URMA

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SWISS QUALITY

# URMA Technology & Inserts

# Placas URMA

URMA Inserts

| | Order Number | | r | $a_p$ mm | Gama aplicación ISO [1] / ISO Application Range [1] P | M | K | N | S | H | Condiciones de corte / Cutting Condition: facil / easy | medio / medium | dificil / difficult | Typ F | M | R | E [2] ≥ 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | CCGT 060201-FX | UT150 | 0.1 | 0.05 - 0.2 | ▲ | ■ | | | | | ▲ | | | ▲ | | | ▲ |
| | CCGT 060202-FX | UT150 | 0.2 | 0.05 - 0.2 | ▲ | ■ | | | | | ▲ | | | ▲ | | | ▲ |
| | CCGT 060202-FX | UT200 | 0.2 | 0.05 - 0.2 | ▲ | ■ | | | | | ▲ | | | ▲ | □ | | ▲ |
| | CCGT 060202-FX | UC360 | 0.2 | 0.05 - 0.2 | ▲ | ▲ | ■ | | | | ▲ | ▲ | ▲ | ▲ | ■ | | ▲ |
| | CCGT 060204-FX | UT150 | 0.4 | 0.1 - 0.4 | ▲ | ■ | | | | | ▲ | | | ▲ | | | □ |
| | CCGT 060204-FX | UT200 | 0.4 | 0.1 - 0.4 | ▲ | ■ | | | | | ▲ | | | ▲ | □ | | □ |
| | CCGT 060204-FX | UC360 | 0.4 | 0.1 - 0.5 | ▲ | ▲ | ■ | | | | ▲ | ▲ | ▲ | ▲ | ■ | | ▲ |
| | CCGT 09T302-FX | UT150 | 0.2 | 0.05 - 0.2 | ▲ | ▲ | | | | | ▲ | | | ▲ | | | ▲ |
| | CCGT 09T304-FX | UC360 | 0.4 | 0.1 - 0.4 | ▲ | ▲ | ■ | | | | ▲ | ▲ | ▲ | ▲ | ■ | | ▲ |
| | CCGT 09T308-FX | UC360 | 0.8 | 0.1 - 0.5 | ▲ | ▲ | ■ | | | | ▲ | ▲ | ▲ | ▲ | ■ | | ▲ |
|  | CCET 060201-FY | UC105 | 0.1 | 0.05 - 0.2 | ▲ | ▲ | | ■ | | | ▲ | | | ▲ | | | ▲ |
| | CCET 060201-FY | UC320 | 0.1 | 0.05 - 0.3 | ■ | ▲ | ■ | ■ | ▲ | | ▲ | | | ▲ | | | ▲ |
| | CCET 060202-FY | UC105 | 0.2 | 0.05 - 0.2 | ▲ | ▲ | | ■ | | | ▲ | | | ▲ | | | ▲ |
| | CCET 060202-FY | UC320 | 0.2 | 0.05 - 0.3 | ■ | ▲ | ■ | ■ | ▲ | | ▲ | | | ▲ | | | ▲ |
| | CCET 060204-FY | UC105 | 0.4 | 0.05 - 0.5 | ▲ | ▲ | | ■ | | | ▲ | | | ▲ | | | ▲ |
| | CCET 060204-FY | UC320 | 0.4 | 0.05 - 0.5 | ■ | ▲ | ■ | ■ | ▲ | | ▲ | | | ▲ | | | ▲ |
| | CCET 09T302-FY | UC105 | 0.2 | 0.08 - 0.3 | ▲ | ▲ | | ■ | | | ▲ | | | ▲ | | | ▲ |
| | CCET 09T302-FY | UC320 | 0.2 | 0.08 - 0.3 | ■ | ▲ | ■ | ■ | ▲ | | ▲ | | | ▲ | | | ▲ |
| | CCET 09T304-FY | UC105 | 0.4 | 0.1 - 0.5 | ▲ | ▲ | | ■ | | | ▲ | | | ▲ | | | ▲ |
| | CCET 09T304-FY | UC320 | 0.4 | 0.1 - 0.5 | ■ | ▲ | ■ | ■ | ▲ | | ▲ | | | ▲ | | | ▲ |
|  | CCMT 060202-MFU | UT150 | 0.2 | 0.1 - 0.8 | ▲ | ■ | | | | | ▲ | | | ▲ | □ | | ▲ |
| | CCMT 060202-MFU | UC250 | 0.2 | 0.1 - 0.8 | ▲ | | ▲ | | | | ▲ | ▲ | | ▲ | ▲ | | |
| | CCMT 060204-MFU | UT150 | 0.4 | 0.1 - 1 | ▲ | ■ | | | | | ▲ | | | ▲ | | | |
| | CCMT 060204-MFU | UC250 | 0.4 | 0.1 - 1 | ▲ | | ▲ | | | | ▲ | ▲ | | ▲ | ▲ | | |
| | CCMT 09T304-MFU | UT150 | 0.4 | 0.1 - 1 | ▲ | ■ | | | | | ▲ | | | ▲ | □ | | □ |
| | CCMT 09T308-MFU | UT150 | 0.8 | 0.1 - 1 | ▲ | ■ | | | | | ▲ | | | ▲ | □ | | □ |
| | CCMT 060202-MFU | UC300 | 0.2 | 0.1 - 0.8 | ■ | ▲ | | | ▲ | | ▲ | ▲ | ▲ | ▲ | ■ | | ▲ |
| | CCMT 060204-MFU | UC300 | 0.4 | 0.1 - 1 | ■ | ▲ | | | ▲ | | ▲ | ▲ | ▲ | ▲ | ■ | | |
| | CCMT 09T304-MFU | UC300 | 0.4 | 0.1 - 1 | ■ | ▲ | | | | | ▲ | ▲ | ▲ | ▲ | ■ | | |
| | CCMT 09T308-MFU | UC300 | 0.8 | 0.1 - 1 | ■ | ▲ | | | | | ▲ | ▲ | ▲ | ▲ | ■ | | |
|  | CCMT 060204-MRU | UC250 | 0.4 | 0.4 - 2 | ▲ | | ▲ | | | | ▲ | ▲ | | ▲ | ▲ | | |
| | CCMT 060204-MRU | UC350 | 0.4 | 0.4 - 2 | ▲ | ■ | | | ■ | | | ▲ | | ▲ | ▲ | ▲ | □ |
| | CCMT 060208-MRU | UC250 | 0.8 | 0.4 - 2 | ▲ | | ▲ | | | | ▲ | ▲ | | ▲ | ▲ | | |
| | CCMT 060208-MRU | UC350 | 0.8 | 0.4 - 2 | ▲ | ■ | | | ■ | | | ▲ | | ▲ | ▲ | ▲ | □ |
| | CCMT 09T304-MRU | UC250 | 0.4 | 0.4 - 3 | ▲ | | ▲ | | | | ▲ | ▲ | | ▲ | ▲ | | |
| | CCMT 09T304-MRU | UC350 | 0.4 | 0.4 - 3 | ▲ | ■ | | | ■ | | | ▲ | | ▲ | ▲ | ▲ | □ |
| | CCMT 09T308-MRU | UC250 | 0.8 | 0.4 - 3 | ▲ | | ▲ | | | | ▲ | ▲ | | ▲ | ▲ | | |
| | CCMT 09T308-MRU | UC350 | 0.8 | 0.4 - 3 | ▲ | ■ | | | ■ | | | ▲ | | ▲ | ▲ | ▲ | □ |
| | CCMT 120408-MRU | UC250 | 0.8 | 0.4 - 3 | ▲ | | ▲ | | ■ | | ▲ | ■ | | ▲ | ■ | | |
| | CCMT 120408-MRU | UC350 | 0.8 | 0.4 - 3 | ▲ | ■ | | | ■ | | | ▲ | | ▲ | ▲ | ▲ | □ |

▲ **idónea**
■ **mejor alternativa**
□ **adecuada**

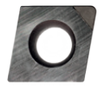
F **acabado**
M **semi desbaste**
R **desbaste**
[1] **ver página 14**
[2] **E ver página 8**

