

# Cutting Data

## for M1200 Mini Milling Cutters using 1/2" I.C. Inserts

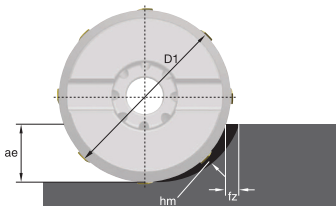
| ANSI<br>ISO<br>513 | Cutting Data for M1200 Milling Cutters                           |                        |                      |          | COATED                 |      |      |        |      |      |        |      |      | UNCOATED |      |      |   |
|--------------------|--|------------------------|----------------------|----------|------------------------|------|------|--------|------|------|--------|------|------|----------|------|------|---|
|                    | Cutter   |                        | Carbide Insert       |          | TN6525                 |      |      | TN6540 |      |      | TN7535 |      |      | THM-U    |      |      |   |
|                    |  |                        |                      |          | feed per tooth *(inch) |      |      |        |      |      |        |      |      |          |      |      |   |
|                    | M1200 Mini Milling Cutters Using 1/2" I.C. Inserts               |                        | HNGJ-07- LDJ         |          | -                      | -    | -    | -      | -    | -    | -      | -    | -    | .0024    | .004 | .012 |   |
|                    |  |                        | HNGJ-07, HNPJ-07- LD |          | .003                   | .005 | .010 | .004   | .007 | .013 | .004   | .006 | .012 | -        | -    | -    |   |
|                    |  |                        | HNGJ-07, HNPJ-07- GD |          | .004                   | .007 | .011 | .005   | .009 | .015 | .005   | .008 | .014 | -        | -    | -    |   |
|                    |  |                        | HNGJ-07, HNPJ-07- HD |          | .006                   | .008 | .020 | .008   | .011 | .026 | .007   | .010 | .024 | -        | -    | -    |   |
| P                  | Work Material  | Condition              | Hardness HB          | Mat. Gr. | vc *(sfm)              |      |      |        |      |      |        |      |      |          |      |      |   |
|                    | Carbon steel, Unalloyed steel, cast steel and free cutting steel | < 0.25% C annealed     | 125                  | 1        | 1150                   | 890  | 750  | 950    | 720  | 620  | 1180   | 920  | 790  | -        | -    | -    |   |
|                    |  | ≥ 0.25% C annealed     | 190                  | 2        | 790                    | 590  | 520  | 660    | 490  | 430  | 820    | 620  | 540  | -        | -    | -    |   |
|                    |  | < 0.55% C heat-treated | 250                  | 3        | 660                    | 490  | 430  | 560    | 430  | 360  | 690    | 520  | 460  | -        | -    | -    |   |
|                    |  | ≥ 0.55% C              | annealed             | 220      | 4                      | 690  | 520  | 430    | 560  | 430  | 360    | 710  | 540  | 460      | -    | -    | - |
|                    |  |                        | heat-treated         | 300      | 5                      | 560  | 430  | 360    | 460  | 330  | 300    | 590  | 430  | 360      | -    | -    | - |
|                    | Low alloy steel and cast steel                                   | annealed               | 200                  | 6        | 750                    | 560  | 460  | 620    | 460  | 390  | 790    | 590  | 490  | -        | -    | -    |   |
|                    |  | heat-treated           | 275                  | 7        | 560                    | 430  | 390  | 460    | 360  | 330  | 590    | 460  | 390  | -        | -    | -    |   |
|                    |  | heat-treated           | 300                  | 8        | 490                    | 390  | 330  | 430    | 330  | 260  | 520    | 390  | 330  | -        | -    | -    |   |
|                    |  | heat-treated           | 350                  | 9        | 430                    | 330  | 260  | 360    | 260  | 200  | 460    | 330  | 260  | -        | -    | -    |   |
|                    | High alloy steel, cast steel & tool steel                        | annealed               | 200                  | 10       | 560                    | 460  | 430  | 460    | 390  | 330  | 590    | 480  | 430  | -        | -    | -    |   |
|                    |  | heat-treated           | 325                  | 11       | 390                    | 300  | 230  | 330    | 230  | 200  | 390    | 300  | 230  | -        | -    | -    |   |
|                    | 400 series stainless   | FE / MA                | 200                  | 12       | 720                    | 560  | 460  | 590    | 460  | 390  | 750    | 570  | 490  | -        | -    | -    |   |
