIVE, SUPERIOR QUALITY

Phantom is the leading brand of cutting tools of the highest quality for use in metalworking. With no less than 20,000 general metalworking and modern precision-engineering tools to choose from, the extensive range contains machining tools of all types and sizes, including models. At Phantom, not only is the highest quality guaranteed, your options are also limitless. With precision and a long service life assured, we can safely say that, at Phantom, we can handle any cutting task.

## BETROUWBAAR, INNOVATIEF EN A-KWALITEIT

Phantom is het A-merk van absolute topkwaliteit voor verspanende gereedschappen ten behoeve van metaalbewerking. U heeft keuze uit maar liefst 20.000 gereedschappen voor algemene metaalbewerking en moderne precisietechniek.

Het assortiment is zeer compleet en bestaat uit verspanend gereedschap in alle soorten en maten, ook de meest bijzondere. Met Phantom heeft u topkwaliteit in handen en zijn uw mogelijkheden werkelijk onbegrensd. U bent verzekerd van precisie en hoge standtijden. Daardoor kunnen wij gerust stellen dat u met Phantom werkelijk ieder verspaningsvraagstuk aan kunt.



## UN PRODUIT D'EXCELLENTE QUALITÉ

Les produits de la marque Phantom sont des produits à haute valeur ajoutée technique pour l'usinage des métaux. Notre gamme comporte plus de 20.000 références qui vous permettront de réaliser quasiment toutes les opérations d'usinage avec des produits bénéficiant des dernières avancées technologiques.

Notre catalogue dispose d'un choix d'outils extrêmement large, de toutes les formes, de toutes les dimensions et pour toutes les applications. Vous avez donc accès à des produits d'excellente qualité qui vous offrent des possibilités sans limites. Pour cette raison, nous pouvons en toute sécurité vous assurer que vous serez en mesure, avec les produits Phantom, de maîtriser et de répondre à l'ensemble de vos opérations d'usinage, des plus simples aux plus complexes.

## INTERNATIONAL TOOLS

## EXTENSIVE AND COMPETITIVELY PRICED

With its extensive, highly competitive range, International Tools offers an attractive array of drills, taps and countersinks in standard sizes. For universal use, available from stock.



## UITGEBREID EN PRIJSCONCURREEREND

Met een uitgebreid en zeer prijsconcurrerend assortiment biedt International Tools u een aantrekkelijk aanbod boren, tappen en verzinkfrezen in gangbare maten. Universeel inzetbaar en ook nog eens uit voorraad leverbaar.

## UNE LARGE GAMME A PRIX COMPETITIF

Avec International Tools vous accédez à une large gamme de forets, tarauds et fraise à chanfreiner dans les dimensions les plus courantes pour une utilisation universelle, le tout disponible sur stock.

# THERE'S NO END TO WHAT YOU CAN DO.



## UNA PRESTIGIOSA MARCA DE PRIMERA CALIDAD

Phantom es una prestigiosa marca de herramientas de mecanizado para el procesamiento de metal de alta calidad. Puede elegir entre nada menos que 20.000 herramientas para el procesamiento general de metal y una moderna técnica de precisión.

El surtido es muy completo y consta de herramientas de mecanizado de todo tipo y tamaño. Con Phantom tiene garantizada la calidad y unas posibilidades de trabajo verdaderamente ilimitadas. Precisión y larga vida útil garantizadas. Las ilimitadas se miden en fábrica y se prueban con equipos de última tecnología. Esto nos permite asegurarle que con Phantom es posible mecanizar todo aquello que necesita.

## ZUVERLÄSSIG, INNOVATIV UND HÖCHSTER QUALITÄT

Phantom ist die A-Marke für zerspanende Werkzeuge, die für die Metallbearbeitung geeignet sind. Sie können von bis zu 20.000 Werkzeugen wählen für den allgemeinen Maschinenbau und moderne Feinmechanik.

Der Bereich ist sehr komplett und umfasst Bearbeitungswerkzeuge aller Formen und Größen, auch die besonderen. Phantom hat eine Top Qualität, mit grenzenlosen Möglichkeiten und Optionen. Hier ist Präzision und eine lange Lebensdauer gewährleistet. Sie sind Präzision gewährleistet und lange Lebensdauer. Daher können wir Ihnen versprechen, dass unsere Marke Phantom, für alle Ihre Probleme eine Lösung findet.

**ECO**

- › **LOWEST PRICE**  
LAAGSTE PRIJS  
PRIX TRÈS COMPÉTITIF  
PRECIO MÁS BAJO  
NIEDRIGSTER PREIS

**ECO  
PRO**

- › **INDUSTRIAL QUALITY**  
INDUSTRIE KWALITEIT  
QUALITÉ INDUSTRIELLE  
CALIDAD INDUSTRIAL  
INDUSTRIEQUALITÄT

- › **Basic quality**

Basis kwaliteit  
Qualité STANDARD  
Calidad básica  
Grundlegende Qualität

- › **Suitable for a wide range of materials**

Geschikt voor vele materialen  
Adaptée à différents types de matières  
Adecuado para muchos materiales  
Geeignet für viele Materialien

- › **Professional use**

Professioneel gebruik  
Usage professionnel  
Uso profesional  
Professioneller Einsatz

- › **Favourably priced**

Gunstige prijs  
Le meilleur rapport qualité prix  
Precio favorable  
Günstiger Preis

- › **Suitable for a wide range of materials and stainless steel**

Geschikt voor vele materialen en RVS  
Adaptée à différents types de matières ainsi que les inox  
Adecuado para muchos materiales y acero inoxidable  
Geeignet für viele Materialien und Edelstahl

- › **Professional and industrial use**

Professioneel en industrieel gebruik  
Usage professionnel et industriel  
Uso profesional e industrial  
Professioneller und industrieller Einsatz

## UNA AMPLIA GAMA A PRECIOS COMPETITIVOS

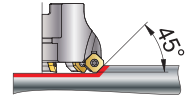
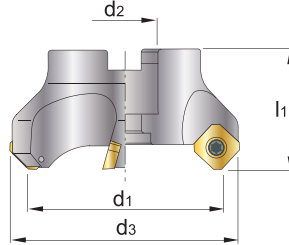
El amplio catálogo con precios competitivos de International Tools le ofrece una selección atractiva de brocas, machos y avellanadores de tamaños habituales. Para uso universal y disponibles en stock.

## BREIT & PREISBEWUSST

Mit seinem breiten und sehr preisbewussten Programm verfügt International Tools über ein attraktives Angebot universell einsetzbarer Bohrer und Gewindebohrer in gängigen Maßen, die ab Lager lieferbar sind.

> **76.100 Phantom**

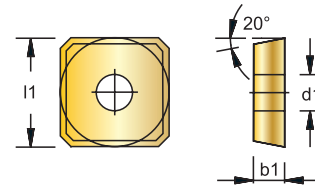
NL **Viakfrees, 45° SEHX 1204**  
 FR **Fraise à chanfreiner à 45° SEHX 1204**  
 ES **Fresa de planear, 45° SEHX 1204**  
 DE **Planfräser, 45° SEHX 1204**



| Ref.        | Type                     | d1  | d2 | d3  | l1 | z | 1           | 2           | 3        |
|-------------|--------------------------|-----|----|-----|----|---|-------------|-------------|----------|
| 76.100.0050 | SEHX12 50X22X63X40 Z=4   | 50  | 22 | 63  | 40 | 4 | 73.998.0650 | 73.998.0680 | SEH.. 12 |
| 76.100.0063 | SEHX12 63X22X76X40 Z=5   | 63  | 22 | 76  | 40 | 5 | 73.998.0650 | 73.998.0680 | SEH.. 12 |
| 76.100.0080 | SEHX12 80X27X93X50 Z=6   | 80  | 27 | 93  | 50 | 6 | 73.998.0650 | 73.998.0680 | SEH.. 12 |
| 76.100.0100 | SEHX12 100X32X113X50 Z=7 | 100 | 32 | 113 | 50 | 7 | 73.998.0650 | 73.998.0680 | SEH.. 12 |

> **76.615 Phantom**

NL **Wisselplaat SEHT 1204**  
 FR **Plaquette SEHT 1204**  
 ES **Plaquita SEHT 1204**  
 DE **Wendeplatte SEHT 1204**



| SE.. | l1(mm) | d1(mm) | b1(mm) |
|------|--------|--------|--------|
| 12   | 12,7   | 5,50   | 4,76   |

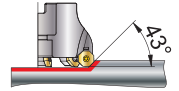
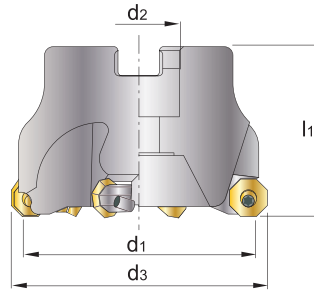
| Ref.        | Type                         | ap (mm) | fz (mm)  | P | M | K | N | S | H |
|-------------|------------------------------|---------|----------|---|---|---|---|---|---|
| 76.615.0150 | SEHT 1204AF-ALU K10          | 6       | 0,1-0,5  |   |   |   | N |   |   |
| 76.615.0200 | SEHT 1204AFSN HC-P25         | 6       | 0,1-0,35 | P |   |   |   |   |   |
| 76.615.0250 | SEHT 1204AFSN HC-P25/M20/S15 | 6       | 0,1-0,35 | P | M |   |   | S |   |
| 76.615.0360 | SEHT 1204AFSN HC-P20/M20     | 6       | 0,1-0,35 | P | M |   |   |   |   |





## > 76.115 Phantom

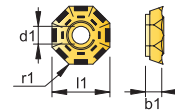
NL **Vlakfrees, 45° OFEX 05T3**  
 FR **Fraise à chanfreiner à 45° OFEX 05T3**  
 ES **Fresa de planear, 45° OFEX 05T3**  
 DE **Planfräser, 45° OFEX 05T3**



| Ref.        | Type                   | d1 | d2 | d3 | l1 | z | 1           | 2           | 3         |
|-------------|------------------------|----|----|----|----|---|-------------|-------------|-----------|
| 76.115.0040 | OFEX05 40X16X47X40 Z=3 | 40 | 16 | 47 | 40 | 3 | 73.998.0645 | 73.998.0670 | OFEX 05T3 |
| 76.115.0050 | OFEX05 50X22X57X40 Z=3 | 50 | 22 | 57 | 40 | 4 | 73.998.0645 | 73.998.0670 | OFEX 05T3 |
| 76.115.0063 | OFEX05 63X22X70X40 Z=5 | 63 | 22 | 70 | 40 | 5 | 73.998.0645 | 73.998.0670 | OFEX 05T3 |
| 76.115.0080 | OFEX05 80X27X87X50 Z=6 | 80 | 27 | 87 | 50 | 6 | 73.998.0645 | 73.998.0670 | OFEX 05T3 |

## > 76.470 Phantom

NL **Wisselplaat OFEX 05T3**  
 FR **Plaquette OFEX 05T3**  
 ES **Plaquita OFEX 05T3**  
 DE **Wendeplatte OFEX 05T3**