▲ most suitable
■ best alternative
□ conditionally suitable

F finishing
M semi roughing
R roughing
[1] see page 14
[2] E see page 8





| | Order Number | | r | $a_p$ mm | Gama aplicación ISO [1] / ISO Application Range [1] P | M | K | N | S | H | Condiciones de corte / Cutting Condition: facil / easy | medio / medium | dificil / difficult | F | M | R | E [2] ≥ 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | CCMT 060204-WF | UMC15 | 0.4 | 1 - 3 | ▲ | ■ | ▲ | | | | ▲ | ■ | | ■ | ▲ | □ | |
| | CCMT 060204-WF | UMT15 | 0.4 | 1 - 3 | ▲ | ■ | | | | | ▲ | □ | | ■ | ▲ | □ | |
| | CCMT 060208-WF | UMC15 | 0.8 | 1 - 3 | ▲ | ■ | ▲ | | | | ▲ | ■ | | ■ | ▲ | □ | |
| | CCMT 060208-WF | UMT15 | 0.8 | 1 - 3 | ▲ | ■ | | | | | ▲ | □ | | ■ | ▲ | □ | |
| | CCMT 09T304-WFU | UC250 | 0.4 | 0.3 - 2 | ▲ | | ▲ | | | | ▲ | ▲ | | ■ | ▲ | □ | |
| | CCMT 09T308-WFU | UC250 | 0.8 | 0.3 - 2 | ▲ | | ▲ | | | | ▲ | ▲ | ▲ | ■ | ▲ | □ | |
|  | CCMW 060202-SF | UMB10 | 0.2 | 0.1 - 0.3 | | | ▲ | | ▲ | | ▲ | ▲ | | ▲ | ■ | | □ |
| | CCMW 060202-SF | UMB20 | 0.2 | 0.03 - 0.2 | | | □ | | ■ | ▲ | ▲ | ▲ | | ▲ | □ | | □ |
| | CCMW 060202-SF | UMD01 | 0.2 | 0.1 - 0.3 | | | | ▲ | | | ▲ | | | ▲ | | | □ |
| | CCMW 060204-SF | UMB10 | 0.4 | 0.1 - 0.3 | | | ▲ | | ▲ | | ▲ | ▲ | | ▲ | ■ | | □ |
| | CCMW 060204-SF | UMB20 | 0.4 | 0.03 - 0.2 | | | □ | | ■ | ▲ | ▲ | ▲ | | ▲ | □ | | □ |
| | CCMW 060204-SF | UMD01 | 0.4 | 0.1 - 0.3 | | | | ▲ | | | ▲ | | | ▲ | | | □ |
| | CCMW 060208-SF | UMB10 | 0.8 | 0.2 - 0.4 | | | ▲ | | ▲ | | ▲ | ▲ | | ▲ | ■ | | |
| | CCMW 09T304-SF | UMB10 | 0.4 | 0.1 - 0.3 | | | ▲ | | ▲ | | ▲ | ▲ | | ▲ | ■ | | □ |
| | CCMW 09T304-SF | UMB20 | 0.4 | 0.03 - 0.2 | | | □ | | ■ | ▲ | ▲ | ▲ | | ▲ | □ | | □ |
| | CCMW 09T304-SF | UMD01 | 0.4 | 0.1 - 0.3 | | | | ▲ | | | ▲ | | | ▲ | | | □ |
| | CCMW 09T308-SF | UMB20 | 0.8 | 0.03 - 0.3 | | | □ | | ■ | ▲ | ▲ | ▲ | | ▲ | □ | | |
| | CCMW 09T308-SF | UMD01 | 0.8 | 0.2 - 1 | | | | ▲ | | | ▲ | | | ▲ | | | |
| | CCMW 060202-ST | UMB20 | 0.2 | 0.03 - 0.2 | | | □ | | ■ | ▲ | ▲ | ▲ | | ▲ | ■ | | □ |
| | CCMW 060204-ST | UMB20 | 0.4 | 0.03 - 0.2 | | | □ | | ■ | ▲ | ▲ | ▲ | | ▲ | ■ | | □ |
| | CCMW 09T302-ST | UMB20 | 0.2 | 0.03 - 0.2 | | | □ | | ■ | ▲ | ▲ | ▲ | | ▲ | ■ | | □ |
| | CCMW 09T308-ST | UMB20 | 0.8 | 0.03 - 0.3 | | | □ | | ■ | ▲ | ▲ | ▲ | | ▲ | ■ | | |
|  | CCGT 060202-ALU | UW100 | 0.2 | 0.2 - 2 | | | □ | ▲ | □ | | ▲ | ■ | | ▲ | ■ | | ▲ |
| | CCGT 060204-ALU | UW100 | 0.4 | 0.2 - 2 | | | □ | ▲ | □ | | ▲ | ■ | | ▲ | ▲ | | □ |
| | CCGT 09T302-ALU | UW100 | 0.2 | 0.4 - 3 | | | □ | ▲ | □ | | ▲ | ■ | | ▲ | ■ | | ▲ |
| | CCGT 09T304-ALU | UW100 | 0.4 | 0.4 - 3 | | | □ | ▲ | □ | | ▲ | ■ | | ▲ | ▲ | | □ |
| | CCGT 09T308-ALU | UW100 | 0.8 | 0.4 - 3 | | | □ | ▲ | □ | | ▲ | ■ | | ▲ | ▲ | | |
|  | CNMG 120404-MRG | UC250 | 0.4 | 0.5 - 2 | ▲ | | ▲ | | | | ▲ | ▲ | ■ | ■ | ▲ | ■ | □ |
| | CNMG 120408-MRG | UC250 | 0.8 | 0.5 - 2 | ▲ | | ▲ | | | | ▲ | ▲ | ■ | ■ | ▲ | ■ | |
| | CNMG 120404-MRG | UC300 | 0.4 | 0.5 - 2 | ▲ | ▲ | | | □ | | | ▲ | ■ | ■ | ▲ | ■ | □ |
| | CNMG 120408-MRG | UC300 | 0.8 | 0.5 - 2 | ▲ | ▲ | | | □ | | | ▲ | ■ | ■ | ▲ | ■ | |
|  | CNMG 120408-RRG | UC100 | 0.8 | 1 - 5 | | | ▲ | | | | ■ | ▲ | | | ▲ | ■ | |
| | CNMG 120412-RRG | UC100 | 1.2 | 1 - 5 | | | ▲ | | | | ■ | ▲ | | | ▲ | ■ | |
| | CNMG 160612-RRG | UC350 | 1.2 | 1 - 6 | ▲ | ■ | | | □ | | ▲ | ▲ | | ▲ | ■ | | |
| | CNMG 160612-RRG | UC100 | 1.2 | 1 - 6 | | | ▲ | | | | ■ | ▲ | | | ▲ | ■ | |
|  | CNMM 120408-RRU | UC350 | 0.8 | 2 - 5 | ▲ | ■ | | | □ | | | ■ | ▲ | | ■ | ▲ | |
| | CNMM 120412-RRU | UC350 | 1.2 | 2 - 5 | ▲ | ■ | | | □ | | | ■ | ▲ | | ■ | ▲ | |
| | | | | | ▲ | ■ | | | □ | | ■ | ▲ | ▲ | | ■ | ▲ | |
| | CNMM 160612-RRU | UC350 | 1.2 | 3 - 7 | ▲ | ■ | | | □ | | | ■ | ▲ | | ■ | ▲ | |
| | CNMM 160616-RRU | UC350 | 1.6 | 3 - 7 | ▲ | ■ | | | □ | | | ■ | ▲ | | ■ | ▲ | |

▲ **idónea**
■ **mejor alternativa**
□ **adecuada**

F **acabado**
M **semi desbaste**
R **desbaste**
[1] **ver página 14**
[2] **E ver página 8**

▲ most suitable
■ best alternative
□ conditionally suitable

F finishing
M semi roughing
R roughing
[1] see page 14
[2] E see page 8

| | Order Number | | r | $a_p$ mm | Gama aplicación ISO [1] / ISO Application Range [1] P | M | K | N | S | H | Condiciones de corte / Cutting Condition: facil / easy | medio / medium | dificil / difficult | F | M | R | E [2] ≥ 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | CPGT 060201-FX | UT150 | 0.1 | 0.05 - 0.2 | ▲ | ■ | | | | | ▲ | | | ▲ | | | ▲ |
| | CPGT 060201-FX | UT200 | 0.1 | 0.05 - 0.2 | | | | | | | ▲ | | | ▲ | | | ▲ |
| | CPGT 060201-FX | UC360 | 0.1 | 0.05 - 0.2 | ▲ | ▲ | ■ | | | | ▲ | ▲ | ▲ | ▲ | ■ | | ▲ |
| | CPGT 060202-FX | UT150 | 0.2 | 0.05 - 0.2 | ▲ | ■ | | | | | ▲ | | | ▲ | | | ▲ |
| | CPGT 060202-FX | UT200 | 0.2 | 0.05 - 0.2 | ▲ | ■ | ■ | | | | ▲ | | | ▲ | | | ▲ |
| | CPGT 060202-FX | UC360 | 0.2 | 0.05 - 0.2 | ▲ | ▲ | ■ | | | | ▲ | ▲ | ▲ | ▲ | ■ | | ▲ |
| | CPGT 060204-FX | UT150 | 0.4 | 0.1 - 0.4 | ▲ | ■ | | | | | ▲ | | | ▲ | | | ▲ |
| | CPGT 060204-FX | UC360 | 0.4 | 0.1 - 0.4 | ▲ | ▲ | ■ | | | | ▲ | ▲ | ▲ | ▲ | ■ | | ▲ |
|  | CPMW 060202-SF | UMB10 | 0.2 | 0.1 - 0.3 | | | ▲ | | ▲ | | ▲ | ▲ | | ▲ | □ | | □ |
| | CPMW 060202-SF | UMB20 | 0.2 | 0.1 - 0.3 | | | □ | | ■ | ▲ | ▲ | ▲ | | ▲ | | | □ |
| | CPMW 060202-SF | UMD01 | 0.2 | 0.1 - 0.3 | | | | ▲ | | | ▲ | | | ▲ | | | □ |
| | CPMW 060204-SF | UMB10 | 0.4 | 0.03 - 0.2 | | | ▲ | | ▲ | | ▲ | | | ▲ | □ | | □ |
| | CPMW 060204-SF | UMB20 | 0.4 | 0.03 - 0.2 | | | □ | | ■ | ▲ | ▲ | ▲ | | ▲ | | | □ |
| | CPMW 060204-SF | UMD01 | 0.4 | 0.1 - 0.3 | | | | ▲ | | | ▲ | | | ▲ | | | □ |
|  | DCMT 070204-MFU | UC250 | 0.4 | 0.1 - 0.8 | ▲ | | ■ | | | | ■ | ▲ | ▲ | | ■ | ▲ | |
| | DCMT 11T304-MFU | UC250 | 0.4 | 0.1 - 0.8 | ▲ | ■ | ■ | ■ | ■ | | ■ | ▲ | ▲ | | ■ | ▲ | |
|  | SCMT 060204-MR | UMC35 | 0.4 | 1 - 3 | ▲ | ■ | ■ | ■ | ■ | | ■ | ▲ | ▲ | | ■ | ▲ | |
| | SCMT 09T304-MR | UMC35 | 0.4 | 1 - 3.5 | ▲ | ■ | ■ | ■ | ■ | | ■ | ▲ | ▲ | | ■ | ▲ | |
|  | WCGT 020102-FX | UC500 | 0.2 | 0.05 - 0.2 | | ▲ | ■ | | ▲ | | ▲ | □ | | ▲ | | | ▲ |
| | WCGT 020104-FX | UC500 | 0.4 | 0.05 - 0.2 | | ▲ | ■ | | ▲ | | ▲ | □ | | ▲ | □ | | □ |
|  | WCGT 020102-FY | UT150 | 0.2 | 0.05 - 0.2 | ▲ | ■ | | | | | ▲ | □ | | ▲ | | | ▲ |
| | WCGT 020104-FY | UT150 | 0.4 | 0.05 - 0.2 | ▲ | ■ | | | | | ▲ | □ | | ▲ | □ | | □ |
|  | WCGW 020102-SF | UMD01 | 0.2 | 0.1 - 0.3 | | | | ▲ | | | ▲ | | | ▲ | | | □ |
| | WCGW 020102-SF | UMB20 | 0.2 | 0.02 - 0.3 | | | □ | | ■ | ▲ | ▲ | ■ | | ▲ | □ | | □ |
| | WCGW 020104-SF | UMB20 | 0.4 | 0.03 - 0.15 | | | □ | | ■ | ▲ | ▲ | ▲ | | ▲ | □ | | □ |

▲ **idónea**
■ **mejor alternativa**
□ **adecuada**

**F acabado**
**M semi desbaste**
**R desbaste**
[1] **ver página 14**
[2] **E ver página 8**

▲ most suitable
■ best alternative
□ conditionally suitable

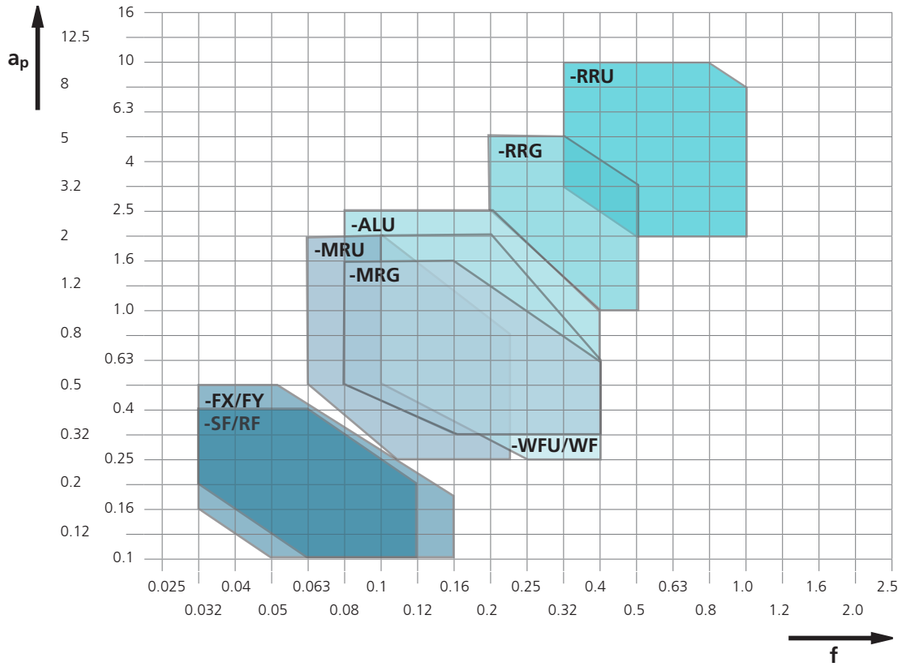
F finishing
M semi roughing
R roughing
[1] see page 14
[2] E see page 8





## Geometrías de corte

Chipbreaker Styles



**Gama de aplicación para geometrías de corte URMA**
Application Range for URMA Chipbreaker Styles

La gama de aplicación tambien depende del tamaño de la placa. Ver los valores recomendaciones en la columna $a_p$ de las páginas 2 y 4.