| MA                 |  | 240                    | 13.1                 | 620      | 460                    | 390  | 520  | 390    | 330  | 660  | 480    | 390  | -    | -        | -    |      |   |
| MA / PH            |  | 330                    | 13.2                 | 310      | 230                    | 200  | 260  | 200    | 160  | 330  | 250    | 200  | -    | -        | -    |      |   |
| M                  | 300 Series   | AU                     | 180                  | 14.1     | 620                    | 390  | 300  | 520    | 330  | 230  | 660    | 390  | 300  | -        | -    | -    |   |
|                    | Stainless  | DU                     | 230                  | 14.2     | 490                    | 300  | 230  | 430    | 260  | 200  | 520    | 310  | 230  | -        | -    | -    |   |
|                    | Duplex   | S-AU                   | 200                  | 14.3     | 390                    | 230  | 160  | 330    | 200  | 130  | 390    | 230  | 180  | -        | -    | -    |   |
|                    | Stainless  | AU-PH                  | 330                  | 14.4     | 330                    | 200  | 130  | 260    | 160  | 130  | 330    | 200  | 150  | -        | -    | -    |   |
| K                  | Grey cast iron   | ferrit./pearl.         | 180                  | 15       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -        | -    | -    |   |
|                    |  | pearlitic              | 260                  | 16       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -        | -    | -    |   |
|                    | Nodular cast iron  | ferritic               | 160                  | 17       | 790                    | 590  | 520  | 660    | 490  | 430  | 820    | 620  | 540  | -        | -    | -    |   |
|                    |  | pearlitic              | 250                  | 18       | 660                    | 490  | 430  | 560    | 430  | 360  | 690    | 520  | 460  | -        | -    | -    |   |
|                    | Malleable cast iron  | ferritic               | 130                  | 19       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -        | -    | -    |   |
| pearlitic          |  | 230                    | 20                   | -        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -        | -    |      |   |
| N                  | Wrought  | Non AG                 | 60                   | 21       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | 5910     | 3120 | 1940 |   |
|                    |  | AG                     | 100                  | 22       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | 2890     | 1640 | 1330 |   |
|                    | Cast aluminum alloys   | Non Ag                 | 75                   | 23       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | 5250     | 2820 | 1770 |   |
|                    |  | Si ≤ 12% AG            | 90                   | 24       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | 3120     | 1940 | 1480 |   |
|                    |  | Si ≥ 12%               | 130                  | 25       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | 2230     | 1480 | 1030 |   |
|                    | Copper & Copper alloys   | Pb > 1%                | 110                  | 26       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | 2200     | 1640 | 1020 |   |
|                    |  |                        | 90                   | 27       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | 2300     | 2000 | 1640 |   |
|                    |  |                        | 100                  | 28       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | 2460     | 2170 | 1770 |   |
| Non Metals         |  |                        | 29                   | -        | -                      | -    | -    | -      | -    | -    | -      | -    | 2460 | 2130     | 1740 |      |   |
|                    |  |                        | 30                   | -        | -                      | -    | -    | -      | -    | -    | -      | -    | 2300 | 2150     | 1640 |      |   |
| S                  | High Temp  | G                      | 200                  | 31       | -                      | -    | -    | 200    | 160  | 150  | -      | -    | -    | -        | -    | -    |   |
|                    | Alloy FE   | AG                     | 280                  | 32       | -                      | -    | -    | 160    | 130  | 110  | -      | -    | -    | -        | -    | -    |   |