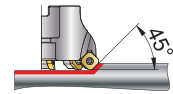
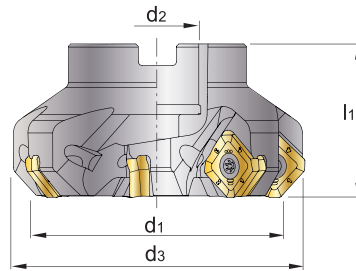


| OFEX | l1(mm) | d1(mm) | b1(mm) | r1(mm) |
|------|--------|--------|--------|--------|
| 05   | 12,7   | 4,50   | 3,97   | 0,5    |

| Ref.        | Type                   | a <sub>p</sub> (mm) | f <sub>z</sub> (mm) | P | M | K | N | S | H |
|-------------|------------------------|---------------------|---------------------|---|---|---|---|---|---|
| 76.470.0150 | OFEX 05T305-ALU K10    | 0,5-3,5             | 0,1-0,5             |   |   |   | N |   |   |
| 76.470.0200 | OFEX 05T305 HC-P25     | 0,5-3,5             | 0,1-0,35            | P |   |   |   |   |   |
| 76.470.0360 | OFEX 05T305 HC-P20/M20 | 0,5-3,5             | 0,1-0,35            | P | M |   |   |   |   |

> **76.125 Phantom**

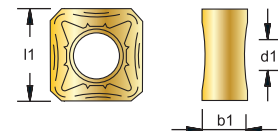
NL **Viakfrees, 45° SNHX 1205**  
 FR **Fraise à chanfreiner à 45° SNHX 1205**  
 ES **Fresa de planear, 45° SNHX 1205**  
 DE **Planfräser, 45° SNHX 1205**



| Ref.        | Type                      | d1  | d2 | d3  | l1 | z  | 1           | 2           | 3       |
|-------------|---------------------------|-----|----|-----|----|----|-------------|-------------|---------|
| 76.125.0050 | SNHX12 50X22X63X40 Z=4    | 50  | 22 | 63  | 40 | 4  | 73.998.0645 | 73.998.0670 | SNHX 12 |
| 76.125.0063 | SNHX12 63X22X76X40 Z=6    | 63  | 22 | 76  | 40 | 6  | 73.998.0645 | 73.998.0670 | SNHX 12 |
| 76.125.0080 | SNHX12 80X27X93X50 Z=7    | 80  | 27 | 93  | 50 | 7  | 73.998.0645 | 73.998.0670 | SNHX 12 |
| 76.125.0100 | SNHX12 100X32X113X50 Z=8  | 100 | 32 | 113 | 50 | 8  | 73.998.0630 | 73.998.0670 | SNHX 12 |
| 76.125.0125 | SNHX12 125X40X138X63 Z=10 | 125 | 40 | 138 | 63 | 10 | 73.998.0630 | 73.998.0670 | SNHX 12 |

> **76.500 Phantom**

NL **Wisselplaat SNHX 1205**  
 FR **Plaquette SNHX 1205**  
 ES **Plaquita SNHX 1205**  
 DE **Wendeplatte SNHX 1205**



| SN.X | l1(mm) | d1(mm) | b1(mm) |
|------|--------|--------|--------|
| 12   | 12,7   | 6,0    | 5,49   |

| Ref.        | Type                       | ap (mm) | fz (mm)   | P        | M        | K | N | S        | H |
|-------------|----------------------------|---------|-----------|----------|----------|---|---|----------|---|
| 76.500.0200 | SNHX 1205AN HC-P25         | 6       | 0,15-0,45 | <b>P</b> |          |   |   |          |   |
| 76.500.0250 | SNHX 1205AN HC-P25/M20/S15 | 6       | 0,15-0,45 | <b>P</b> | <b>M</b> |   |   | <b>S</b> |   |
| 76.500.0360 | SNHX 1205AN HC-P20/M20     | 6       | 0,15-0,45 | <b>P</b> | <b>M</b> |   |   |          |   |

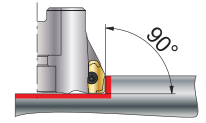
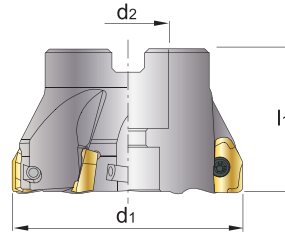






## > 76.135 Phantom

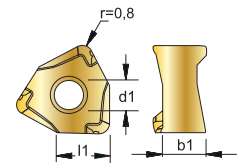
NL Hoekfrees, 90° XNEX 0806  
 FR Outil à surfacer, 90° XNEX 0806  
 SP Fresa de Escuadrado, 90° XNEX 0806  
 DE Winkel 90° XNEX 0806



| Ref.        | Type                 | d1  | d2 | l1 | z | 1           | 2           | 3       |
|-------------|----------------------|-----|----|----|---|-------------|-------------|---------|
| 76.135.0050 | XNEX08 50X22X40 Z=4  | 50  | 22 | 40 | 4 | 73.998.0640 | 73.998.0670 | XNEX 08 |
| 76.135.0055 | XNEX08 50X22X40 Z=5  | 50  | 22 | 40 | 5 | 73.998.0640 | 73.998.0670 | XNEX 08 |
| 76.135.0063 | XNEX08 63X22X40 Z=6  | 63  | 22 | 40 | 6 | 73.998.0640 | 73.998.0670 | XNEX 08 |
| 76.135.0080 | XNEX08 80X27X50 Z=7  | 80  | 27 | 50 | 7 | 73.998.0640 | 73.998.0670 | XNEX 08 |
| 76.135.0100 | XNEX08 100X32X50 Z=8 | 100 | 32 | 50 | 8 | 73.998.0640 | 73.998.0670 | XNEX 08 |

## > 76.520 Phantom

NL Wisselplaat XNEX 0806  
 FR Plaqueette XNEX 0806  
 ES Plaquita XNEX 0806  
 DE Wendeplatte XNEX 0806

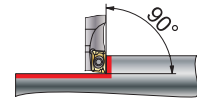
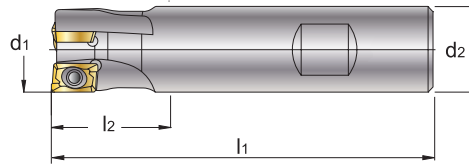


| XN.X | l1(mm) | d1(mm) | b1(mm) |
|------|--------|--------|--------|
| 08   | 7,5    | 4,5    | 6,56   |

| Ref.        | Type                       | $a_p$ (mm) | $f_z$ (mm) | P | M | K | N | S | H |
|-------------|----------------------------|------------|------------|---|---|---|---|---|---|
| 76.520.0150 | XNEX 80608 K10             | 7          | 0,05-0,35  |   |   |   | N |   |   |
| 76.520.0200 | XNEX 080608 HC-P25         | 7          | 0,08-0,4   | P |   |   |   |   |   |
| 76.520.0250 | XNEX 080608 HC-P25/M20/S15 | 7          | 0,08-0,4   | P | M |   |   | S |   |
| 76.520.0360 | XNEX 080608 HC-P20/M20     | 7          | 0,08-0,4   | P | M |   |   |   |   |

> **76.145 Phantom**

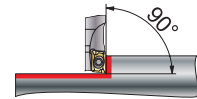
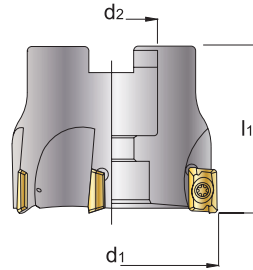
NL Schachtfrees, 90° APKT 1003  
 FR Fraise à plaquettes, 90° APKT 1003  
 ES Fresa integral, 90° APKT 1003  
 DE Schafffräser, 90° APKT 1003



| Ref.        | Type                | d1 | d2 | l1 | l2 | z | 1           | 2           | 3         |
|-------------|---------------------|----|----|----|----|---|-------------|-------------|-----------|
| 76.145.0016 | APKT10 16X16X85 Z=2 | 16 | 16 | 85 | 25 | 2 | 73.998.0600 | 73.998.0660 | APKT 1003 |
| 76.145.0020 | APKT10 20X20X85 Z=3 | 20 | 20 | 85 | 30 | 3 | 73.998.0600 | 73.998.0660 | APKT 1003 |
| 76.145.0025 | APKT10 25X25X95 Z=4 | 25 | 25 | 95 | 35 | 4 | 73.998.0600 | 73.998.0660 | APKT 1003 |
| 76.145.0032 | APKT10 32X32X95 Z=5 | 32 | 32 | 95 | 35 | 5 | 73.998.0600 | 73.998.0660 | APKT 1003 |

> **76.146 Phantom**

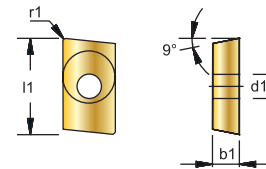
NL Hoekfrees, 90° APKT 1003  
 FR Outil à surfer, 90° APKT 1003  
 ES Fresa de Escuadrado, 90° APKT 1003  
 DE Winkel 90° APKT 1003



| Ref.        | Type                | d1 | d2 | l1 | z | 1           | 2           | 3         |
|-------------|---------------------|----|----|----|---|-------------|-------------|-----------|
| 76.146.0040 | APKT10 40X16X40 Z=6 | 40 | 16 | 40 | 6 | 73.998.0600 | 73.998.0660 | APKT 1003 |
| 76.146.0050 | APKT10 50X22X40 Z=7 | 50 | 22 | 40 | 7 | 73.998.0600 | 73.998.0660 | APKT 1003 |

> **76.365 Phantom**

NL Wisselplaat APKT, APHT 1003  
 FR Plaque APKT, APHT 1003  
 ES Plaquita APKT, APHT 1003  
 DE Wendeplatte APKT, APHT 1003



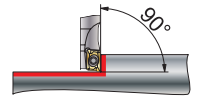
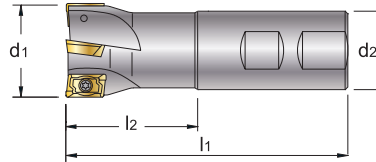
| APKT | l1(mm) | d1(mm) | b1(mm) | r1(mm) |
|------|--------|--------|--------|--------|
| 10   | 10,5   | 2,80   | 3,50   | 0,5    |

| Ref.        | Type                        | ap (mm) | fz (mm)  | P | M | K | N | S | H |
|-------------|-----------------------------|---------|----------|---|---|---|---|---|---|
| 76.365.0150 | APHT 1003-ALU K10           | 10      | 0,1-0,5  |   |   |   | N |   |   |
| 76.365.0200 | APKT 1003PDR HC-P25         | 10      | 0,08-0,3 | P |   |   |   |   |   |
| 76.365.0250 | APKT 1003PDR HC-P25/M20/S15 | 10      | 0,08-0,3 | P | M |   |   | S |   |
| 76.365.0360 | APKT 1003PDR HC-P20/M20     | 10      | 0,08-0,3 | P | M |   |   |   |   |