The application range also depends on the insert size. Guideline values see column $a_p$ on pages 2 and 4.

| **Radio del filo** | | **N6** | **N7** | **N8** | **N9** | **N10** | **N11** |
|---|---|---|---|---|---|---|---|
| Nose radius | $R_a$ | 0.4 - 0.8 | 0.8 - 1.6 | 1.6 - 3.2 | 3.2 - 6.3 | 6.3 - 12.5 | 12.5 - 25 |
| | $R_z$ | 2.2 - 4.0 | 4.0 - 8.4 | 8.4 - 15 | 15 - 24 | 24 - 49 | 49 - 80 |
| **r** | | f | | | | | |
| **0.1** | | 0.04 | 0.05 | 0.07 | 0.10 | 0.12 | 0.18 |
| **0.2** | | 0.05 | 0.07 | 0.10 | 0.14 | 0.18 | 0.47 |
| **0.4** | | 0.07 | 0.09 | 0.15 | 0.22 | 0.25 | 0.36 |
| **0.8** | | 0.10 | 0.17 | 0.22 | 0.27 | 0.35 | 0.51 |
| **1.2** | | 0.12 | 0.17 | 0.25 | 0.34 | 0.43 | 0.62 |

**Los valores de las recomendaciones para conseguir un acabado superficial definido**
Guideline Values to Achieve a Defined Surface Quality

Los datos del avance deben ser los de la zona gris. Para geometrias Wiper esta permitido doblar el avance consiguiendo el mismo acabado superficial.

Feed rates must remain within the gray area. The feed rate of wiper geometries can be doubled and still achieve the same surface quality.





## Descripción calidades
Grade Description

| **URMA** | **ISO AISI** | | | **Tipo de recubrimiento** Type of Coating | **µ mm** | **P** | | | **M** | | | **K** | | | **N** | | | **S** | | | **H** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **10 C7** | **25 C6** | **40 C5** | **10** | **25** | **40** | **10 C3** | **25 C2** | **40 C1** | **10 C3** | **25 C2** | **40 C1** | **10** | **25** | **40** | **10** | **25** | **40** |
| **UW100** | HW-K10 C3 | | | - | | | | | | | | | | | | | | | | | | | |
| **UC100** | HC-P10 C7 | HC-K10 C3 | | TiCN Al2O3 CVD | 18 | | | | | | | | | | | | | | | | | | |
| **UC105** | HC-P10 C7 | HC-M10 | HC-N10 | TiN PVD | 1 | | | | | | | | | | | | | | | | | | |
| **UMC15** | HC-P15 C7 | | | TiCN Al2O3 CVD | 10 - 12 | | | | | | | | | | | | | | | | | | |
| **UC250** | HC-P25 C6 | HC-M25 | HC-K20 C2 | TiCN Al2O3 CVD | 14 | | | | | | | | | | | | | | | | | | |
| **UC300** | HC-P30 C6 | HC-M30 | | TiCN-TiN Al2O3 CVD | 5 | | | | | | | | | | | | | | | | | | |
| **UC320** | HC-P25 C6 | HC-M20 | HC-S20 | TiAlN-AlCrN PVD | 3 | | | | | | | | | | | | | | | | | | |
| **UC350** | HC-P35 C5 | HC-M35 | | TiCN-TiN Al2O3 CVD | 8 | | | | | | | | | | | | | | | | | | |
| **UMC35** | HC-P35 C5 | | | TiCN Al2O3 CVD | 10 - 12 | | | | | | | | | | | | | | | | | | |
| **UC360** | HC-P35 C5 | HC-M30 | | TiAlN-AlCrN PVD | 3 | | | | | | | | | | | | | | | | | | |
| **UC500** | HC-P15 C7 | HC-M20 | HC-K20 C2 | TiAlN-AlCrN PVD | 3 | | | | | | | | | | | | | | | | | | |
| **UMT15** | HT-P15 C7 | HT-M10 | | - | | | | | | | | | | | | | | | | | | | |
| **UT150** | HT-P15 C7 | HT-M10 | HT-K10 C3 | - | | | | | | | | | | | | | | | | | | | |
| **UT200** | HT-P15 C7 | HT-M10 | HT-K10 C3 | TiAlN PVD | 3 | | | | | | | | | | | | | | | | | | |
| **UMB10** | BN-H05 (C4) | | | - | | | | | | | | | | | | | | | | | | | |
| **UMB20** | BN-H10 (C4) | | | - | | | | | | | | | | | | | | | | | | | |
| **UMD01** | DP-N05 (C4) | | | - | | | | | | | | | | | | | | | | | | | |

**HW Metal duro sin recubrimiento**
**HC Metal duro con recubrimiento**
HW uncoated carbide
HC coated carbide

**HT Cermet**
HT cermet

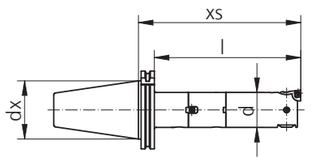
**BN CBN**
**PD PKD**
BN CBN
DP PCD

**Gama de aplicación principal**
**Gama de aplicación alternativa**
main application range
alternative application range

## Ratio E

Ratio E

**El ratio E es el valor obtenido de la longitud de la barra de mandrinar en relación a su diámetro**
Ratio E is a number obtained form the length of the boring bar and its diameter

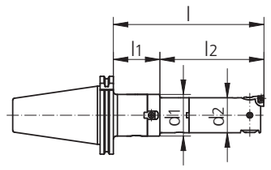



**Con diámetro constante ø d**
with constant d

$$E = \frac{l}{d}$$

**Importante:** **si** $d_x \leq d$ **entonces** $E = \frac{xs}{d_x}$
Important: if then

( ISO 40 : $d_x = 44{,}45$
ISO 50 : $d_x = 69{,}85$ )




**Con ø $d_1$ y ø $d_2$ combinados:**
with combined $d_1$ and $d_2$

$$E = \frac{l}{d} \qquad d = \frac{d_1 + d_2}{2}$$

**Para calcular E, el diámetro lo calculamos con la media de $l_1$ y $l_2$**
to calculate E, the mean diameter d is calculated with approximately $l_1$ and $l_2$

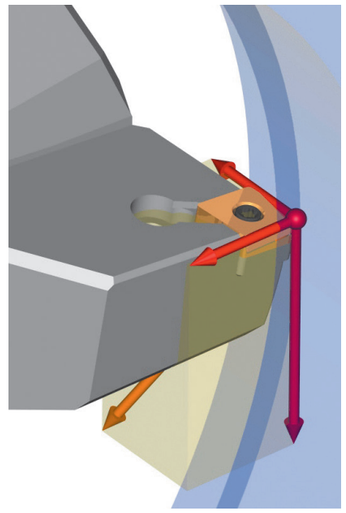




## Definiciones y fórmulas básicas

Definitions and Basic Formula

| | Descripción | Designation | |
|---|---|---|---|
| $a_p$ | Profundidad de corte | depth of cut | mm |
| n | Revoluciones | speed | $min^{-1}$ |
| d | Diámetro del agujero | bore diameter | mm |
| $v_c$ | Velocidad de corte | cutting speed | m/min |
| $v_f$ | Velocidad avance | feed rate | mm/min |
| f | Avance por revolución | feed per revolution | mm |
| $f_z$ | Avance por diente | feed per cutter | mm |
| z | Número de dientes | number of cutters | |
| $k_c$ | Fuerzas de corte especificas | specific cutting force | $N/mm^2$ |
| $F_c$ | Fuerzas de corte | cutting force | N |
| $F_f$ | Fuerza de avance | feed force | N |
| $F_p$ | Fuerza pasiva | passive force | |
| r | Radio de la placa | apex radius of the cutter apex | mm |
| $l_f$ | Distancia de avance | feed distance | mm |
| $M_d$ | Par | torque | Nm |
| $P_c$ | Unidad de potencia requerida | required drive power | kW |
| $R_a$ | Valor aritmético de la rugosidad | arithmetic centre line average value | µm |
| $R_t$ | Altura máxima de "pico a valle" | peak-to-valley height | µm |
| $R_z$ | Media de la altura de "pico a valle" | average peak-to-valley height | µm |
| $R_m$ | Resistencia a la tracción | tensile strength | $N/mm^2$ |
| $t_c$ | Tiempo de corte por pieza | cutting time per workpiece | min |
| T | Vida de herramienta | tool life | min |
| $\gamma$ | Ángulo de corte | cutting angle | ° |
| $\varepsilon$ | Ángulo del vertice | apex angle | ° |
| $\eta$ | Eficacia | efficiency | - |



**Velocidad de corte**
Cutting Speed

$$v_c = \frac{\pi \cdot d \cdot n}{1000}$$

**Velocidad**
Speed

$$n = \frac{v_c \cdot 1000}{\pi \cdot d}$$

**Avance/min**
Feed/min

$$v_f = f \cdot n$$
$$v_f = f_z \cdot z \cdot n$$

**Unidad de pot. req.**
Required Power

$$P_c = \frac{a_p \cdot f_z \cdot k_c \cdot v_c \cdot z}{60 \cdot 10^3 \cdot \eta}$$

**Fuerzas de corte (por placa)**
Cutting Force (per Cutter)

$$F_c = a_p \cdot f_z \cdot k_c$$

**Par**
Torque

$$M_d = \frac{(D^2 - d^2) \cdot f \cdot k_c}{8 \cdot 10^3}$$

**Volumen viruta**
Cutting Volume

$$V = v_c \cdot f \cdot a_p$$

**Tiempo de mecanizado**
Machining Time

$$t_c = \frac{l_f}{f \cdot n}$$

## Requisitos de potencia

Power Requirement

### Valores para calcular la potencia requerida

$k_c$ Values for Calculating the Power Requirement

| UC | DIN | Number | Rm N/mm² | HB | Fuerzas de corte especificas $k_c$ (N/mm²), avance $f_z$ Specific cutting force $k_c$ (N/mm²) for a feed rate $f_z$ 0.1 | 0.2 | 0.25 | 0.4 | 0.5 | 0.63 | 0.8 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | RSt-37 | 1.0038 | > 500 | 160 | 2230 | 1840 | 1740 | 1540 | 1450 | 1360 | 1280 |
| 1 | St50-2 | 1.0050 | 520 | 170 | 2540 | 2090 | 1970 | 1740 | 1650 | 1550 | 1460 |
| 2 | St60-2 | 1.0060 | 620 | 180 | 2570 | 2140 | 2010 | 1780 | 1680 | 1580 | 1490 |
| 2 | Ck 45 | 1.1191 | 670 | 180 | 2430 | 2040 | 1900 | 1660 | 1550 | 1440 | 1340 |
| 3 | 16 MnCr 5 | 1.7131 | 550 | 170 | 2460 | 2060 | 1930 | 1670 | 1560 | 1460 | 1360 |
| 3 | 42 CrMo 4 | 1.7225 | 730 | 240 | 2400 | 2030 | 1910 | 1670 | 1590 | 1500 | 1410 |
| 3 | 34 CrNiMo V6 | 1.6582 | 1010 | 280 | 2350 | 1990 | 1870 | 1630 | 1530 | 1430 | 1330 |
| 3 | 50 Cr V4 | 1.8159 | 1050 | 210 | 2450 | 2050 | 1930 | 1690 | 1590 | 1490 | 1390 |
| 4 | 100 Cr 6 | 1.2067 | | 55 HRC | 5060 | 3760 | 3670 | 3510 | 3430 | 3350 | 3270 |
| 5 | X 5 CrNi 18 9 | 1.4301 | 640 | 150 | 3410 | 2350 | 2260 | 2080 | 1980 | 1900 | 1820 |
| 6 | GG 15 | 0.6015 | | 150 | 1450 | 1330 | 1270 | 1150 | 1100 | 1050 | 1000 |
| 6 | GG 20 | 0.6020 | | 180 | 1890 | 1530 | 1440 | 1280 | 1210 | 1150 | 1080 |
| 6 | GGG 50 | 0.7050 | | 195 | 2180 | 1710 | 1600 | 1390 | 1290 | 1210 | 1130 |
| 7 | Al Mg Si 0.5 F22 | 3.3206.71 | 260 | 90 | 780 | 680 | 650 | 590 | 570 | 540 | 520 |

Los valores son aplicables cuando la geometria del rompevirutas es adecuada para el material utilizado.