|                    | High Temp  | G                      | 250                  | 33       | -                      | -    | -    | 110    | 80   | 70   | -      | -    | -    | -        | -    | -    |   |
|                    | Alloy  | AG                     | 350                  | 34       | -                      | -    | -    | 100    | 70   | 50   | -      | -    | -    | -        | -    | -    |   |
|                    | Ni / Co  | GO                     | 320                  | 35       | -                      | -    | -    | 100    | 70   | 50   | -      | -    | -    | -        | -    | -    |   |
|                    | Titanium alloys  |                        |                      | 36       | -                      | -    | -    | 260    | 160  | 130  | -      | -    | -    | -        | -    | -    |   |
|                    | TiAL6V4  | AG                     |                      | 37       | -                      | -    | -    | 230    | 150  | 110  | -      | -    | -    | -        | -    | -    |   |

# Cutting Data

## for M1200 Mini Milling Cutters using 1/2" I.C. Inserts

| ANSI ISO 513                                       | Cutting Data for M1200 Milling Cutters                           |                        |                      |          |           | COATED                 |      |      |             |      |      |             |      |      |             |      |      |            |      |      |   |
|--|--|------------------------|----------------------|----------|-----------|------------------------|------|------|-------------|------|------|-------------|------|------|-------------|------|------|------------|------|------|---|
|  | Cutter   |                        | Carbide Insert       |          |           | TN5515                 |      |      | TN6501      |      |      | TH6505      |      |      | TN6510      |      |      | TN6520     |      |      |   |
|  |  |                        |                      |          |           | feed per tooth *(inch) |      |      |             |      |      |             |      |      |             |      |      |            |      |      |   |
| M1200 Mini Milling Cutters Using 1/2" I.C. Inserts |  |                        | HNGJ-07- LDJ         |          |           | -                      | -    | -    | .003        | .004 | .012 | -           | -    | -    | -           | -    | -    | -          | -    | -    | - |
|  |  |                        | HNGJ-07, HNPJ-07- LD |          |           | .003                   | .006 | .010 | -           | -    | -    | .003        | .004 | .010 | .004        | .007 | .011 | .004       | .007 | .011 |   |
|  |  |                        | HNGJ-07, HNPJ-07- GD |          |           | .005                   | .008 | .014 | -           | -    | -    | -           | -    | -    | .005        | .009 | .015 | .006       | .009 | .016 |   |
|  |  |                        | HNGJ-07, HNPJ-07- HD |          |           | .007                   | .010 | .022 | -           | -    | -    | -           | -    | -    | .008        | .011 | .024 | .008       | .011 | .024 |   |
| P  | Work Material  | Condition              | Hardness HB          | Mat. Gr. | vc *(sfm) |                        |      |      |             |      |      |             |      |      |             |      |      |            |      |      |   |
|  | Carbon steel, Unalloyed steel, cast steel and free cutting steel | < 0.25% C annealed     | 125                  | 1        | -         | -                      | -    | -    | -           | -    | 1510 | <b>1150</b> | 980  | -    | -           | -    | -    | -          | -    | -    |   |
|  |  | ≥ 0.25% C annealed     | 190                  | 2        | -         | -                      | -    | -    | -           | -    | 1020 | <b>750</b>  | 690  | -    | -           | -    | -    | -          | -    | -    |   |
|  |  | < 0.55% C heat-treated | 250                  | 3        | -         | -                      | -    | -    | -           | -    | 850  | <b>660</b>  | 560  | -    | -           | -    | -    | -          | -    | -    |   |
|  |  | ≥ 0.55% C annealed     | 220                  | 4        | -         | -                      | -    | -    | -           | -    | 890  | <b>690</b>  | 560  | -    | -           | -    | -    | -          | -    | -    |   |