### > 76.155 Phantom

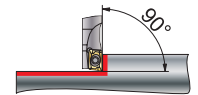
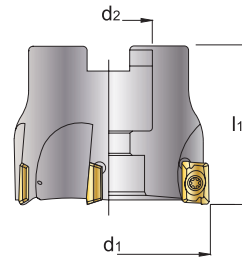
NL Schachtfrees, 90° APKT 1604  
 FR Fraise à plaquettes, 90° APKT 1604  
 ES Fresa integral, 90° APKT 1604  
 DE Schafffräser, 90° APKT 1604



| Ref.        | Type                | d1 | d2 | l1 | l2 | z | 1           | 2           | 3         |
|-------------|---------------------|----|----|----|----|---|-------------|-------------|-----------|
| 76.155.0025 | APKT16 25X20X95 Z=2 | 25 | 20 | 95 | 40 | 2 | 73.998.0610 | 73.998.0670 | APKT 1604 |
| 76.155.0032 | APKT16 32X25X95 Z=3 | 32 | 25 | 95 | 40 | 3 | 73.998.0645 | 73.998.0670 | APKT 1604 |

### > 76.156 Phantom

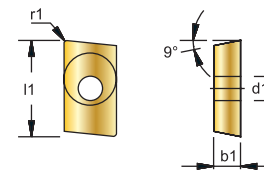
NL Hoekfrees, 90° APKT 1604  
 FR Outil à surfaçer, 90° APKT 1604  
 ES Fresa de Escuadrado, 90° APKT 1604  
 DE Winkel 90° APKT 1604



| Ref.        | Type                | d1 | d2 | l1 | z | 1           | 2           | 3         |
|-------------|---------------------|----|----|----|---|-------------|-------------|-----------|
| 76.156.0040 | APKT16 40X16X40 Z=4 | 40 | 16 | 40 | 4 | 73.998.0645 | 73.998.0670 | APKT 1604 |
| 76.156.0050 | APKT16 50X22X40 Z=5 | 50 | 22 | 40 | 5 | 73.998.0645 | 73.998.0670 | APKT 1604 |
| 76.156.0063 | APKT16 63X22X40 Z=6 | 63 | 22 | 40 | 6 | 73.998.0645 | 73.998.0670 | APKT 1604 |

### > 76.366 Phantom

NL Wisselplaat APKT, APHT 1604  
 FR Plaquette APKT, APHT 1604  
 ES Plaquita APKT, APHT 1604  
 DE Wendeplatte APKT, APHT 1604



| APKT | l1(mm) | d1(mm) | b1(mm) | r1(mm) |
|------|--------|--------|--------|--------|
| 16   | 17,0   | 4,40   | 5,26   | 0,9    |

| Ref.        | Type                        | a <sub>p</sub> (mm) | f <sub>z</sub> (mm) | P | M | K | N | S | H |
|-------------|-----------------------------|---------------------|---------------------|---|---|---|---|---|---|
| 76.366.0150 | APHT 1604-ALU K10           | 15                  | 0,1-0,5             |   |   |   | N |   |   |
| 76.366.0200 | APKT 1604PDR HC-P25         | 15                  | 0,1-0,4             | P |   |   |   |   |   |
| 76.366.0250 | APKT 1604PDR HC-P25/M20/S15 | 15                  | 0,1-0,4             | P | M |   |   | S |   |
| 76.366.0360 | APKT 1604PDR HC-P20/M20     | 15                  | 0,1-0,4             | P | M |   |   |   |   |



> **79.510**

NL **Set Kartelen**  
 FR **Assortiment d'outils à moleter**  
 ES **Juego de herramientas para moletear**  
 DE **Satz Rändelwerkzeuge**



| Ref.        | Type   | Contents  |
|-------------|--------|---|
| 79.510.1000 | KM1-M7 | 1x M7<br>1x M12<br>1x BR30-BL30-AA (0.8)<br>1x BR30-BL30-AA (1.2)<br>1x BR30-BL30-AA(1.6) |

> **79.613**

NL **Set, Hoekfrees, 90°, incl. wisselplaten XNEX 0806**  
 FR **Jeu, Outil à surfacier, 90°, incl. plaquettes XNEX 0806**  
 ES **Juego de, Fresa de Escuadrado, 90°, incl. wisselplaten XNEX 0806**  
 DE **Satz, Winkel 90°, inkl. Wendeplatten XNEX 0806**



-  **P** 76.520.0200
-  **P M S** 76.520.0250
-  **P M** 76.520.0360

| Ref.        | Contents                        |
|-------------|---------------------------------|
| 79.613.1020 | Ø 100 mm - 80 x XNEX HC-P25     |
| 79.613.1025 | Ø 100 mm - 80 x XNEX HC-P25/M20 |
| 79.613.1036 | Ø 100 mm - 80 x XNEX HC-M20     |
| 79.613.5020 | Ø 50 mm - 40 x XNEX HC-P25      |
| 79.613.5025 | Ø 50 mm - 40 x XNEX HC-P25/M20  |
| 79.613.5036 | Ø 50 mm - 40 x XNEX HC-M20      |
| 79.613.5520 | Ø 50 mm - 50 x XNEX HC-P25      |
| 79.613.5525 | Ø 50 mm - 50 x XNEX HC-P25/M20  |
| 79.613.5536 | Ø 50 mm - 50 x XNEX HC-M20      |
| 79.613.6320 | Ø 63 mm - 50 x XNEX HC-P25      |
| 79.613.6325 | Ø 63 mm - 50 x XNEX HC-P25/M20  |
| 79.613.6336 | Ø 63 mm - 50 x XNEX HC-M20      |
| 79.613.8020 | Ø 80 mm - 70 x XNEX HC-P25      |
| 79.613.8025 | Ø 80 mm - 70 x XNEX HC-P25/M20  |
| 79.613.8036 | Ø 80 mm - 70 x XNEX HC-M20      |





NL **Snijsnelheden draaien**  
 FR **Vitesse de coupe de tournage**  
 ES **Velocidades de corte para tornear**  
 DE **Schnittgeschwindigkeit Drehen**

|     |     | HM         |          |         |          |         |                |        |                |         |                |                        |                        |        |                |                |                |  |
|-----|-----|------------|----------|---------|----------|---------|----------------|--------|----------------|---------|----------------|------------------------|------------------------|--------|----------------|----------------|----------------|--|
| ISO | Gr. | CM10       | K10      | K20     | HC-K10   | P25     | HC-P10/<br>K10 | HC-P15 | HC-P15/<br>M15 | HC-P25  | HC-P25/<br>M20 | HC-P25/<br>M20/<br>S15 | HC-P25/<br>M25/<br>K20 | HC-P35 | HC-P35/<br>M25 | HC-P35/<br>M30 | HC-M20/<br>K30 |  |
|     |     | Vc (m/min) |          |         |          |         |                |        |                |         |                |                        |                        |        |                |                |                |  |
| P   | 11  | 280-350    |          |         | 110-160  | 100-140 |                |        | 220-400        |         | 190-290        |                        |                        |        |                | 180-230        | 240-210        |  |
|     | 12  | 260-300    |          |         | 90-120   | 90-120  |                |        | 100-280        | 200-320 | 100-250        | 170-250                | 90-250                 | 60-130 | 80-150         | 130-150        | 220-120        |  |
|     | 13  | 260-300    |          |         | 90-120   | 90-120  |                |        | 100-280        | 200-320 | 100-250        | 170-250                | 90-250                 | 60-130 | 80-150         | 130-150        | 220-120        |  |
|     | 14  | 160-200    |          |         | 80-110   | 60-100  |                |        | 120-280        |         |                | 130-210                |                        |        |                | 70-130         | 80-110         |  |
| H   | 15  |            |          |         |          |         |                |        |                |         |                | 60-120                 |                        |        |                |                |                |  |
|     | 21  | 230-270    |          |         | 90-140   |         |                |        | 220-300        |         | 140-210        | 80-230                 | 80-140                 |        | 140-200        | 120-110        | 150-200        |  |
| M   | 22  | 170-240    |          |         |          |         |                |        |                |         | 70-100         |                        |                        |        | 80-150         | 100-90         | 90-160         |  |
|     | 31  |            | 120-160  |         | 180-220  |         | 250-450        | 90-300 | 140-370        | 90-300  | 130-210        | 100-280                | 80-150                 |        |                |                | 120-160        |  |
| K   | 32  | 220-300    | 130-170  |         | 120-180  |         | 220-380        |        | 140-270        |         | 120-200        |                        |                        |        |                |                | 90-130         |  |
|     | 41  |            | 300-2500 | 100-500 | 300-3200 |         |                |        |                |         |                |                        |                        |        |                |                |                |  |
| N   | 42  |            | 400-1500 | 100-300 | 400-2000 |         |                |        |                |         |                |                        |                        |        |                |                |                |  |
|     | 51  |            | 250-600  | 100-300 | 200-1000 |         |                |        |                |         |                |                        |                        |        |                |                |                |  |
|     | 52  |            | 250-600  | 100-300 | 200-1000 |         |                |        |                |         |                |                        |                        |        |                |                |                |  |
|     | 61  |            | 80-180   | 80-180  | 80-220   |         |                |        |                |         |                |                        |                        |        |                |                |                |  |
| S   | 71  |            |          |         | 20-40    |         |                |        |                |         |                |                        |                        |        |                |                |                |  |
|     | 72  |            |          |         | 80-140   |         |                |        |                |         |                | 60-150                 |                        |        |                |                |                |  |

NL **Snijsnelheden steken**  
 FR **Vitesse de coupe de tronçonnage**  
 ES **Velocidades de corte para tronzar**  
 DE **Schnittgeschwindigkeit Stechen**

|     |     | HM       |                |                |                |
|-----|-----|----------|----------------|----------------|----------------|
| ISO | Gr. | K15      | HC-P25/<br>M20 | HC-P35/<br>M25 | HC-P40/<br>M30 |
| P   | 11  |          |                | 140-210        | 90-200         |
|     | 12  |          |                | 100-160        | 90-180         |
|     | 13  |          |                | 100-160        | 90-180         |
|     | 14  |          | 60-140         | 80-160         | 70-140         |
| H   | 15  |          |                |                |                |
|     | 21  |          | 60-130         | 50-90          | 60-80          |
| M   | 22  |          |                |                |                |
|     | 31  | 60-180   |                |                | 50-140         |
| K   | 32  | 60-150   |                |                | 120-180        |
|     | 41  | 500-2000 |                | 100-500        | 300-3200       |
| N   | 42  | 100-400  |                | 100-300        | 200-1000       |
|     | 51  | 100-400  |                | 100-300        | 200-1000       |
|     | 52  | 100-400  |                | 100-300        | 200-1000       |
|     | 61  | 50-700   |                | 80-180         | 80-220         |
| S   | 71  |          |                |                | 20-40          |
|     | 72  |          |                |                | 80-140         |