The values are applicable when the chip-breaker style geometry is suitable for the particular material is used.

**Ejemplo**

| | |
|---|---|
| **Ø del agujero** | **39 mm** |
| **Material** | **Ck 45 (1.1191)** |
| **$a_p$** | **3 mm** |
| **f** | **0,4 mm/U (0,2 mm/placa)** |
| **$v_c$** | **170 m/min** |
| **z** | **2** |

**Example**

| | |
|---|---|
| Bore Diameter Ø | 39 mm |
| Material | Ck 45 (1.1191) |
| $a_p$ | 3 mm |
| f | 0,4 mm/U (0,2 mm/cutter) |
| $v_c$ | 170 m/min |
| z | 2 |

Para $k_c$ la tabla muestra el valor 2040 N/mm² en el avance (el cual corresponde al avance en el ángulo de contacto de 90°) a 0,2 mm. El valor para la velocidad de corte, avance y profundidad de corte, se tomaron de la tabla de las pautas. La eficacia total del mecanizado se asume que debe ser 0,8.

For kc, the table shows the value 2040 N/mm² at a feed rate (which corresponds to the feed at a contact angle of 90°) of 0,2 mm. The values for cutting speed, feed and depth of cut were taken from the table of guide values. The total efficiency of the machine is assumed to be 0,8.

### Desbaste desplazado "Offset"

Offset Roughing

$$P_c = \frac{a_p \cdot f \cdot v_c \cdot k_c}{60 \cdot 10^3 \cdot \eta}$$

### Desbaste con doble cabezal de corte

Rough Machining with Double Cutter Head

$$P_c = \frac{a_p \cdot f_z \cdot v_c \cdot k_c \cdot z}{60 \cdot 10^3 \cdot \eta} \quad P_c = \frac{3 \cdot 0{,}2 \cdot 2040 \cdot 170 \cdot 2}{60 \cdot 10^3 \cdot 0{,}8} \quad P_c = 8.7 \text{ kW}$$





## Datos de corte recomendados para RFP

Cutting Data Recommendation for RFP


| Material | UC | Ø | Wiper 1) 2) | F \| Order Number | R \| Order Number | $a_p$ (F) mm | $a_p$ (R) mm | $v_c$ m/min | Ra = 0,8 - 1,4 f = $f_z$ 1) mm/rev |
|---|---|---|---|---|---|---|---|---|---|
| **Acero al carbono** Carbon Steel | 2 | 49 - 88 | ■ | CCMT 060204-WF UMC15 | CCMT 09T304-MRU UC250 | 0,1 - 0,5 | 1-2 | 200 - 300 | 0,20 |
| | | | | CCMT 060208-MRU UC250 | CCMT 09T304-MRU UC250 | 0,1 - 0,5 | 1-2 | 200 - 300 | 0,12 |
| | | 87 - 297 | ■ | CCMT 060204-WF UMC15 | CNMG 120404-MRG UC250 | 0,1 - 0,5 | 1-2,5 | 200 - 300 | 0,20 |
| | | | | CCMT 060208-MRU UC250 | CNMG 120404-MRG UC250 | 0,1 - 0,5 | 1-2,5 | 200 - 300 | 0,15 |
| | | 105 - 2'400 | ■ | CCMT 09T308-WFU UC250 | CNMG 120404-MRG UC250 | 0,1 - 0,5 | 1-2,5 | 200 - 300 | 0,20 |
| | | | | CCMT 09T308-MRU UC250 | CNMG 120404-MRG UC250 | 0,1 - 0,5 | 1-2,5 | 200 - 300 | 0,15 |
| **Acero de herramientas** Tool Steel | 3 | 49 - 88 | ■ | CCMT 060204-WF UMC15 | CCMT 09T304-MRU UC250 | 0,1 - 0,5 | 1-2 | 140 - 250 | 0,20 |
| | | | | CCMT 060208-MRU UC250 | CCMT 09T304-MRU UC250 | 0,1 - 0,5 | 1-2 | 140 - 250 | 0,12 |
| | | 87 - 297 | ■ | CCMT 060204-WF UMC15 | CNMG 120404-MRG UC250 | 0,1 - 0,5 | 1-2 | 140 - 250 | 0,20 |
| | | | | CCMT 060208-MRU UC250 | CNMG 120404-MRG UC250 | 0,1 - 0,5 | 1-2 | 140 - 250 | 0,15 |
| | | 105 - 2'400 | ■ | CCMT 09T308-WFU UC250 | CNMG 120404-MRG UC250 | 0,1 - 0,5 | 1-2,5 | 140 - 250 | 0,24 |
| | | | | CCMT 09T308-MRU UC250 | CNMG 120404-MRG UC250 | 0,1 - 0,5 | 1-2,5 | 140 - 250 | 0,15 |
| **Acero inoxidable** Stainless Steel | 5 | 49 - 88 | | CCMT 060208-MFU UC300 | CCMT 09T304-MRU UC350 | 0,1 - 0,5 | 1-2 | 80 - 200 | 0,12 |
| | | | ■ | CCMT 060204-WF UMC15 | CCMT 09T304-MRU UC350 | 0,1 - 0,5 | 1-2 | 80 - 200 | 0,20 |
| | | 87 - 297 | | CCMT 060208-MFU UC300 | CNMG 120404-MRG UC300 | 0,1 - 0,5 | 1-2.5 | 80 - 200 | 0,15 |
| | | | ■ | CCMT 060204-WF UMC15 | CNMG 120404-MRG UC300 | 0,1 - 0,5 | 1-2.5 | 80 - 200 | 0,20 |
| | | 105 - 2'400 | | CCMT 09T308-MFU UC300 | CNMG 120404-MRG UC300 | 0,1 - 0,5 | 1-2.5 | 80 - 200 | 0,15 |
| **Fundición** Cast Iron | 6 | 49 - 88 | ■ | CCMT 060208-WF UMC15 | CCMT 09T304-MRU UC250 | 0,1 - 0,5 | 1-2,5 | 150 - 250 | 0,24 |
| | | | | CCMT 060208-MRU UC250 | CCMT 09T304-MRU UC250 | 0,1 - 0,5 | 1-2,5 | 150 - 250 | 0,12 |
| | | 87 - 297 | ■ | CCMT 060208-WF UMC15 | CNMG 120408-MRG UC250 | 0,1 - 0,8 | 1-3 | 150 - 250 | 0,24 |
| | | | | CCMT 060208-MRU UC250 | CNMG 120408-MRG UC250 | 0,1 - 0,8 | 1-3 | 150 - 250 | 0,15 |
| | | 150 - 2'400 | ■ | CCMT 09T308-WFU UC250 | CNMG 120408-MRG UC250 | 0,1 - 0,5 | 1-3 | 150 - 250 | 0,24 |
| | | | | CCMT 09T308-MRU UC250 | CNMG 120408-MRG UC250 | 0,1 - 0,5 | 1-3 | 150 - 250 | 0,15 |
| **Aluminio** Aluminium | 7 | 49 - 88 | | CCGT 0602004-ALU UW100 | CCGT 09T304-ALU UW100 | 0,1 - 0,5 | 1-2,5 | 250 - 600 | 0,12 |
| | | 87 - 297 | | CCGT 0602004-ALU UW100 | CNMG 120408-MRG UC250 | 0,1 - 0,8 | 1-3,5 | 250 - 600 | 0,15 |
| | | 105 - 2'400** | | CCMT 09T308-ALU UW100 | CNMG 120408-MRG UC250 | 0,1 - 0,5 | 1-3,5 | 250 - 600 | 0,15 |

** **a pedido**
on request

**1) Descripción wiper página 49***
**2) usar porta placas WW20... para Wiper placas página 55***
**R Placa desbaste**
**F Placa de acabado**
**UC Codigo material URMA**

1) description Wiper page 49*
2) use insertholders WW20… for Wiper inserts page 55*
R roughing insert
F finishing insert
UC URMA material code

### Notas

- Porta placas y cabezales de acabado (ver página 54 / 55*)
- El sistema RFP es tambien adecuado para el sistema MegaMax (ver página 69* y las siguientes)
- El proceso RFP puede mostrar resultados pobres en condiciones de mecanizado desfavorables, en longitudes/diámetros extremos
- Las porta placas de los cabezales de acabado son ajustables en longitud (ver página 55*)
- RFP es también adecuado para mecanizado OD (ver página 63*)

### Notes

- Insert holders and fine boring heads on page 54 / 55*
- RFP is also suitable for the MegaMax system (from page 69*)
- RFP process can show poor results under unstable working conditions, under extreme length/diameter ratio tool setups and cutting interruptions
- Fine boring insert holders are length adjustable (see page 55*)
- RFP is also suitable for OD machining (see page 63*)

* **ver «URMA Systems»**
see «URMA Systems»

## Condiciones de corte recomendadas para acabado (con cabezales de acabado)

Recommended Cutting Data for Finishing (with Fine Boring Heads)