NL **Snijsnelheden draadsnijden**  
 FR **Vitesse de coupe de filetage**  
 ES **Velocidades de corte para roscar**  
 DE **Schnittgeschwindigkeit Gewindeschneiden**

|     |     | HM     |        |                |                        |
|-----|-----|--------|--------|----------------|------------------------|
| ISO | Gr. | P30    | HC-P25 | HC-P25/<br>M20 | HC-P25/<br>M20/<br>K20 |
| P   | 11  | 70-130 | 80-150 |                | 115-190                |
|     | 12  | 70-120 | 70-130 |                | 85-145                 |
|     | 13  | 70-120 | 70-130 |                | 85-145                 |
|     | 14  | 50-80  | 60-110 |                | 70-110                 |
| H   | 15  |        |        |                | 45-60                  |
|     | 21  | 75-110 |        | 70-150         | 70-130                 |
| M   | 22  | 70-100 |        | 40-120         | 40-110                 |
|     | 31  |        |        |                | 70-130                 |
| K   | 32  |        |        |                | 125-160                |
|     | 41  |        |        |                | 100-365                |
| N   | 42  |        |        |                | 200-400                |
|     | 51  |        |        |                | 80-225                 |
|     | 52  |        |        |                | 80-225                 |
|     | 61  |        |        |                |                        |
| S   | 71  |        |        |                | 20-30                  |
|     | 72  |        |        |                | 50-70                  |

NL **Snijsnelheden frezen**  
 FR **Vitesse de coupe de fraisage**  
 ES **Velocidades de corte para fresar**  
 DE **Schnittgeschwindigkeit Fräsen**

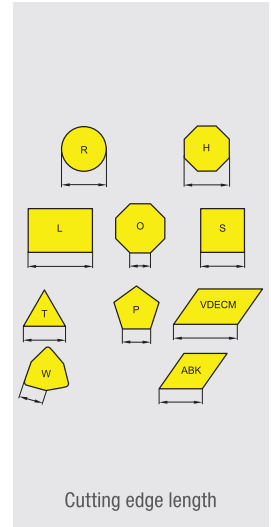
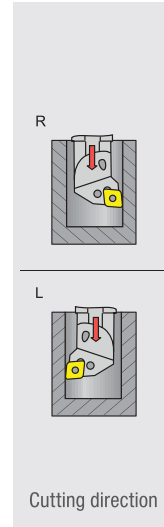
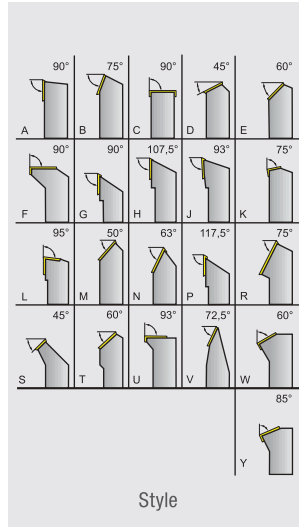
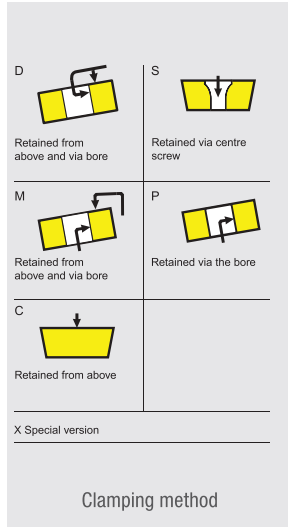
|     |     | HM      |        |                |                        |                |
|-----|-----|---------|--------|----------------|------------------------|----------------|
| ISO | Gr. | K10     | HC-P25 | HC-P20/<br>M20 | HC-P25/<br>M25/<br>S15 | HC-P30/<br>M25 |
| P   | 11  |         |        |                |                        | 190-280        |
|     | 12  |         | 80-180 | 80-180         | 90-250                 | 140-250        |
|     | 13  |         | 80-180 | 80-180         | 90-250                 | 140-250        |
|     | 14  |         |        |                |                        | 80-130         |
| H   | 15  |         |        | 60-120         | 60-120                 |                |
|     | 21  |         |        | 80-200         | 80-230                 |                |
| M   | 22  |         |        |                |                        |                |
|     | 31  |         |        |                | 100-280                | 160-310        |
| K   | 32  |         |        |                |                        | 130-200        |
|     | 41  | 100-600 |        |                |                        |                |
| N   | 42  |         |        |                |                        |                |
|     | 51  |         |        |                |                        |                |
|     | 52  |         |        |                |                        |                |
|     | 61  |         |        |                |                        |                |
| S   | 71  |         |        | 60-150         | 60-150                 |                |
|     | 72  |         |        |                |                        |                |

NL ISO Wisselplaatouder inwendig draaien  
 FR Porte-plaquette ISO tournage intérieur  
 ES Portaplaquita ISO torneado interior  
 DE ISO Klemmhalter innen drehen



|   |   |   |  |
|---|---|---|--|
| S | Steel shank   | E | As C with coolant hole                           |
| A | Steel shank with coolant hole                           | F | As C with anti-vibration system                  |
| B | Steel shank with anti-vibration system                  | C | As C with coolant hole and anti-vibration system |
| D | Steel shank with coolant hole and anti-vibration system | H | Heavy metal                                      |
| C | Carbide shank with steel head                           | J | Heavy metal with coolant hole                    |

Shank version



**S 32 U - D C L N R 12**

Shank Ø

|                   |  |
|-------------------|--|
| d <sub>s</sub> mm |  |
| 08                |  |
| 10                |  |
| 12                |  |
| 16                |  |
| 20                |  |
| 25                |  |
| 32                |  |
| 40                |  |
| 50                |  |
| 60                |  |

Tool length

|                   |   |
|-------------------|---|
| l <sub>t</sub> mm |   |
| 80                | F |
| 100               | H |
| 110               | J |
| 125               | K |
| 140               | L |
| 150               | M |
| 160               | N |
| 180               | P |
| 170               | Q |
| 200               | R |
| 250               | S |
| 300               | T |
| 350               | U |
| 400               | V |
| 450               | W |
| 500               | Y |
| Special length    | X |

Insert shape

|                |      |     |   |     |   |   |
|----------------|------|-----|---|-----|---|---|
| Included angle |      | 35° | V |     |   |   |
|                |      | 55° | D |     |   |   |
|                |      | 75° | E |     |   |   |
|                |      | 80° | C |     |   |   |
|                |      | 86° | M |     |   |   |
| Included angle |      | 55° | K |     |   |   |
|                |      | 82° | B |     |   |   |
|                |      | 85° | A |     |   |   |
| Other shapes   | 90°  | L   | — | ●   | R |   |
|                | 108° | P   | ● | 90° | ● | S |
|                | 120° | H   | ● | 60° | — | T |
|                | 135° | O   | ● | 80° | — | W |

Clearance angle

|     |   |     |   |
|-----|---|-----|---|
| 3°  | A | 25° | F |
| 5°  | B | 30° | G |
| 7°  | C | 0°  | N |
| 15° | D | 11° | P |
| 20° | E |     |   |

Clearance angles not included within the standard for which particular information is necessary } O

- SP 1
- HSS-E 1
- 2
- SP 3
- HSS-E 3
- 4
- 5
- 6
- 7



NL ISO Wisselplaatouder uitwendig draaien  
 FR Porte-plaquette ISO tournage extérieur  
 ES Portaplaquita ISO torneado exterior  
 DE ISO Klemmhalter außen drehen



**D**  
Retained from above and via bore

**M**  
Retained from above and via bore

**C**  
Retained from above

X Special version

Clamping method

**S**  
Retained via centre screw

**P**  
Retained via the bore

Style

A 90° B 75° C 90° D 45° E 60°

F 90° G 90° H 107.5° J 93° K 75°

L 95° M 50° N 63° O 117.5° P 75°

S 45° T 60° U 93° V 72.5° W 60°

Y 85°

**L**  
Cutting direction

**R**  
Cutting direction

**N**  
Cutting direction

Shank width

B

Cutting edge length

R H L O S T P VDECM W ABK

**D C L N R 25 25 - M 12**

Insert shape

|                |      |     |   |     |   |
|----------------|------|-----|---|-----|---|
| Included angle |      | 35° | V |     |   |
|                |      | 55° | D |     |   |
|                |      | 75° | E |     |   |
|                |      | 80° | C |     |   |
|                |      | 86° | M |     |   |
| Included angle |      | 55° | K |     |   |
|                |      | 82° | B |     |   |
|                |      | 85° | A |     |   |
|                |      | 90° | R |     |   |
|                |      | 90° | S |     |   |
| Other shapes   | 90°  | L   | — | —   | R |
|                | 108° | P   | ◆ | 90° | S |
|                | 120° | H   | ● | 60° | T |
|                | 135° | O   | ● | 80° | W |

Clearance angle

|     |   |     |   |
|-----|---|-----|---|
| 3°  | A | 25° | F |
| 5°  | B | 30° | G |
| 7°  | C | 0°  | N |
| 15° | D | 11° | P |
| 20° | E |     |   |

Clearance angles not included within the standard for which particular information is necessary

O

Shank height

Tool holder

Cartridge

Round shank

00

Tool length

| l <sub>1</sub> , mm | A | l <sub>1</sub> , mm | N |
|---------------------|---|---------------------|---|
| 32                  | A | 160                 | N |
| 40                  | B | 170                 | P |
| 50                  | C | 180                 | Q |
| 60                  | D | 200                 | R |
| 70                  | E | 250                 | S |
| 80                  | F | 300                 | T |
| 90                  | G | 350                 | U |
| 100                 | H | 400                 | V |
| 110                 | J | 450                 | W |
| 125                 | K | 500                 | Y |
| 140                 | L | Special             | X |
| 150                 | M |                     |   |

- 1 SC
- 1 HSS-E
- 2
- 3 SC
- 3 HSS-E
- 4
- 5
- 6
- 7

NL ISO Wisselplaten  
 FR Plaquettes ISO  
 ES Plaquetas ISO  
 DE ISO Wendepfatten



|                |      |   |
|----------------|------|---|
| Included angle | 35°  | V |
|                | 55°  | D |
| Included angle | 75°  | E |
|                | 80°  | C |
| Included angle | 86°  | M |
|                | 55°  | K |
| Included angle | 82°  | B |
|                | 85°  | A |
| Other shapes   | 90°  | L |
|                | 108° | P |
| Other shapes   | 120° | H |
|                | 135° | O |
| Other shapes   | -    | R |
|                | 90°  | S |
| Other shapes   | 60°  | T |
|                | 80°  | W |

Insert shape

|     |   |     |   |
|-----|---|-----|---|
| 3°  | A | 25° | F |
| 5°  | B | 30° | G |
| 7°  | C | 0°  | N |
| 15° | D | 11° | P |
| 20° | E |     |   |

Clearance angle

Clearance angles not included within the standard for which particular information is necessary

|   |            |           |       |
|---|------------|-----------|-------|
|   | d ±        | m ±       | s ±   |
| A | 0,025      | 0,005     | 0,025 |
| F | 0,013      | 0,005     | 0,025 |
| C | 0,025      | 0,013     | 0,025 |
| H | 0,013      | 0,013     | 0,025 |
| E | 0,025      | 0,025     | 0,025 |
| G | 0,025      | 0,025     | 0,13  |
| J | 0,05-0,15* | 0,005     | 0,025 |
| K | 0,05-0,15* | 0,013     | 0,025 |
| L | 0,05-0,15* | 0,025     | 0,025 |
| M | 0,05-0,15* | 0,08-0,20 | 0,13  |
| N | 0,05-0,15* | 0,08-0,20 | 0,025 |
| U | 0,08-0,25* | 0,13-0,38 | 0,13  |