| UC | Ø 0.3 - 6 mm<br>1. Elección 1. Choice<br>2. Elección 2. Choice | $a_{p\,max}$ mm | $v_c$ m/min | $f_z$ mm | Ø 5.8 - 11 mm<br>1. Elección 1. Choice<br>2. Elección 2. Choice | $a_{p\,max}$ mm | $v_c$ m/min E ≤ 8 | E ≤ 4 | $f_z$ mm | Ø 8.8 - 22.5 mm<br>1. Elección 1. Choice<br>2. Elección 2. Choice | $a_{p\,max}$ mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | R/L105.18xxxx MG12 | 0.05 | 14 - 100 | 0.01 - 0.02 | WCGT 020102-FY UT150 | 0.2 | 70 | 250 | 0.05 - 0.1 | CPGT 060202-FX UT150 | 0.2 |
| | R/L105.18xxxx TN35 | 0.05 | 14 - 180 | 0.01 - 0.02 | WCGW 020102-FX UC500 | 0.2 | 60 | 200 | 0.05 - 0.1 | CPGT 060202-FX UT200 | 0.2 |
| 2 | R/L105.18xxxx MG12 | 0.05 | 16 - 90 | 0.01 - 0.02 | WCGT 020102-FY UT150 | 0.2 | 70 | 250 | 0.05 - 0.1 | CPGT 060202-FX UT150 | 0.2 |
| | R/L105.18xxxx TN35 | 0.05 | 16 - 150 | 0.01 - 0.02 | WCGT 020102-FX UC500 | 0.2 | 60 | 200 | 0.05 - 0.1 | CPGT 060202-FX UT200 | 0.2 |
| 3 | R/L105.18xxxx MG12 | 0.05 | 16 - 90 | 0.01 - 0.02 | WCGT 020102-FY UT150 | 0.2 | 70 | 250 | 0.05 - 0.1 | CPGT 060202-FX UT150 | 0.2 |
| | R/L105.18xxxx TN35 | 0.05 | 16 - 90 | 0.01 - 0.02 | WCGT 020102-FX UC500 | 0.2 | 60 | 200 | 0.05 - 0.1 | CPGT 060202-FX UT200 | 0.2 |
| 3.1 | R/L105.18xxxx TI25 | 0.05 | 19 - 90 | 0.01 - 0.02 | WCGT 020102-FY UT150 | 0.2 | 70 | 200 | 0.05 - 0.1 | CPGT 060202-FX UT150 | 0.2 |
| | R/L105.18xxxx TN35 | 0.05 | 19 - 90 | 0.01 - 0.02 | WCGT 020102-FX UC500 | 0.2 | 60 | 150 | 0.05 - 0.1 | CPGT 060202-FX UT200 | 0.2 |
| 3.2 | R/L105.18xxxx TI25 | 0.05 | 19 - 90 | 0.01 - 0.02 | WCGT 020102-FY UT150 | 0.2 | 60 | 150 | 0.05 - 0.1 | CPGT 060202-FX UT150 | 0.2 |
| | R/L105.18xxxx TN35 | 0.05 | 19 - 90 | 0.01 - 0.02 | WCGT 020102-FX UC500 | 0.2 | 50 | 120 | 0.05 - 0.1 | CPGT 060202-FX UT200 | 0.2 |
| 3.2 | R/L105.18xxxx TI25 | 0.05 | 19 - 90 | 0.01 - 0.02 | WCGT 020102-FY UT150 | 0.2 | 60 | 150 | 0.05 - 0.1 | CPGT 060202-FX UT150 | 0.2 |
| | R/L105.18xxxx TN35 | 0.05 | 19 - 90 | 0.01 - 0.02 | WCGT 020102-FX UC500 | | 50 | 120 | | CPGT 060202-FX UT200 | 0.2 |
| 4 | | | | | WCGW 020102-SF UMB20 | 0.1 | - | 60-140 | 0.04 - 0.09 | CPMW 060202-SF UMB20 | 0.15 |
| 5 | R/L105.18xxxx TI25 | 0.05 | 19 - 90 | 0.01 - 0.02 | WCGT 020102-FY UT150 | 0.2 | 70 | 200 | 0.03 - 0.1 | CPGT 060202-FX UC360 | 0.2 |
| | R/L105.18xxxx TN35 | 0.05 | 19 - 90 | 0.01 - 0.02 | WCGT 020102-FX UC500 | 0.2 | 70 | 180 | 0.05 - 0.1 | CPGT 060202-FX UT150 | 0.2 |
| 5.1 | R/L105.18xxxx TN35 | 0.05 | 16 - 80 | 0.01 - 0.02 | WCGT 020102-FY UT150 | 0.2 | 70 | 180 | 0.03 - 0.1 | CPGT 060202-FX UC360 | 0.2 |
| | | | | | WCGT 020102-FX UC500 | 0.2 | 60 | 150 | 0.05 - 0.1 | CPGT 060202-FX UT150 | 0.2 |
| 5.2 | R/L105.18xxxx TN35 | 0.05 | 14 - 70 | 0.01 - 0.02 | WCGT 020102-FY UT150 | 0.2 | 70 | 120 | 0.03 - 0.1 | CPGT 060202-FX UC360 | 0.2 |
| | | | | | WCGT 020102-FX UC500 | 0.2 | 70 | 100 | 0.05 - 0.1 | CPGT 060202-FX UT150 | 0.2 |
| 6 | R/L105.18xxxx MG12 | 0.05 | 16 - 90 | 0.01 - 0.02 | WCGW 020102-SF UMB20 | 0.2 | 70 | 300 | 0.05 - 0.1 | CPMW 060202-SF UMB10 | 0.2 |
| | R/L105.18xxxx TN35 | 0.05 | 16 - 150 | 0.01 - 0.02 | WCGT 020102-FX UC500 | 0.2 | 60 | 120 | 0.03 - 0.1 | CPGT 060202-FX UT200 | 0.2 |
| 6.1 | R/L105.18xxxx MG12 | 0.05 | 16 - 90 | 0.01 - 0.02 | WCGW 020102-SF UMB20 | 0.2 | 70 | 300 | 0.05 - 0.1 | CPMW 060202-SF UMB10 | 0.2 |
| | R/L105.18xxxx TN35 | 0.05 | 16 - 130 | 0.01 - 0.02 | WCGT 020102-FX UC500 | 0.2 | 50 | 120 | 0.03 - 0.1 | CPGT 060202-FX UT200 | 0.2 |
| 6.2 | R/L105.18xxxx TI25 | 0.05 | 16 - 130 | 0.01 - 0.02 | WCGT 020102-FY UT150 | 0.2 | 70 | 120 | 0.03 - 0.1 | CPGT 060202-FX UT150 | 0.2 |
| | R/L105.18xxxx TN35 | 0.05 | 16 - 130 | 0.01 - 0.02 | WCGT 020102-FX UC500 | 0.2 | 70 | 100 | 0.05 - 0.1 | CPGT 060202-FX UC360 | 0.2 |
| 7 | R/L105.18xxxx MG12 | 0.05 | 14 - 220 | 0.01 - 0.02 | WCGT 020102-FY UT150 | 0.2 | 100 | 300 | 0.03 - 0.1 | CPMW 060202-SF UMD01 | 0.2 |
| | R/L105.18xxxx TN35 | 0.05 | 16 - 600 | 0.01 - 0.02 | WCGW 020102-SF UMD01 | 0.2 | 120 | 400 | 0.03 - 0.1 | CPGT 060202-FX UW100 | 0.2 |
| 7.1 | R/L105.18xxxx MG12 | 0.05 | 14 - 220 | 0.01 - 0.02 | WCGT 020102-FY UT150 | 0.2 | 100 | 250 | 0.03 - 0.1 | CPMW 060202-SF UMD01 | 0.2 |
| | R/L105.18xxxx TN35 | 0.05 | 14 - 600 | 0.01 - 0.02 | WCGW 020102-SF UMD01 | 0.2 | 120 | 400 | 0.03 - 0.1 | CPGT 060202-FX UW100 | 0.2 |
| 7.2 | R/L105.18xxxx TI25 | 0.05 | 18 - 75 | 0.01 - 0.02 | WCGT 020102-FY UT150 | 0.2 | 40 | 50 | 0.03 - 0.1 | CPGT 060202-FX UW100 | 0.2 |
| | R/L105.18xxxx TF45 | 0.05 | 18 - 75 | 0.01 - 0.02 | WCGW 020102-SF UMD01 | 0.2 | 70 | 200 | 0.05 - 0.1 | CPMW 060202-SF UMB20 | 0.2 |
| 7.3 | | | | | WCGW 020102-SF UMD01 | 0.2 | - | 200 | 0.03 - 0.1 | CPMW 060202-SF UMD01 | 0.2 |
| | | | | | | | | | | CPGT 060202-FX UW100 | 0.2 |
| 7.4 | | | | | WCGW 020102-SF UMD01 | 0.2 | - | 200 | 0.03 - 0.1 | CPMW 060202-SF UMD01 | 0.2 |
| | | | | | | | | | | CPGT 060202-FX UW100 | 0.2 |
| 8 | R/L105.18xxxx MG12 | 0.05 | 14 - 110 | 0.01 - 0.02 | WCGW 020102-SF UMD01 | 0.2 | 150 | 400 | 0.03 - 0.08 | CPMW 060202-SF UMD01 | 0.2 |
| | R/L105.18xxxx TN35 | 0.05 | 14 - 180 | 0.01 - 0.02 | | | | | | CPGT 060202-FX UW100 | 0.2 |
| 8.1 | R/L105.18xxxx MG12 | 0.05 | 14 - 110 | 0.01 - 0.02 | WCGW 020102-SF UMD01 | 0.2 | 150 | 400 | 0.03 - 0.08 | CPMW 060202-SF UMD01 | 0.2 |
| | R/L105.18xxxx TN35 | 0.05 | 14 - 180 | 0.01 - 0.02 | | | | | | CPGT 060202-FX UW100 | 0.2 |

**Los avances recomendados para conseguir el acabado superficial definido van en relacion al radio del filo seleccionado ver página 6**

Recommended feed rates in order to achieve a defined surface quality in relation to the nose radius see page 6