Tolerances

|      |                 |  |
|------|-----------------|--|
| N    |                 |  |
| R    |                 |  |
| F    |                 |  |
| A    |                 |  |
| M, P |                 |  |
| G, P |                 |  |
| W    |                 |  |
| T    |                 |  |
| Q    |                 |  |
| U    |                 |  |
| B    |                 |  |
| H    |                 |  |
| C    |                 |  |
| J    |                 |  |
| X    | Special version |  |

Form of top surface

|      |    |    |  |
|------|----|----|--|
| d mm |    |    |  |
|      | 06 | 16 |  |
|      | 08 | 20 |  |
|      | 10 | 25 |  |
|      | 12 | 32 |  |

|    |      |      |    |
|----|------|------|----|
| mm | Inch | mm   | mm |
| 06 | 5/32 | 3,96 | 03 |
| 09 | 7/32 | 5,56 | 05 |
| 11 | 1/4  | 6,35 | 06 |
| 16 | 3/8  | 9,52 | 09 |
| 22 | 1/2  | 12,7 | 12 |
| 27 | 5/8  | 15,8 | 15 |
| 33 | 3/4  | 19,0 | 19 |
| 44 | 1    | 25,4 | 25 |

Cutting edge length

|      |      |       |
|------|------|-------|
| Inch | mm   | Index |
| 1/16 | 1,59 | 01    |
| 3/32 | 2,38 | 02    |
| 1/8  | 3,18 | 03    |
| 5/32 | 3,97 | T3    |
| 3/16 | 4,76 | 04    |
| 7/32 | 5,56 | 05    |
| 1/4  | 6,35 | 06    |
| 5/16 | 7,94 | 07    |
| 3/8  | 9,52 | 09    |

Insert thickness

|      |                  |
|------|------------------|
| Code | Corner radius mm |
| 00   | ≤ 0,05           |
| 01   | 0,1              |
| 02   | 0,2              |
| 04   | 0,4              |
| 08   | 0,8              |
| 12   | 1,2              |
| 16   | 1,6              |
| 24   | 2,4              |
| 32   | 3,2              |

Corner radius

⊙ RN 00  
 ⊙ RC MO

**C**   **N**   **M**   **G**   **12**   **04**   **08**

|          |                              |          |                     |          |           |
|----------|------------------------------|----------|---------------------|----------|-----------|
| <b>N</b> | <b>F</b>                     | <b>1</b> | <b>ALU</b> Uncoated | <b>P</b> | <b>10</b> |
| <b>P</b> | <b>M</b>                     | <b>6</b> | <b>HC</b> Coated    | <b>M</b> | <b>35</b> |
| <b>R</b> | <b>A</b> Aluminium Non-Ferro |          |                     | <b>K</b> |           |
|          |                              |          |                     | <b>S</b> |           |

Insert Type

Insert Index

Chipbreaker Index

Surface

ISO Index

Carbide Grade

**N**   **M**   **3**   **HC**   **P**   **25**







NL **Negatieve wisselplaten voor draaien**  
 FR **Plaquettes négatives pour tournage**  
 ES **Plaquetas negativas para torneado**  
 DE **Negative Wendepplatten zum drehen**

N

NL **Fijn/nadraaien**  
 FR **Tournage fin**  
 ES **Torneado fino**  
 DE **Schlichten**

F


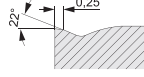
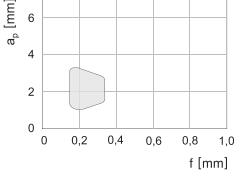



|  |   |   |   |   |
|--|---|---|---|---|
| <p>NF2</p>    |       |    |    |    |
|  |   | <p>HC-P15/M15<br/>HC-P35/M25</p>  | <p>HC-P35/M25</p>   |   |
|  |   | <p>HC-P15/M15<br/>HC-P35/M25</p>  | <p>HC-P35/M25</p>   |   |
|  |   |   |   |   |
|  |   |   |   |   |
|  |   |   |   |   |
|  |   |   |   |   |
| <p>NF2E</p>  |      |    |    |    |
|  |   | <p>HC-P25/M20/S15<br/>HC-P15</p>  | <p>HC-P25/M20/S15</p>   |   |
|  |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|  |   |   |   |   |
|  |   |   |   |   |
|  |   |   |   |   |
|  |   |   |   |   |
| <p>NF3</p>  |   |  |  |  |
|  |   | <p>HC-P25/M20</p>   | <p>HC-P25/M20</p>   |   |
|  |   | <p>HC-P25/M20</p>   | <p>HC-P25/M20</p>   |   |
|  |   | <p>HC-P25/M20</p>   | <p>HC-P25/M20</p>   |   |
|  |   |   |   |   |
|  |   |   |   |   |
|  |   |   |   |   |
| <p>NF4</p>  |   |  |  |  |
|  |   | <p>HC-M20/K30</p>   |   |   |
|  |   | <p>HC-M20/K30</p>   |   |   |
|  |   | <p>HC-M20/K30</p>   |   |   |
|  |   | <p>HC-M20/K30</p>   |   |   |
|  |   | <p>HC-M20/K30</p>   |   |   |
|  |   |   |   |   |

NL **Negatieve wisselplaten voor draaien**  
 FR **Plaquettes négatives pour tournage**  
 ES **Plaquetas negativas para torneado**  
 DE **Negative Wendeplatten zum drehen**

**N**

NL **Middelmatige bewerking negatieve wisselplaat**  
 FR **Tournage semi-finition**  
 ES **Torneado medio**  
 DE **Mittlere Zerspanung**

**M**

|   |   |   |   |   |
|---|---|---|---|---|
| <p>NM3E</p>  |   |  |  |  |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |
|   |   | <p>HC-P25/M20/S15</p>   | <p>HC-P25/M20/S15</p>   |   |




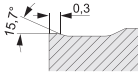
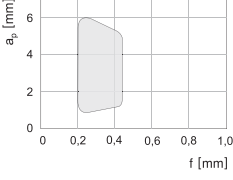




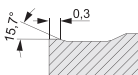
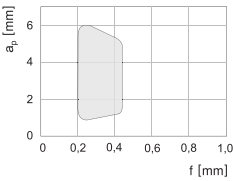




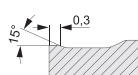
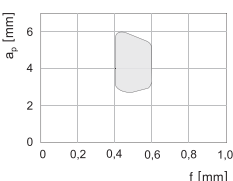




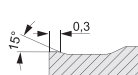
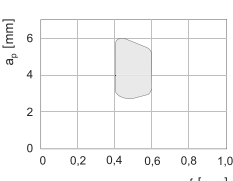





NL **Negatieve wisselplaten voor draaien**  
 FR **Plaquettes négatives pour tournage**  
 ES **Plaquetas negativas para torneado**  
 DE **Negative Wendepplatten zum drehen**

NL **Ruwen negatieve wisselplaat**  
 FR **Usinage d'ébauche**  
 ES **Mecanizado en desbaste**  
 DE **Schruppen**

N


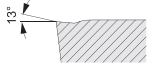
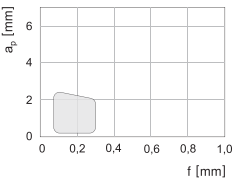




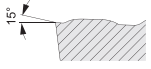
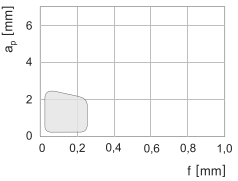




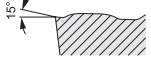
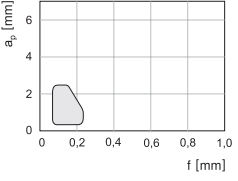



R

|   |   |   |   |   |
|---|---|---|---|---|
| <p>NR4E</p>    |       | <br>HC-P15                     |                  |                  |
| <p>NR4</p>     |      | <br>HC-P25/M20<br>HC-P35/M25   | <br>HC-P25/M20   | <br>HC-P35/M25   |
| <p>NR5E</p>  |   | <br>HC-P25                   | <br>HC-P25     |                |
| <p>NR5</p>   |   | <br>HC-P25/M20<br>HC-P15/M15 | <br>HC-P25/M20 | <br>HC-P25/M20 |

NL **Positieve wisselplaten voor draaien**  
 FR **Plaquettes positives pour tournage**  
 ES **Plaquetas positivas para torneado**  
 DE **Positive Wendeplatten zum drehen**

NL **Fijn/nadraaien**  
 FR **Tournage fin**  
 ES **Torneado fino**  
 DE **Schlichten**

**P**  
**F**

|  |   |   |   |   |
|--|---|---|---|---|
| <p>PF2</p>    |       | <br>CM10         | <br>CM10         | <br>CM10         |
| <p>PF3</p>    |      | <br>HC-P25/M20   | <br>HC-P35/M25   | <br>HC-P35/M25   |
| <p>PF4</p>  |   | <br>HC-P35/M30 | <br>HC-P35/M30 | <br>HC-P35/M30 |






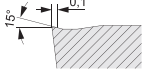
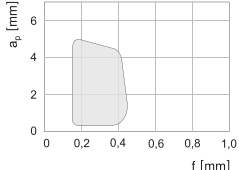




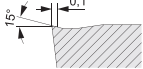
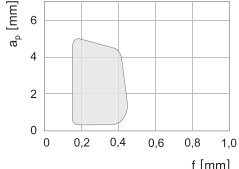





NL **Positieve wisselplaten voor draaien**  
 FR **Plaquettes positives pour tournage**  
 ES **Plaquetas positivas para torneado**  
 DE **Positive Wendepplatten zum drehen**

P

NL **Middelmatige bewerking**  
 FR **Tournage semi-finition**  
 ES **Torneado medio**  
 DE **Mittlere Zerspantung**

M


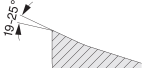
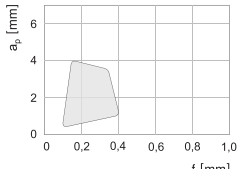



|   |  |   |   |   |
|---|--|---|---|---|
| <p>PM3E</p>  |    |  |  |  |
|   |  | HC-P15<br>HC-P25/M20/S15  | HC-P25/M20/S15  |   |
|   |  | HC-P25/M20/S15  | HC-P25/M20/S15  |   |
|   |  |   |   |   |
|   |  | HC-P25/M20/S15  | HC-P25/M20/S15  |   |
| <p>PM3</p>  |   |  |  |  |
|   |  | HC-P25/M20  | HC-P25/M20<br>HC-P35/M25  | HC-P35/M25  |
|   |  | HC-P25/M20  | HC-P25/M20<br>HC-P35/M25  | HC-P35/M25  |
|   |  | HC-P25/M20  | HC-P25/M20  |   |
|   |  |   |   |   |