| UC | Ø 20 - 153 mm<br>$v_c$ m/min E ≤ 8 | E ≤ 4 | $f_z$ mm | 1. Elección 1. Choice<br>2. Elección 2. Choice | $a_{p\,max}$ mm | $v_c$ m/min E ≤ 6 | E ≤ 4 | $f_z$ mm | Ø 150 - 805 mm<br>1. Elección 1. Choice<br>2. Elección 2. Choice | $a_{p\,max}$ mm | $v_c$ m/min L > 220 | L < 220 | $f_z$ mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 70 | 350 | 0.05 - 0.12 | CCGT 060204-FX UT150 | 0.3 | 120 | 350 | 0.06 - 0.12 | CCMT 09T304-MFU UT150 | 0.4 | 120 | 350 | 0.1 - 0.15 |
| | 70 | 350 | 0.05 - 0.12 | CCMT 060204-MFU UC250 | 0.4 | - | 300 | 0.08 - 0.15 | CCMT 09T304-WFU UC250 | 0.4 | 100 | 300 | 0.15 - 0.3 |
| 2 | 70 | 350 | 0.05 - 0.12 | CCGT 060204-FX UT150 | 0.3 | 120 | 350 | 0.06 - 0.12 | CCMT 09T304-MFU UT150 | 0.4 | 120 | 350 | 0.1 - 0.15 |
| | 70 | 350 | 0.05 - 0.12 | CCMT 060204-MFU UC250 | 0.4 | - | 300 | 0.08 - 0.15 | CCMT 09T304-WFU UC250 | 0.4 | 100 | 300 | 0.15 - 0.3 |
| 3 | 70 | 350 | 0.05 - 0.12 | CCGT 060204-FX UT150 | 0.3 | 120 | 350 | 0.06 - 0.12 | CCMT 09T304-MFU UT150 | 0.4 | 120 | 350 | 0.1 - 0.15 |
| | 70 | 350 | 0.05 - 0.12 | CCMT 060204-MFU UC250 | 0.4 | - | 300 | 0.08 - 0.15 | CCMT 09T304-WFU UC250 | 0.4 | 100 | 300 | 0.15 - 0.3 |
| 3.1 | 70 | 300 | 0.05 - 0.1 | CCGT 060204-FX UT150 | 0.3 | 110 | 300 | 0.06 - 0.12 | CCMT 09T304-MFU UT150 | 0.4 | 110 | 300 | 0.1 - 0.15 |
| | 70 | 350 | 0.05 - 0.12 | CCMT 060204-MFU UC250 | 0.4 | - | 250 | 0.08 - 0.15 | CCMT 09T304-WFU UC250 | 0.4 | 100 | 300 | 0.15 - 0.3 |
| 3.2 | 60 | 200 | 0.05 - 0.1 | CCGT 060204-FX UT150 | 0.3 | 100 | 200 | 0.06 - 0.12 | CCMT 09T304-MFU UT150 | 0.4 | 100 | 200 | 0.1 - 0.15 |
| | 60 | 200 | 0.05 - 0.12 | CCMT 060204-MFU UC250 | 0.4 | - | 180 | 0.08 - 0.15 | CCMT 09T304-WFU UC250 | 0.4 | 100 | 300 | 0.15 - 0.3 |
| 3.2 | 60 | 120 | 0.05 - 0.1 | CCGT 060204-FX UT150 | 0.3 | 60 | 120 | 0.06 - 0.12 | CCMT 09T304-MFU UT150 | 0.4 | 60 | 120 | 0.1 - 0.15 |
| | 60 | 120 | 0.05 - 0.12 | CCMT 060204-MFU UC250 | 0.3 | 60 | 120 | 0.08 - 0.12 | CCMT 09T304-WFU UC250 | 0.4 | 60 | 110 | 0.1 - 0.15 |
| 4 | - | 60-140 | 0.04 - 0.09 | CCMW 060204-SF UMB20 | 0.2 | - | 60 - 140 | 0.04 - 0.09 | CCMW 09T304-SF UMB20 | 0.3 | 60 | 140 | 0.08 - 0.15 |
| 5 | 70 | 200 | 0.05 - 0.1 | CCGT 060202-FX UT200 | 0.3 | 120 | 220 | 0.08 - 0.12 | CCMT 09T304-MFU UC300 | 0.4 | 100 | 200 | 0.08 - 0.15 |
| | 70 | 220 | 0.05 - 0.1 | CCMT 060204-FX UC360 | 0.2 | 100 | 180 | 0.10 - 0.15 | CCGT 09T304-FX UT150 | 0.2 | 110 | 220 | 0.08 - 0.15 |
| 5.1 | 70 | 180 | 0.05 - 0.1 | CCGT 060202-FX UT200 | 0.3 | 100 | 200 | 0.08 - 0.12 | CCMT 09T304-MFU UC300 | 0.4 | 90 | 180 | 0.08 - 0.15 |
| | 80 | 200 | 0.05 - 0.1 | CCMT 060204-MFU UC300 | 0.2 | 90 | 170 | 0.10 - 0.15 | CCGT 09T304-FX UT150 | 0.2 | 100 | 190 | 0.08 - 0.15 |
| 5.2 | 70 | 120 | 0.05 - 0.1 | CCMT 060204-MFU UC300 | 0.3 | 70 | 120 | 0.10 - 0.15 | CCMT 09T304-MFU UC300 | 0.4 | 70 | 120 | 0.15 - 0.3 |
| | 80 | 130 | 0.05 - 0.1 | CCGT 060202-FX UT200 | 0.2 | 80 | 140 | 0.08 - 0.12 | CCGT 09T304-FX UT150 | 0.2 | 80 | 130 | 0.08 - 0.15 |
| 6 | 80 | 300 | 0.05 -0.12 | CCMW 060204-SF UMB10 | 0.3 | 100 | 300 | 0.08 - 0.12 | CCMW 09T304-SF UMB10 | 0.3 | 100 | 300 | 0.08 - 0.12 |
| | 80 | 160 | 0.05 - 0.1 | CCMT 060204-MFU UC250 | 0.4 | 80 | 180 | 0.10 - 0.15 | CCGT 09T304-FX UT150 | 0.3 | 100 | 180 | 0.15 - 0.3 |
| 6.1 | 70 | 300 | 0.05 -0.12 | CCMW 060204-SF UMB10 | 0.3 | 100 | 300 | 0.08 - 0.12 | CCMW 09T304-SF UMB10 | 0.3 | 100 | 300 | 0.08 - 0.12 |
| | 80 | 160 | 0.05 - 0.1 | CCMT 060204-MFU UC250 | 0.4 | 80 | 180 | 0.10 - 0.15 | CCMT 09T304-MRU UC250 | 0.3 | 100 | 180 | 0.15 - 0.3 |
| 6.2 | 70 | 120 | 0.05 - 0.1 | CCMT 060204-MFU UC250 | 0.3 | 100 | 180 | 0.05 - 0.15 | CCMT 09T304-MR UMC15 | 0.3 | 100 | 180 | 0.1 - 0.15 |
| | 80 | 120 | 0.05 - 0.1 | CCMT 060204-MRU UC250 | 0.2 | 80 | 180 | 0.05 - 0.1 | CCMT 09T304-MRU UC250 | 0.3 | 100 | 180 | 0.15 - 0.3 |
| 7 | 120 | 400 | 0.03 - 0.1 | CCMW 060204-SF UMD01 | 0.2 | 150 | 500 | 0.08 - 0.15 | CCMW 09T304-SF UMD01 | 0.2 | 200 | 500 | 0.04 - 0.1 |
| | 100 | 200 | 0.05 - 0.1 | CCGT 060204-ALU UW100 | 0.5 | 120 | 300 | 0.10 - 0.20 | CCGT 09T304-ALU UW100 | 0.3 | 120 | 250 | 0.05 - 0.1 |
| 7.1 | 120 | 400 | 0.03 - 0.1 | CCMW 060204-SF UMD01 | 0.2 | 120 | 500 | 0.08 - 0.15 | CCMW 09T304-SF UMD01 | 0.2 | 200 | 500 | 0.04 - 0.1 |
| | 100 | 200 | 0.05 - 0.1 | CCGT 060204-ALU UW100 | 0.5 | 120 | 300 | 0.10 - 0.20 | CCGT 09T304-ALU UW100 | 0.4 | 120 | 180 | 0.05 - 0.1 |
| 7.2 | 40 | 50 | 0.03 - 0.1 | CCMW 060204-SF UMD01 | 0.2 | 120 | 500 | 0.08 - 0.15 | CCGT 09T304-FX UT150 | 0.3 | 40 | 60 | 0.05 - 0.1 |
| | 70 | 200 | 0.05 - 0.1 | CCGT 060204-ALU UW100 | 0.5 | 120 | 300 | 0.10 - 0.20 | CCGT 09T304-ALU UW100 | 0.3 | 120 | 200 | 0.05 - 0.1 |
| 7.3 | - | 200 | 0.03 - 0.1 | CPMW 060202-SF UMD01 | 0.2 | - | 200 | 0.03 - 0.1 | CCMW 09T304-SF UMD01 | 0.3 | - | 200 | 0.05 - 0.1 |
| | - | 50 | 0.03 - 0.1 | CPGT 060202-FX UW100 | 0.2 | - | 50 | 0.03 - 0.1 | CCGT 09T304-FX UT150 | 0.3 | - | 50 | 0.04 - 0.1 |
| 7.4 | - | 200 | 0.03 - 0.1 | CPMW 060202-SF UMD01 | 0.2 | - | 200 | 0.03 - 0.1 | CCMW 09T304-SF UMD01 | 0.3 | - | 200 | 0.05 - 0.1 |
| | - | 50 | 0.03 - 0.1 | CPGT 060202-FX UW100 | 0.2 | - | 50 | 0.03 - 0.1 | CCGT 09T304-FX UT150 | 0.3 | - | 50 | 0.04 - 0.1 |
| 8 | 150 | 400 | 0.03 - 0.1 | CCMW 060204-SF UMD01 | 0.3 | 180 | 400 | 0.04 - 0.1 | CCMW 09T304-SF UMD01 | 0.3 | 180 | 400 | 0.04 - 0.1 |
| | 100 | 200 | 0.05 - 0.1 | CCGT 060204-ALU UW100 | 0.3 | 80 | 120 | 0.05 - 0.1 | CCGT 09T304-ALU UW100 | 0.3 | 60 | 180 | 0.05 - 0.1 |
| 8.1 | 150 | 400 | 0.03 - 0.1 | CCMW 060204-SF UMD01 | 0.3 | 180 | 400 | 0.04 - 0.1 | CCMW 09T304-SF UMD01 | 0.3 | 180 | 400 | 0.04 - 0.1 |
| | 100 | 200 | 0.05 - 0.1 | CCGT 060204-ALU UW100 | 0.3 | 80 | 120 | 0.05 - 0.1 | CCGT 09T304-ALU UW100 | 0.3 | 60 | 120 | 0.05 - 0.1 |

**condiciones de corte para RFP ver página 11**

cutting data for RFP see page 11





## Tabla de comparación de materiales

Material Comparison Table

| ISO | UC | Designación material | Material Designation | Rm N/mm² | HB HRC | $k_c$ N/mm² | DIN Number | DIN Designation |
|---|---|---|---|---|---|---|---|---|
| P | 1 | acero al carbono sin alear<br>acero de estructura general | unalloyed carbon steel<br>general structural steel | < 500 | < 160 | 1740 | 1.0038<br>1.0144 | RSt-37-2<br>St44-3 |
| | 2 | acero al carbono de baja aleación, acero estructural, fundicion de acero, acero de herramientas, acero de baja aleación | low-alloy carbon steel, structural steel, Cast-hardened steel, tool steel, low-alloy steel | 500-900 | 140-325 | 1970 | 1.1191<br>1.0841 | Ck45<br>St52-3 |
| | 3 | acero de herramientas aleado | alloyed tool steel<br>nitride steel | 800-1200 | 250-350 | 1910 | 1.7225<br>1.7131 | 42CrMo4<br>16MnCr5 |
| | 3.1 | acero altamente aleado | high alloyed steel | < 1000 | | 2200 | 1.2067<br>1.2601 | 100Cr6<br>X165CrMoV12 |
| | 3.2 | acero altamente aleado | high alloyed steel | < 1600 | | 2450 | 1.2083<br>1.2344 | X42Cr13<br>X40CrMoV5 1 |
| | 3.3 | acero rápido | high speed steel | | | 1860 | 1.3207<br>1.3265 | S 10-4-3-10<br>S 18-1-2-10 |
| H | 4 | acero endurecido | hardened steel | >1400 | 45 - 65 HRC | 3670 | 1.3207<br>1.2067 | S 10-4-3-10<br>100Cr6 |
| M | 5 | acero inoxidable martensitico | stainless steel martensitic | 500-1000 | | 2530 | 1.4005<br>1.4512 | X12CrS13<br>X5CrTi 12 |
| | 5.1 | acero inoxidable austenitico | stainless steel austenitic | | | 2260 | 1.4301<br>1.4435 | X5CrNi 18 9<br>X2CrNiMo 18 14 3 |
| | 5.2 | acero inoxidable resistente al calor | stainless heat resisting steel | | | 2580 | 1.4724<br>1.4828 | X10CrA113<br>X15CrNiSi20 12 |
| K | 6 | fundición fris, aleación de fundición gris | grey cast iron, alloyed gres cast iron | | < 250 | 1270 | 0.6015<br>0.6025 | GG15<br>GG25 |
| | 6.1 | hierro nodular ferritico | nodular iron ferritic | | | 1300 | 0.6660<br>0.9625 | GG-NiCr202<br>G-X 330 NiCr 4 2 |
| | 6.2 | hierro nodular ferritico/perlitico, hierro maleable | nodular iron ferritic/pearlitic, malleable Iron | > 550 | | 1600 | 0.7050<br>0.8165 | GGG50<br>GTS-65 |
| N | 7 | aluminio < 7 % Si, aleaciones aluminio | aluminium < 7 % Si, alu-wrough alloys | | | 650 | 2.1182<br>2.0060 | CuZn36Pb3<br>E-Cu57 |
| | 7.1 | alu-Legierungen > 7 % Si | alu-alloy > 7 % Si | | | 720 | 1.3315<br>1.3561 | AlMg1<br>G-AlMg5 |
| | 7.2 | aleaciones no ferritica, aleaciones de cobre, latón, bronce | ou ferrous alloys, copper alloys, Brass, bronzes | | | 2100 | 2.4631<br>2.4668 | Nimonic 80A<br>Inconel 718 |
| | 7.3 | titanio | titanium | | | 1350 | 3.7114<br>3.7124 | TiAl5Sn2<br>TiCu2 |
| | 7.4 | aleacción basadas en niquel | nickelbased alloys | | | 2250 | 3.7165<br>3.7184 | TiAl6V4<br>TiAl4Mo4Sn2 |
| S | 8 | termoplásticos, duroplast | plastics thermo-, duroplast | | | | PVC<br>PF | Vinnol<br>Bakelit |
| | 8.1 | plásticos reforzados con fibra | fibre reinforced plastics | | | | AFK<br>GFK | Kevlar |