NL **Positieve wisselplaten voor draaien**  
 FR **Plaquettes positives pour tournage**  
 ES **Plaquetas positivas para torneado**  
 DE **Positive Wendepplatten zum drehen**


P

NL **Aluminium/Non-Ferro**  
 FR **Aluminium/Non-Ferro**  
 ES **Aluminio/Non-Ferro**  
 DE **Aluminium/Nichteisenmetall**

A

|  |   |   |   |   |
|--|---|---|---|---|
| <p>PA2</p>  |   |  |  |  |
|  |   | HC-K10<br>K10   | HC-K10  |   |
|  |   | HC-K10<br>K10   | HC-K10  |   |
|  |   | HC-K10<br>K10   | HC-K10  |   |
|  |   | HC-K10<br>K10   | HC-K10  |   |

NL **Draadsnijden**  
 FR **Filetage**  
 ES **Roscar**  
 DE **Gewindedrehen**

| <br><table border="1"> <thead> <tr> <th>mm</th> <th>Inch</th> <th>mm</th> </tr> </thead> <tbody> <tr> <td>09</td> <td>7/32</td> <td>5,56</td> </tr> <tr> <td>11</td> <td>1/4</td> <td>6,35</td> </tr> <tr> <td>16</td> <td>3/8</td> <td>9,52</td> </tr> <tr> <td>22</td> <td>1/2</td> <td>12,7</td> </tr> <tr> <td>27</td> <td>5/8</td> <td>15,8</td> </tr> </tbody> </table> <p>Insert size</p> | mm                  | Inch | mm | 09 | 7/32 | 5,56 | 11 | 1/4 | 6,35 | 16 | 3/8 | 9,52 | 22 | 1/2 | 12,7 | 27 | 5/8 | 15,8 | <table border="1"> <tbody> <tr> <td>E</td> <td>External</td> </tr> <tr> <td>I</td> <td>Internal</td> </tr> <tr> <td>EI</td> <td>Ex- &amp; Internal</td> </tr> </tbody> </table> <p>Type of Insert</p> | E | External | I | Internal | EI | Ex- & Internal | <table border="1"> <tbody> <tr> <td>R</td> <td>Right Hand</td> </tr> <tr> <td>L</td> <td>Left Hand</td> </tr> </tbody> </table> <p>RH/LH Insert</p> | R | Right Hand | L | Left Hand | <table border="1"> <thead> <tr> <th colspan="2">Full Profile - Pitch Range</th> </tr> <tr> <th>mm</th> <th>tpi</th> </tr> </thead> <tbody> <tr> <td>0.35-25.0</td> <td>72-1</td> </tr> </tbody> </table><br><table border="1"> <thead> <tr> <th colspan="2">Partial Profile - Pitch Range</th> </tr> <tr> <th>mm</th> <th>tpi</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>0.5-1.5 48-16</td> </tr> <tr> <td>AG</td> <td>0.5-3.0 48-8</td> </tr> <tr> <td>G</td> <td>1.75-3.0 14-8</td> </tr> <tr> <td>N</td> <td>3.5-5.0 7-5</td> </tr> </tbody> </table> <p>Pitch</p> | Full Profile - Pitch Range |  | mm | tpi | 0.35-25.0 | 72-1 | Partial Profile - Pitch Range |  | mm | tpi | A | 0.5-1.5 48-16 | AG | 0.5-3.0 48-8 | G | 1.75-3.0 14-8 | N | 3.5-5.0 7-5 | <table border="1"> <thead> <tr> <th colspan="2">Partial Profile</th> </tr> </thead> <tbody> <tr> <td>60°</td> <td>60° Partial profile</td> </tr> <tr> <td>55°</td> <td>55° Partial profile</td> </tr> </tbody> </table><br><table border="1"> <thead> <tr> <th colspan="2">Full Profile</th> </tr> </thead> <tbody> <tr> <td>ISO</td> <td>ISO Metric</td> </tr> <tr> <td>UN</td> <td>American UN</td> </tr> <tr> <td>W</td> <td>Whitworth BSW/BSP</td> </tr> <tr> <td>TR</td> <td>Trapez</td> </tr> </tbody> </table> <p>Thread Standard</p> | Partial Profile |  | 60° | 60° Partial profile | 55° | 55° Partial profile | Full Profile |  | ISO | ISO Metric | UN | American UN | W | Whitworth BSW/BSP | TR | Trapez | <table border="1"> <tbody> <tr> <td>B</td> <td>With chipbreaker</td> </tr> <tr> <td>-</td> <td>Without</td> </tr> </tbody> </table> <p>Chipbreaker</p> | B | With chipbreaker | - | Without |
|---|---------------------|------|----|----|------|------|----|-----|------|----|-----|------|----|-----|------|----|-----|------|---|---|----------|---|----------|----|----------------|---|---|------------|---|-----------|--|----------------------------|--|----|-----|-----------|------|-------------------------------|--|----|-----|---|---------------|----|--------------|---|---------------|---|-------------|--|-----------------|--|-----|---------------------|-----|---------------------|--------------|--|-----|------------|----|-------------|---|-------------------|----|--------|--|---|------------------|---|---------|
| mm  | Inch                | mm   |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| 09  | 7/32                | 5,56 |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| 11  | 1/4                 | 6,35 |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| 16  | 3/8                 | 9,52 |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| 22  | 1/2                 | 12,7 |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| 27  | 5/8                 | 15,8 |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| E   | External            |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| I   | Internal            |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| EI  | Ex- & Internal      |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| R   | Right Hand          |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| L   | Left Hand           |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| Full Profile - Pitch Range  |                     |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| mm  | tpi                 |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| 0.35-25.0   | 72-1                |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| Partial Profile - Pitch Range   |                     |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| mm  | tpi                 |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| A   | 0.5-1.5 48-16       |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| AG  | 0.5-3.0 48-8        |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| G   | 1.75-3.0 14-8       |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| N   | 3.5-5.0 7-5         |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| Partial Profile   |                     |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| 60°   | 60° Partial profile |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| 55°   | 55° Partial profile |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| Full Profile  |                     |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| ISO   | ISO Metric          |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| UN  | American UN         |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| W   | Whitworth BSW/BSP   |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| TR  | Trapez              |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| B   | With chipbreaker    |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |
| -   | Without             |      |    |    |      |      |    |     |      |    |     |      |    |     |      |    |     |      |   |   |          |   |          |    |                |   |   |            |   |           |  |                            |  |    |     |           |      |                               |  |    |     |   |               |    |              |   |               |   |             |  |                 |  |     |                     |     |                     |              |  |     |            |    |             |   |                   |    |        |  |   |                  |   |         |

16

E

R

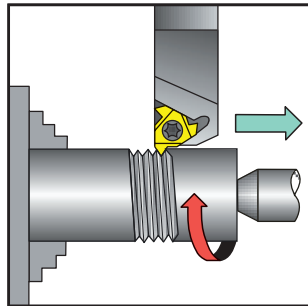
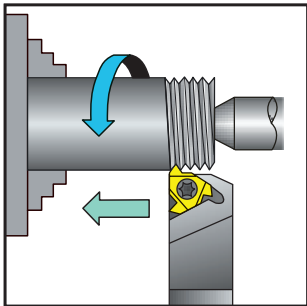
175

ISO

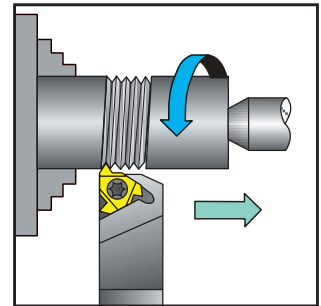
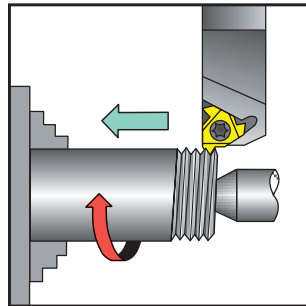
B

NL **Schroefdraadsnij methodes**  
 FR **Méthodes de filetage en tournage**  
 ES **Métodos de torneado de roscas**  
 DE **Gewindedrehverfahren**

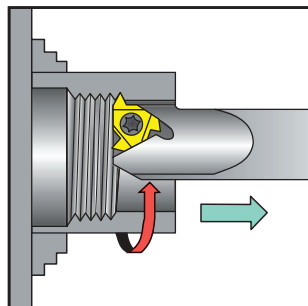
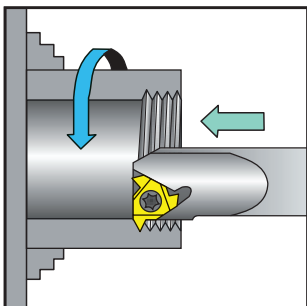
**External RH Thread**



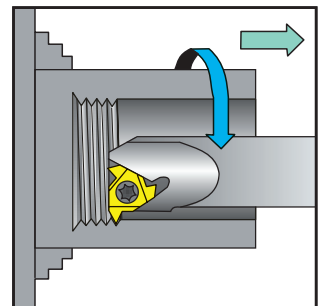
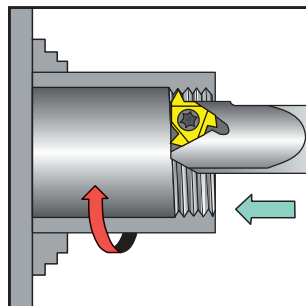
**External LH Thread**



**Internal RH Thread**

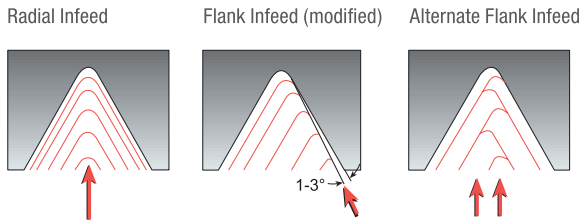


**Internal LH Thread**

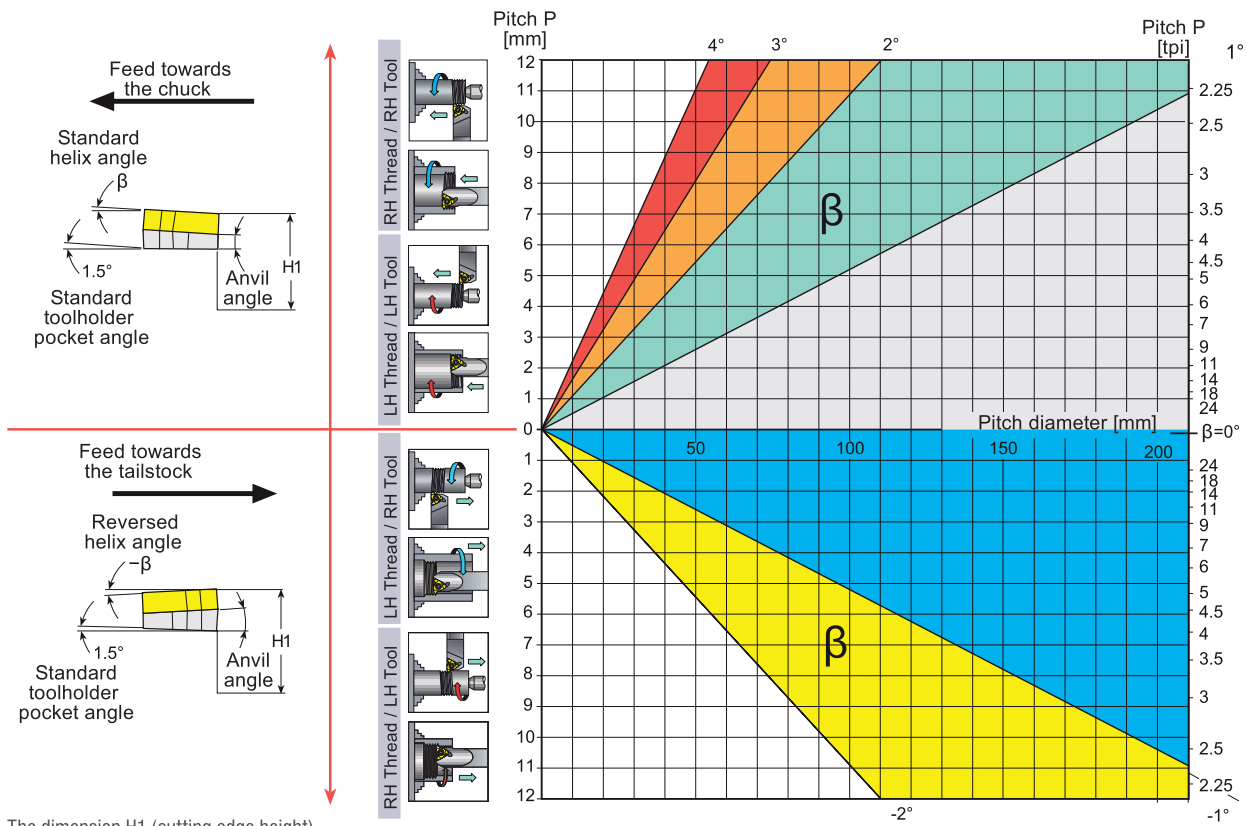




NL **Invoer methoden**  
 FR **Méthode angle d'attaque**  
 ES **Métodos de ataque de la rosca**  
 DE **Gewinzustellverfahren**



NL **Schroefdraadhelingshoek diagram**  
 FR **Diagramme de l'angle d'hélice**  
 ES **Diagrama del ángulo de hélice**  
 DE **Teilungswinkel Diagramm**



The dimension H1 (cutting edge height) remains constant with every insert / anvil combination.

NL **Onderlegplaten**  
 FR **Sous-plaquettes**  
 ES **Placa base**  
 DE **Unterlegplatten**

| Resultant Helix Angle |      | $\beta$ Holder | 3.5°          | 2.5°      | 1.5°      | 0.5°      | 0°        | -0.5°     | -1.5°     |
|-----------------------|------|----------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Insert Size           | L mm |                | Ordering Code |           |           |           |           |           |           |
| 3/8"                  | 16   | ER / IL        | 743980170     | 743980175 | 743980165 | 74398180  | -         | 743980190 | 743980195 |
|                       |      | EL / IR        | 743980265     | 743980270 | 743980260 | 743980275 | -         | 743980280 | 743980285 |
| 1/2"                  | 22   | ER / IL        | 743980205     | 743980210 | 743980200 | 743980215 | -         | 743980220 | 743980225 |
|                       |      | EL / IR        | 743980295     | 743980300 | 743980290 | 743980305 | -         | 743980310 | 743980315 |
| 3/8" Groove           | 16   | ER / IL        | -             | -         | -         | -         | 743980400 | -         | -         |
|                       |      | EL / IR        | -             | -         | -         | -         | 743980500 | -         | -         |

NL ISO Wisselplaten  
FR Plaquettes ISO  
ES Plaquitas ISO  
DE ISO Wendeplatten



| <p>A 85°<br/>B 82°<br/>K 55°</p> <p>H 120°</p> <p>L 90°</p> <p>O 135°</p> <p>P 108°</p> <p>C 80°<br/>D 55°<br/>E 75°<br/>M 86°<br/>V 35°</p> <p>R -</p> <p>S 90°</p> <p>T 60°</p> <p>W 80°</p> <p>X Special shapes</p> <p>Insert shape</p> | <p>Clearance angle</p> <p>α</p> <p>A 3°<br/>B 5°<br/>C 7°<br/>D 15°<br/>E 20°<br/>F 25°<br/>G 30°<br/>N 0°<br/>P 11°<br/>O Special version</p> | <p>Tolerances</p> <table border="1"> <tr> <th>d [mm]</th> <th>m [mm]</th> <th>s [mm]</th> <th>α</th> </tr> <tr> <td>A .025</td> <td>.005</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>C .025</td> <td>.013</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>E .025</td> <td>.025</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>F .013</td> <td>.005</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>G .025</td> <td>.025</td> <td>.13</td> <td>•••••</td> </tr> <tr> <td>H .013</td> <td>.013</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>J .05</td> <td>.005</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>K .08</td> <td>.013</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>L .10</td> <td>.005</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>M .05</td> <td>.013</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>N .08</td> <td>.013</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>O .10</td> <td>.013</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>P .08</td> <td>.013</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>Q .10</td> <td>.013</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>R .08</td> <td>.013</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>S .10</td> <td>.013</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>T .08</td> <td>.013</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>U .10</td> <td>.013</td> <td>.025</td> <td>•••••</td> </tr> <tr> <td>V .18</td> <td>.027</td> <td>.13</td> <td>•••••</td> </tr> </table> | d [mm] | m [mm] | s [mm] | α  | A .025 | .005 | .025 | ••••• | C .025 | .013 | .025 | ••••• | E .025 | .025 | .025 | ••••• | F .013 | .005 | .025 | ••••• | G .025 | .025 | .13 | ••••• | H .013 | .013 | .025 | ••••• | J .05 | .005 | .025 | ••••• | K .08 | .013 | .025 | ••••• | L .10 | .005 | .025 | ••••• | M .05 | .013 | .025 | ••••• | N .08 | .013 | .025 | ••••• | O .10 | .013 | .025 | ••••• | P .08 | .013 | .025 | ••••• | Q .10 | .013 | .025 | ••••• | R .08 | .013 | .025 | ••••• | S .10 | .013 | .025 | ••••• | T .08 | .013 | .025 | ••••• | U .10 | .013 | .025 | ••••• | V .18 | .027 | .13 | ••••• | <p>Form of top surface</p> <p>A<br/>F<br/>G<br/>M<br/>N<br/>Q<br/>R<br/>T<br/>U<br/>W<br/>X Special shapes</p> | <p>Cutting edge length</p> <table border="1"> <tr> <th>d [mm]</th> <th>A</th> <th>T/V</th> <th>C/S</th> <th>H</th> <th>L</th> <th>R</th> <th>W</th> <th>O</th> </tr> <tr> <td>5.00</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>05</td> <td>-</td> <td>-</td> </tr> <tr> <td>5.56</td> <td>-</td> <td>09</td> <td>05</td> <td>-</td> <td>08</td> <td>-</td> <td>03</td> <td>-</td> </tr> <tr> <td>6.00</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>06</td> <td>-</td> <td>-</td> </tr> <tr> <td>6.35</td> <td>-</td> <td>11</td> <td>06</td> <td>03</td> <td>10</td> <td>-</td> <td>04</td> <td>02</td> </tr> <tr> <td>6.65</td> <td>10</td> <td>-</td> <td>07</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>7.94</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>8.00</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>08</td> <td>-</td> <td>-</td> </tr> <tr> <td>9.00</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>12</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>9.52</td> <td>-</td> <td>16</td> <td>08</td> <td>05</td> <td>15</td> <td>-</td> <td>06</td> <td>04</td> </tr> <tr> <td>9.57</td> <td>15</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>10.00</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>10</td> <td>-</td> <td>-</td> </tr> <tr> <td>12.00</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>12</td> <td>-</td> <td>-</td> </tr> <tr> <td>12.70</td> <td>22</td> <td>12</td> <td>07</td> <td>20</td> <td>-</td> <td>08</td> <td>05</td> <td>-</td> </tr> <tr> <td>15.87</td> <td>27</td> <td>15</td> <td>09</td> <td>-</td> <td>-</td> <td>10</td> <td>06</td> <td>-</td> </tr> <tr> <td>16.00</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>16</td> <td>-</td> <td>-</td> </tr> <tr> <td>16.74</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>16</td> <td>-</td> <td>-</td> </tr> <tr> <td>19.05</td> <td>33</td> <td>19</td> <td>11</td> <td>-</td> <td>-</td> <td>13</td> <td>07</td> <td>-</td> </tr> <tr> <td>20.00</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>20</td> <td>-</td> <td>-</td> </tr> </table> | d [mm] | A | T/V | C/S | H | L | R | W | O | 5.00 | - | - | - | - | - | 05 | - | - | 5.56 | - | 09 | 05 | - | 08 | - | 03 | - | 6.00 | - | - | - | - | - | 06 | - | - | 6.35 | - | 11 | 06 | 03 | 10 | - | 04 | 02 | 6.65 | 10 | - | 07 | - | - | - | - | - | 7.94 | - | - | - | - | - | - | - | - | 8.00 | - | - | - | - | - | 08 | - | - | 9.00 | - | - | - | - | 12 | - | - | - | 9.52 | - | 16 | 08 | 05 | 15 | - | 06 | 04 | 9.57 | 15 | - | - | - | - | - | - | - | 10.00 | - | - | - | - | - | 10 | - | - | 12.00 | - | - | - | - | - | 12 | - | - | 12.70 | 22 | 12 | 07 | 20 | - | 08 | 05 | - | 15.87 | 27 | 15 | 09 | - | - | 10 | 06 | - | 16.00 | - | - | - | - | - | 16 | - | - | 16.74 | - | - | - | - | - | 16 | - | - | 19.05 | 33 | 19 | 11 | - | - | 13 | 07 | - | 20.00 | - | - | - | - | - | 20 | - | - | <p>Insert thickness</p> <p>s [mm]</p> <p>01 1.59<br/>T1 1.98<br/>02 2.38<br/>03 3.18<br/>T3 3.97<br/>04 4.76<br/>05 5.56<br/>06 6.35<br/>07 7.94<br/>09 9.52</p> | <p>Facet corner radius</p> <p>1st sign k<br/>A 45°<br/>D 60°<br/>E 75°<br/>F 85°<br/>P 30°<br/>Z Others</p> <p>2nd sign α<sub>1</sub><br/>A 3°<br/>B 5°<br/>C 7°<br/>D 15°<br/>E 20°<br/>F 25°<br/>G 30°<br/>N 0°<br/>P 11°<br/>Z Others</p> <p>Radius r (mm)<br/>M0*<br/>02 0.2<br/>04 0.4<br/>05 0.8<br/>08 1.2</p> <p>* Shape R only</p> | <p>Cutting edge</p> <p>F Sharp<br/>E Honed<br/>S Chamfered and honed<br/>T Chamfered</p> <p>Cutting direction</p> <p>R<br/>L<br/>N</p> |
|--|--|--|--------|--------|--------|----|--------|------|------|-------|--------|------|------|-------|--------|------|------|-------|--------|------|------|-------|--------|------|-----|-------|--------|------|------|-------|-------|------|------|-------|-------|------|------|-------|-------|------|------|-------|-------|------|------|-------|-------|------|------|-------|-------|------|------|-------|-------|------|------|-------|-------|------|------|-------|-------|------|------|-------|-------|------|------|-------|-------|------|------|-------|-------|------|------|-------|-------|------|-----|-------|--|---|--------|---|-----|-----|---|---|---|---|---|------|---|---|---|---|---|----|---|---|------|---|----|----|---|----|---|----|---|------|---|---|---|---|---|----|---|---|------|---|----|----|----|----|---|----|----|------|----|---|----|---|---|---|---|---|------|---|---|---|---|---|---|---|---|------|---|---|---|---|---|----|---|---|------|---|---|---|---|----|---|---|---|------|---|----|----|----|----|---|----|----|------|----|---|---|---|---|---|---|---|-------|---|---|---|---|---|----|---|---|-------|---|---|---|---|---|----|---|---|-------|----|----|----|----|---|----|----|---|-------|----|----|----|---|---|----|----|---|-------|---|---|---|---|---|----|---|---|-------|---|---|---|---|---|----|---|---|-------|----|----|----|---|---|----|----|---|-------|---|---|---|---|---|----|---|---|--|---|--|
| d [mm]   | m [mm]   | s [mm]   | α      |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| A .025   | .005   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| C .025   | .013   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| E .025   | .025   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| F .013   | .005   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| G .025   | .025   | .13  | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| H .013   | .013   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| J .05  | .005   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| K .08  | .013   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| L .10  | .005   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| M .05  | .013   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| N .08  | .013   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| O .10  | .013   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| P .08  | .013   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| Q .10  | .013   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| R .08  | .013   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| S .10  | .013   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| T .08  | .013   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| U .10  | .013   | .025   | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| V .18  | .027   | .13  | •••••  |        |        |    |        |      |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| d [mm]   | A  | T/V  | C/S    | H      | L      | R  | W      | O    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 5.00   | -  | -  | -      | -      | -      | 05 | -      | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 5.56   | -  | 09   | 05     | -      | 08     | -  | 03     | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 6.00   | -  | -  | -      | -      | -      | 06 | -      | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 6.35   | -  | 11   | 06     | 03     | 10     | -  | 04     | 02   |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 6.65   | 10   | -  | 07     | -      | -      | -  | -      | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 7.94   | -  | -  | -      | -      | -      | -  | -      | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 8.00   | -  | -  | -      | -      | -      | 08 | -      | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 9.00   | -  | -  | -      | -      | 12     | -  | -      | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 9.52   | -  | 16   | 08     | 05     | 15     | -  | 06     | 04   |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 9.57   | 15   | -  | -      | -      | -      | -  | -      | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 10.00  | -  | -  | -      | -      | -      | 10 | -      | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 12.00  | -  | -  | -      | -      | -      | 12 | -      | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 12.70  | 22   | 12   | 07     | 20     | -      | 08 | 05     | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 15.87  | 27   | 15   | 09     | -      | -      | 10 | 06     | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 16.00  | -  | -  | -      | -      | -      | 16 | -      | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 16.74  | -  | -  | -      | -      | -      | 16 | -      | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 19.05  | 33   | 19   | 11     | -      | -      | 13 | 07     | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |
| 20.00  | -  | -  | -      | -      | -      | 20 | -      | -    |      |       |        |      |      |       |        |      |      |       |        |      |      |       |        |      |     |       |        |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |      |       |       |      |     |       |  |   |        |   |     |     |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |    |    |   |    |   |    |   |      |   |   |   |   |   |    |   |   |      |   |    |    |    |    |   |    |    |      |    |   |    |   |   |   |   |   |      |   |   |   |   |   |   |   |   |      |   |   |   |   |   |    |   |   |      |   |   |   |   |    |   |   |   |      |   |    |    |    |    |   |    |    |      |    |   |   |   |   |   |   |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |    |   |    |    |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |       |   |   |   |   |   |    |   |   |       |    |    |    |   |   |    |    |   |       |   |   |   |   |   |    |   |   |  |   |  |