**UC** **código material URMA**
URMA material code

**$k_c$** **fuerzas de corte especificas**
specific cutting force

## Estudio de mecanizado

Machining Study

| | | |
|---|---|---|
| **Remitente *** Sender | | Number |
| **Compañía** Company | | **Distribuidor URMA** URMA Distributor |
| **Adresse** Address | | **Contacto** Contact |
| | | **Departamento** Department |
| **Teléfono** Telephone | **Telefax** Fax | **Email** E-Mail |

**Máquina** Machine-tool

| | | |
|---|---|---|
| **Tipo de máquina** Machine Type | | **Potencia (kW)** Drive Power (kW) |
| **Horizontal *** Horizontal ❑ | **Vertical *** Vertical ❑ / **Herramienta rotativa *** Tool Rotating ❑ | **Estabilidad** Stability |
| **Agarre husillo *** Spindle Holder | | |
| **Restricciones debidas a** Restrictions due to | | |

**Lubricante** Lubricant

| | | |
|---|---|---|
| **Aceite *** Oil ❑ | **MMS *** [1] MLS [1] ❑ / **Emulsión *** Emulsion ❑ | **Porcentaje de mezcla** Ratio of Mixture |
| **Suministro de la refrigeración interior *** Internal Coolant Supply ❑ | | **Presión del refrigerante (bar) *** Coolant Pressure (bar) |

**Pieza** Workpiece

| | | |
|---|---|---|
| **Descripción** Designation | **Dibujo nº** Drawing Number | **Material nº *** Material Number |
| **Especificaciones *** Specification | **Tratamiento de la pieza *** Treatment Condition | **Fuerza *** Strength |
| **Número de agujeros/año *** Number of Bores per Year | **Nº piezas del lote** Batch Size | |

**Requisitos de la pieza** Machining requirements

| | | |
|---|---|---|
| **Diámetro del agujero *** Bore ø | **Longitud del agujero *** Bore length | **Diámetro pre-mecanizado *** Pre-Machined ø |
| **Tolerancia *** Tolerance | **Longitud herramienta (xs)** Gage length (xs) | **Metodo de pre-mecanizado *** Method of Pre-Machining |
| **Requisitos adicionales de tolerancia** Additional Tolerance Requirements | **Agujero ciego *** Blind Hole ❑ | **Tiempo objetivo** Target Time |
| **Calidad superficie (µm) *** Surface Quality (µm) | **Corte interrumpido *** Cutting Interruption ❑ | **Cantidad objetivo** Target Quantity |
| $R_a$ ❑ $R_z$ ❑ $R_t$ ❑ | **Tiempo de ciclo** Cycle Time ❑ | **Adjunto: Dibujo de la aplicación *** Attachement: Your application sketch |
| **Fecha *** Date | **Visto bueno *** Visa | |

* **campos obligatorios** mandatory fields

[1] micro lubricación minimal lubrication system (mist coolant)

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## Condiciones de corte recomendadas para debaste (con cabezas de doble corte) *

Recommended Cutting Data for Roughing (with Double Cutter Heads) *

| UC | Ø 19,5 - 39 mm<br>**1. Elección** 1. Choice<br>**2. Elección** 2. Choice | $a_{p\,max}$ mm | $v_c$ m/min E ≤ 6 | $v_c$ m/min E ≤ 4 | $f_z$ mm | Ø 38 - 67 mm<br>**1. Elección** 1. Choice<br>**2. Elección** 2. Choice | $a_{p\,max}$ mm | $v_c$ m/min E ≤ 6 | $v_c$ m/min E ≤ 4 | $f_z$ mm |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CCMT 060204-MRU UC250 | 1.75 | 80 | 200 | 0.15 - 0.2 | CCMT 09T308-MRU UC350 | 3 | 80 | 200 | 0.2 - 0.25 |
| | CCMT 060204-MFU UT150 | 1.75 | 100 | 220 | 0.12 - 0.2 | CCMT 09T304-MRU UC250 | 2.5 | 100 | 200 | 0.15 - 0.2 |
| 2 | CCMT 060204-MRU UC250 | 1.75 | 80 | 200 | 0.15 - 0.2 | CCMT 09T308-MRU UC350 | 3 | 80 | 200 | 0.2 - 0.25 |
| | CCMT 060204-MFU UT150 | 1.75 | 100 | 220 | 0.12 - 0.2 | CCMT 09T304-MRU UC250 | 2.5 | 100 | 200 | 0.15 - 0.2 |
| 3 | CCMT 060204-MRU UC250 | 2 | 80 | 220 | 0.1 - 0.2 | CCMT 09T308-MRU UC350 | 3.5 | 80 | 220 | 0.2 - 0.25 |
| | CCMT 060204-MFU UT150 | 2 | 100 | 230 | 0.1 - 0.2 | CCMT 09T304-MRU UC250 | 2.5 | 100 | 220 | 0.15 - 0.2 |
| 3.1 | CCMT 060204-MRU UC250 | 2 | 80 | 180 | 0.1 - 0.2 | CCMT 09T308-MRU UC350 | 3.5 | 80 | 180 | 0.2 - 0.25 |
| | CCMT 060204-MRU UC350 | 2 | 70 | 160 | 0.1 - 0.2 | CCMT 09T304-MRU UC250 | 2.5 | 100 | 200 | 0.15 - 0.2 |
| 3.2 | CCMT 060204-MRU UC250 | 2 | 70 | 140 | 0.1 - 0.2 | CCMT 09T308-MRU UC350 | 3.5 | 70 | 140 | 0.1 - 0.2 |
| | CCMT 060204-MRU UC350 | 2 | 70 | 140 | 0.1 - 0.2 | CCMT 09T304-MRU UC250 | 2.5 | 80 | 150 | 0.1 - 0.2 |
| 3.3 | CCMT 060204-MRU UC250 | 2 | 60 | 90 | 0.08 - 0.15 | CCMT 09T308-MRU UC350 | 3 | 60 | 90 | 0.1 - 0.2 |
| | CCMT 060208-MRU UC350 | 2 | 65 | 90 | 0.08 - 0.15 | CCMT 09T304-MRU UC250 | 2.5 | 60 | 100 | 0.1 - 0.2 |
| 4 | | | | | | | | | | |
| 5 | CCMT 060204-MRU UC250 | 1.75 | 90 | 140 | 0.08 - 0.2 | CCMT 09T308-MRU UC350 | 3 | 90 | 140 | 0.15 - 0.25 |
| | CCMT 060204-MFU UC300 | 1.75 | 90 | 140 | 0.08 - 0.2 | CCMT 09T308-MFU UC300 | 2.5 | 90 | 140 | 0.15 - 0.25 |
| 5.1 | CCMT 060204-MRU UC250 | 1.75 | 90 | 140 | 0.08 - 0.2 | CCMT 09T308-MRU UC350 | 3 | 90 | 140 | 0.15 - 0.25 |
| | CCMT 060204-MFU UC300 | 1.75 | 90 | 140 | 0.08 - 0.2 | CCMT 09T308-MFU UC300 | 2.5 | 90 | 140 | 0.15 - 0.25 |
| 5.2 | CCMT 060204-MRU UC250 | 1.75 | 60 | 90 | 0.08 - 0.15 | CCMT 09T308-MRU UC350 | 3 | 60 | 90 | 0.15 - 0.25 |
| | CCMT 060204-MFU UC300 | 1.75 | 60 | 90 | 0.08 - 0.2 | CCMT 09T308-MFU UC300 | 2.5 | 60 | 90 | 0.15 - 0.25 |
| 6 | CCMT 060204-MRU UC250 | 2.5 | 120 | 180 | 0.15 - 0.25 | CCMT 09T308-MRU UC250 | 3.5 | 100 | 180 | 0.15 - 0.3 |
| | CCMT 060204-WF UMC15 | 2.5 | 120 | 180 | 0.15 - 0.25 | | | | | |
| 6.1 | CCMT 060204-MRU UC250 | 2.5 | 90 | 180 | 0.15 - 0.25 | CCMT 09T308-MRU UC250 | 3.5 | 90 | 180 | 0.15 - 0.3 |
| | CCMT 060204-WF UMC15 | 2.5 | 90 | 180 | 0.15 - 0.25 | | | | | |
| 6.2 | CCMT 060204-MRU UC250 | 2.5 | 70 | 120 | 0.15 - 0.25 | CCMT 09T308-MRU UC250 | 3.5 | 10 | 120 | 0.15 - 0.3 |
| | CCMT 060204-WF UMC15 | 2.5 | 80 | 140 | 0.15 - 0.25 | | | | | |
| 7 | CCGT 060204-ALU UW100 | 2.5 | 120 | 300 | 0.15 - 0.25 | CCGT 09T308-ALU UW100 | 3.5 | 120 | 300 | 0.2 - 0.3 |
| 7.1 | CCGT 060204-ALU UW100 | 2.5 | 120 | 400 | 0.15 - 0.25 | CCGT 09T308-ALU UW100 | 3.5 | 120 | 300 | 0.2 - 0.3 |
| 7.2 | CCGT 060204-ALU UW100 | 2 | 40 | 60 | 0.08 - 0.15 | CCGT 09T308-ALU UW100 | 3.5 | 40 | 60 | 0.1 - 0.2 |
| 7.3 | CCMT 060208-MRU AC510U | 1.5 | 30 | 70 | 0.1 - 0.2 | CCMT 09T308-MRU AC510U | 1.5 | 30 | 70 | 0.1 - 0.25 |
| 7.4 | CCMT 060208-MRU AC510U | 1.5 | 30 | 70 | 0.1 - 0.2 | CCMT 09T308-MRU AC510U | 1.5 | 30 | 70 | 0.1 - 0.25 |
| 8 | CCGT 060204-ALU UW100 | 2.5 | 100 | 150 | 0.15 - 0.25 | CCMW 09T308-SF UMD01 | 2.0 | 120 | 1000 | 0.15 - 0.3 |
| | | | | | | CCGT 09T308-ALU UW100 | 3.5 | 120 | 400 | 0.20 - 0.4 |
| 8.1 | CCGT 060204-ALU UW100 | 2.5 | 100 | 150 | 0.15 - 0.25 | CCMW 09T308-SF UMD01 | 2.0 | 120 | 1000 | 0.15 - 0.3 |
| | | | | | | CCGT 09T308-ALU UW100 | 3.5 | 120 | 400 | 0.20 - 0.4 |