**S E H T 12 03 AE SN**




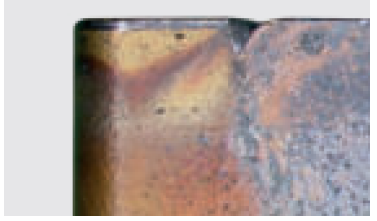



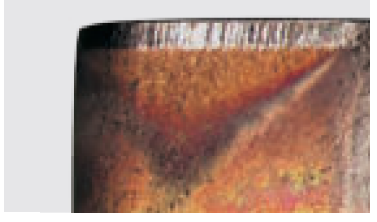



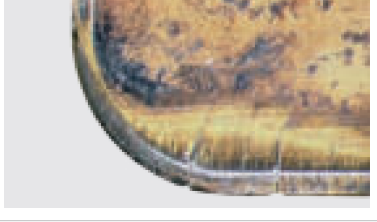
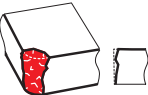

|  |  |  |
|--|--|--|
| <p>Surface</p> <p>ALU Uncoated<br/>HC Coated</p> <p>HC</p> | <p>ISO Index</p> <p>P Steel<br/>M INOX<br/>K Cast NF<br/>S Super Alloys</p> <p>P</p> | <p>Carbide Grade</p> <p>10 Hard<br/>35 Tough</p> <p>25</p> |
|--|--|--|







NL Slijtage soorten  
 FR Types d'usure  
 ES Tipos de desgaste  
 DE Verschleißarten

|   |   |   |
|---|---|---|
|    | <p>Built-up edge<br/>(Adhesive wear)</p>      |    |
|    | <p>Notching<br/>(Adhesive/Mechanic)</p>       |    |
|   | <p>Crater<br/>(Chemical wear)</p>             |   |
|  | <p>Flank wear<br/>(Abrasive wear)</p>         |  |
|  | <p>Plastic deformation<br/>(Thermal wear)</p> |  |
|  | <p>Thermal cracks<br/>(Thermal wear)</p>      |  |
|  | <p>Breakage<br/>(Mechanic wear)</p>           |  |

NL **Maatregelen bij draaiproblemen**  
 FR **Problèmes de tournage et solutions**  
 ES **Problemas de torneado y soluciones**  
 DE **Maßnahmen bei Drehproblemen**

| Type of problem |          |           |            |                     |          |               |                 |           |                              |                             |                                 |                       |                                     |
|-----------------|----------|-----------|------------|---------------------|----------|---------------|-----------------|-----------|------------------------------|-----------------------------|---------------------------------|-----------------------|-------------------------------------|
| Build up edge   | Notching | Cratering | Flank wear | Plastic deformation | Breakage | Edge chipping | Surface quality | Vibration | Formation of burrs and chips | Long chips ( tangled swarf) | Short chips ( fragmented chips) | Corrective measures   |                                     |
| ↑               | ↓        | ↓         | ↓          | ↓                   |          |               | ↑               | ↓         |                              |                             |                                 | Cutting values        | Cutting speed                       |
|                 |          |           | ■          |                     |          |               |                 |           |                              | ↑                           | ↓                               |                       | Feed rate                           |
|                 |          | ↓         |            |                     |          | ↓             |                 |           | ↓                            |                             |                                 |                       | Feed - center area                  |
| ↓               |          | ↓         | ■          | ■                   |          | ↑             |                 | ■         | ↓                            | ↓                           |                                 | Selection of inserts  | Chip groove                         |
|                 |          |           | ↑          | ↑                   |          | ↑             |                 |           | ↓                            |                             |                                 |                       | Corner radius                       |
|                 |          |           |            |                     |          |               |                 |           |                              |                             |                                 |                       | Larger<br>↓ ↑<br>smaller            |
|                 |          | ↑         | ↑          | ↑                   | ↓        | ↓             |                 |           |                              |                             |                                 | General criteria      | Cutting material                    |
|                 |          |           | ■          | ■                   | ■        | ■             | ■               |           |                              |                             |                                 |                       | wear resistance<br>↓ ↑<br>toughness |
|                 |          |           | ■          | ■                   | ■        | ■             | ■               |           |                              |                             |                                 |                       | Clamping of tool                    |
|                 |          |           | ■          | ■                   | ■        | ■             | ■               |           |                              |                             |                                 | Clamping of workpiece |                                     |
| □               |          |           | □          | □                   |          |               | □               |           | □                            | □                           |                                 | Coolant               |                                     |

↑ Raise, increase      ↓ Avoid, reduce      ■ Check, optimize      □ Use





NL **Maatregelen bij freesproblemen**  
 FR **Problèmes de fraisage et solutions**  
 ES **Problemas de fresado y soluciones**  
 DE **Maßnahmen bei Fräsproblemen**

| Type of problem |          |           |            |                     |                |          |               |                       |                      |                                | Corrective measures                 |
|-----------------|----------|-----------|------------|---------------------|----------------|----------|---------------|-----------------------|----------------------|--------------------------------|-------------------------------------|
| Build up edge   | Notching | Cratering | Flank wear | Plastic deformation | Thermal cracks | Breakage | Edge chipping | Bad workpiece surface | Chattering vibration | Edge chipping on the workpiece |                                     |
| ↑               | ↓        | ↓         | ↓          | ↓                   | ↓              |          | ↑             | ↑                     | ■                    |                                | Cutting speed                       |
| ↑               | ↓        | ↓         | ↑          | ↓                   | ↓              | ↓        | ↓             | ↓                     | ■                    |                                | Feed rate per tooth                 |
|                 | ↑        |           |            |                     | ■              | ↑        | ↑             |                       |                      |                                | Thoughtness of cutting material     |
|                 |          | ↑         | ↑          | ↑                   |                |          |               |                       |                      |                                | Wear resistance of cutting material |
| ■               | ↓        |           |            |                     | ↓              |          |               |                       | ↓                    | ↓                              | Approach angle                      |
| ↑               | ■        |           |            | ↑                   |                | ■        | ■             |                       | ↑                    |                                | Rake angle                          |
| ■               | ↑        |           |            |                     |                |          | ↑             | ↓                     |                      | ↓                              | Cutting edge facet                  |
|                 |          |           |            |                     |                | ↑        | ↑             | ↑                     |                      |                                | Stability                           |
|                 |          |           |            |                     |                |          |               | ↑                     | ↑                    |                                | Precision of axial & radial run-out |
|                 |          |           | ■          | ■                   |                | ■        | ■             |                       |                      | ■                              | Wear of cutting edge                |
| ↑               | ↑        | ↑         |            | ■                   | ↑              |          |               | ■                     |                      |                                | Cooling, chipremoval                |
|                 | ■        |           |            |                     |                | ■        | ■             | ■                     | ■                    | ↓                              | Dept of cut                         |

↑ Raise, increase

↓ Lower, decrease

■ Check, optimize