**UC código material URMA (ver página 14)**
*** el desbaste contrapesado requiere un solo filo de corte para el calculo del ratio del avance**
UC URMA material-code (see page 14)
* offset roughing requires only one cutting edge for the feed rate calculation





| Ø 66 - 88 mm<br>**1. Elección** 1. Choice<br>**2. Elección** 2. Choice | $a_{p\,max}$ mm | $v_c$ m/min E ≤ 6 | $v_c$ m/min E ≤ 4 | $f_z$ mm | Ø 87 - 805 mm<br>**1. Elección** 1. Choice<br>**2. Elección** 2. Choice | $a_{p\,max}$ mm | $v_c$ m/min E ≤ 6 | $v_c$ m/min E ≤ 4 | $f_z$ mm |
|---|---|---|---|---|---|---|---|---|---|
| CNMM 120408-RRU UC350 | 4.5 | 80 | 250 | 0.25 - 0.35 | CNMM 160612-RRU UC350 | 6 | 80 | 200 | 0.3 - 0.8 |
| CNMG 120408-RRG UC250 | 3.5 | 120 | 270 | 0.2 - 0.3 | CNMG 160612-RRG UC350 | 4 | 80 | 200 | 0.3 - 0.6 |
| CNMM 120408-RRU UC350 | 4.5 | 80 | 220 | 0.25 - 0.35 | CNMM 160612-RRU UC350 | 6 | 80 | 200 | 0.3 - 0.8 |
| CNMG 120408-RRG UC250 | 3.5 | 120 | 250 | 0.2 - 0.3 | CNMG 160612-RRG UC350 | 4 | 80 | 200 | 0.3 - 0.6 |
| CNMM 120408-RRU UC350 | 4.5 | 80 | 220 | 0.25 - 0.35 | CNMM 160612-RRU UC350 | 7 | 80 | 180 | 0.3 - 0.8 |
| CNMG 120408-RRG UC250 | 3.5 | 120 | 250 | 0.2 - 0.3 | CNMG 160612-RRG UC350 | 4 | 80 | 180 | 0.3 - 0.6 |
| CNMM 120408-RRU UC350 | 4.5 | 80 | 180 | 0.25 - 0.35 | CNMM 160612-RRU UC350 | 7 | 80 | 180 | 0.3 - 0.8 |
| CNMG 120408-RRG UC250 | 3.5 | 120 | 220 | 0.2 - 0.3 | CNMG 160612-RRG UC350 | 4 | 80 | 180 | 0.3 - 0.6 |
| CNMM 120408-RRU UC350 | 4.5 | 70 | 140 | 0.2 - 0.3 | CNMM 160612-RRU UC350 | 6 | 70 | 140 | 0.25 - 0.6 |
| CNMG 120408-RRG UC250 | 3.5 | 120 | 180 | 0.2 - 0.3 | CNMG 160612-RRG UC350 | 4 | 80 | 140 | 0.3 - 0.6 |
| CNMM 120408-RRU UC350 | 4.5 | 60 | 90 | 0.2 - 0.3 | CNMM 160612-RRU UC350 | 5 | 60 | 90 | 0.25 - 0.6 |
| CNMG 120408-RRG UC250 | 3.5 | 80 | 120 | 0.2 - 0.3 | CNMG 160612-RRG UC350 | 3 | 60 | 90 | 0.25 - 0.5 |
| | | | | | | | | | |
| CNMG 120408-RRG UC300 | 4 | 90 | 140 | 0.2 - 0.3 | CNMM 160612-RRU UC350 | 6 | 90 | 140 | 0.3 - 0.8 |
| CNMM 120408-RRU UC350 | 4 | 90 | 140 | 0.2 - 0.3 | CNMG 160612-RRG UC350 | 4 | 90 | 140 | 0.25 - 0.6 |
| CNMG 120408-RRG UC300 | 4 | 90 | 140 | 0.2 - 0.3 | CNMM 160612-RRU UC350 | 6 | 90 | 140 | 0.3 - 0.8 |
| CNMM 120408-RRU UC350 | 4 | 90 | 140 | 0.2 - 0.3 | CNMG 160612-RRG UC350 | 4 | 90 | 140 | 0.25 - 0.6 |
| CNMM 120408-RRU UC300 | 4 | 60 | 90 | 0.2 - 0.3 | CNMM 160612-RRU UC350 | 6 | 60 | 90 | 0.2 - 0.3 |
| CNMM 120408-RRU UC350 | 4 | 60 | 90 | 0.2 - 0.3 | CNMG 160612-RRG UC350 | 4 | 80 | 140 | 0.2 - 0.3 |
| CNMG 120408-RRG UC100 | 4 | 100 | 180 | 0.2 - 0.35 | CNMG 160612-RRG UC100 | 6 | 100 | 180 | 0.25 - 0.35 |
| CNMG 120408-RRG UC100 | 4 | 90 | 180 | 0.2 - 0.35 | CNMG 160612-RRG UC100 | 5 | 90 | 180 | 0.25 - 0.35 |
| | | | | | CNMM 160612-RRU UC350 | 7 | 80 | 160 | 0.3 - 0.8 |
| CNMG 120408-RRG UC100 | 4 | 70 | 120 | 0.2 - 0.35 | CNMG 160612-RRG UC100 | 5 | 80 | 150 | 0.25 - 0.35 |
| CNMM 120408-RRU UC350 | 4 | 60 | 120 | 0.25 0.4 | CNMM 160612-RRU UC350 | 7 | 70 | 120 | 0.3 - 0.8 |
| CNMG 120408-RRG UC300 | 3.5 | 120 | 300 | 0.2 - 0.3 | CNMG 160612-RRG UC350 | 6 | 120 | 300 | 0.25 - 0.35 |
| CNMG 120408-RRG UC300 | 3.5 | 120 | 300 | 0.2 - 0.3 | CNMG 160612-RRG UC350 | 6 | 120 | 300 | 0.25 - 0.35 |
| CNMG 120408-RRG UC300 | 3.5 | 40 | 60 | 0.1 - 0.3 | CNMG 160612-RRG UC350 | 6 | 40 | 60 | 0.2 - 0.3 |
| CNMG 120408-RRG UC300 | 2.5 | 30 | 70 | 0.1 - 0.3 | CNMG 160612-RRG UC350 | 4 | 30 | 50 | 0.2 - 0.3 |
| CNMG 120408-UP AC520U | 2.5 | 30 | 70 | 0.1 - 0.3 | CNMG 160612-MU AC520U | 4 | 30 | 70 | 0.2 - 0.5 |
| CNMG 120408-RRG UC300 | 2.5 | 30 | 70 | 0.1 - 0.3 | CNMG 160612-RRG UC350 | 4 | 30 | 50 | 0.2 - 0.3 |
| CNMG 120408-UP AC520U | 2.5 | 30 | 70 | 0.1 - 0.3 | CNMG 160612-MU AC520U | 4 | 30 | 70 | 0.2 - 0.5 |
| CNMG 120408-RRG UC300 | 3.5 | 120 | 300 | 0.2 - 0.3 | CNMG 160612-RRG UC350 | 6 | 120 | 300 | 0.25 - 0.35 |
| CNMG 120408-RRG UC300 | 3.5 | 120 | 300 | 0.2 - 0.3 | CNMG 160612-RRG UC350 | 6 | 120 | 300 | 0.25 - 0.35 |

## Soluciones prácticas para problemas de mecanizado

Practical Solutions for Cutting Problems

| | **Fragmentación, rotura** Fragmentation | **Desgaste del filo** Flank Wear | **Desgaste de la placa** Crater Wear | **Aportación de material** Built-up Edges | **Deformación plastica** Plastic Deformation | **Fragmentación/ rotura placa** Fragments/Insert Break | **Movimientos** Chattering | **Vibraciones** Vibration | **Desviaciones dimensionales** Dimensional Deviation | **Agujero conico** Conical Bore | **Calidad superficial mala** Poor Surface Quality | **Pieza con rebaba** Chipped Workpiece Edges | **Viruta demasiado larga** Chips too Long | **Acumulacion de viruta** Chip Accumulation | **Calentamiento de la pieza** Heating of Workpiece |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Datos de corte** Cutting Data | | | | | | | | | | | | | | | |
| **Velocidad de corte** Cutting Speed | ↑ | ↓ | ↓ | ↑ | ↓ | | ↑ | ↓ | ⚠ | ↓ | ↑ | ↑ | ↓ | ↓ | ↓ |
| **Velocidad rotatoria permitida** Permitted Rotary Speed | | | | | | | | ⚠ | | ⚠ | ⚠ | | | | |
| **Avance** Feed | ↓ | ↑ | ↓ | ↑ | ↓ | ↓ | ↑ | ↑ | ⚠ | ↑ | ↓ | ↓ | ↑ | ⚠ | ↑ |
| **Profundidad de corte** Depth of Cut | | | | ↓ | ⚠ | ⚠ | ↓ | ↑ | ↓ | ↓ | ↓ | | ↑ | ↓ | ↓ |
| **Placas intercambiables** Indexable Inserts | | | | | | | | | | | | | | | |
| **Geometria de rompevirutas** Chipbreaker Geometry | ⚠ | | ⚠ | ⚠ | ⚠ | ⚠ | ⚠ | ⚠ | ⚠ | ⚠ | ⚠ | | ⚠ | | ⚠ |
| **Radio del filo** Nose Radius | ↑ | ↓ | | | ↑ | ↑ | ↓ | ↓ | | ↓ | ⚠ | | ↓ | | ↓ |
| **Fijación** Fixing | | | | | | ⚠ | | | | | | | | | |
| **Material de corte** Cutting Material | | | | | | | | | | | | | | | |
| **Selección del material de corte** Cutting Material Selection | ⚠ | ⚠ | ⚠ | ⚠ | ⚠ | ⚠ | | | ⚠ | ⚠ | ⚠ | | | | |
| **Dureza** Toughness | ↑ | | | | | ↑ | | | | | | | | | |
| **Resistencia al desgaste** Wear Resistance | | ↑ | ↑ | | ↑ | | | | ↑ | ↑ | | | | | |
| **Desgaste del filo** Cutting Edge Wear | | | | | | ⚠ | ⚠ | ⚠ | ⚠ | ⚠ | ⚠ | | | | ⚠ |
| **Herramienta** Tool | | | | | | | | | | | | | | | |
| **Fijación del porta placas** Insert Holder Fixing | | | | | | | ⚠ | | ⚠ | | ⚠ | | | | |
| **Fijación del sistema** Fixing Interface | ⚠ | | | | | | ⚠ | | | | | | | | |
| **Angulo de fijación del porta placas** Insert Holder Setting Angle | | | | | | | ↑ | | ↑ | | ↑ | ↓ | ⚠ | ⚠ | |
| **Ratio E** Ratio E | ↓ | | | | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | | | | |
| **Orientación del filo de corte** Cutting Edge Orientation | | ⚠ | | | | | | ⚠ | | | | | | | |
| **Equilibrado** Balance | | | | | | | | ⚠ | ⚠ | | ⚠ | | | | |
| **Bloqueo de los elementos ajustables** Blocking of Adjusting Element | | | | | | | | | ⚠ | ⚠ | ⚠ | | | | |
| **Pieza** Workpiece | | | | | | | | | | | | | | | |
| **Dispositivo de amarre** Clamping Device | ↑ | | | | | | ⚠ | ↑ | ⚠ | ⚠ | ⚠ | | | | |
| **Desalojo viruta** Chip Space | ↑ | | | | | ↑ | ↑ | | | | | | | ↑ | ⚠ |
| **Máquina** Machine | | | | | | | | | | | | | | | |
| **Estabilidad** Stability | ↑ | | | | | ↑ | ↑ | ↑ | ⚠ | ⚠ | ↑ | | | | |
| **Presion del refrigerante/desalojo** Coolant Pressure/Flow Rate | | | ↑ | ↓ | ↑ | ↑ | | | | | ↑ | | ↑ | ↑ | ↑ |
| **Potencia husillo** Spindle Power | | | | | | | ⚠ | | | | | | | | |

↑ **incrementar, mejorar** increase, improve

↓ **reducir, disminuir** reduce, decrease

⚠ **revisar, mejorar** check, optimize

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