|  |  | ≥ 0.55% C heat-treated | 300                  | 5        | -         | -                      | -    | -    | -           | -    | 720  | <b>560</b>  | 460  | -    | -           | -    | -    | -          | -    | -    |   |
|  | Low alloy steel and cast steel                                   | annealed               | 200                  | 6        | -         | -                      | -    | -    | -           | -    | 980  | <b>720</b>  | 590  | -    | -           | -    | -    | -          | -    | -    |   |
|  |  | heat-treated           | 275                  | 7        | -         | -                      | -    | -    | -           | -    | 720  | <b>560</b>  | 520  | -    | -           | -    | -    | -          | -    | -    |   |
|  |  | heat-treated           | 300                  | 8        | -         | -                      | -    | -    | -           | -    | 660  | <b>520</b>  | 430  | -    | -           | -    | -    | -          | -    | -    |   |
|  |  | heat-treated           | 350                  | 9        | -         | -                      | -    | -    | -           | -    | 560  | <b>430</b>  | 330  | -    | -           | -    | -    | -          | -    | -    |   |
|  | High alloy steel, cast steel & tool steel                        | annealed               | 200                  | 10       | -         | -                      | -    | -    | -           | -    | 720  | <b>590</b>  | 560  | -    | -           | -    | -    | -          | -    | -    |   |
|  |  | heat-treated           | 325                  | 11       | -         | -                      | -    | -    | -           | -    | 520  | <b>390</b>  | 300  | -    | -           | -    | -    | -          | -    | -    |   |
|  | 400 series stainless   | FE / MA                | 200                  | 12       | -         | -                      | -    | -    | -           | -    | 950  | <b>720</b>  | 590  | -    | -           | -    | -    | -          | -    | -    |   |
|  |  | MA                     | 240                  | 13.1     | -         | -                      | -    | -    | -           | -    | 820  | <b>590</b>  | 520  | -    | -           | -    | -    | -          | -    | -    |   |
|  |  | MA / PH                | 330                  | 13.2     | -         | -                      | -    | -    | -           | -    | 430  | <b>300</b>  | 260  | -    | -           | -    | -    | -          | -    | -    |   |
| M  | 300 Series   | AU                     | 180                  | 14.1     | -         | -                      | -    | -    | -           | -    | -    | -           | -    | -    | -           | -    | -    | -          | -    |      |   |
|  | Stainless  | DU                     | 230                  | 14.2     | -         | -                      | -    | -    | -           | -    | -    | -           | -    | -    | -           | -    | -    | -          | -    |      |   |
|  | Duplex   | S-AU                   | 200                  | 14.3     | -         | -                      | -    | -    | -           | -    | -    | -           | -    | -    | -           | -    | -    | -          | -    |      |   |
|  | Stainless  | AU-PH                  | 330                  | 14.4     | -         | -                      | -    | -    | -           | -    | -    | -           | -    | -    | -           | -    | -    | -          | -    |      |   |
| K  | Grey cast iron   | ferrit./pearl.         | 180                  | 15       | 1740      | <b>1280</b>            | 920  | -    | -           | -    | -    | -           | -    | 1570 | <b>1150</b> | 820  | 1250 | <b>920</b> | 660  |      |   |
|  |  | pearlitic              | 260                  | 16       | 1350      | <b>1020</b>            | 750  | -    | -           | -    | -    | -           | -    | 1210 | 920         | 690  | 980  | 720        | 560  |      |   |
|  | Nodular cast iron  | ferritic               | 160                  | 17       | 1510      | <b>1020</b>            | 750  | -    | -           | -    | 1020 | <b>750</b>  | 690  | 1380 | <b>920</b>  | 690  | 1120 | <b>720</b> | 560  |      |   |
|  |  | pearlitic              | 250                  | 18       | 980       | <b>720</b>             | 560  | -    | -           | -    | 850  | <b>660</b>  | 560  | 890  | <b>660</b>  | 490  | 720  | <b>520</b> | 390  |      |   |
|  | Malleable cast iron  | ferritic               | 130                  | 19       | 1210      | <b>950</b>             | 720  | -    | -           | -    | -    | -           | -    | 1120 | 850         | 660  | 890  | 690        | 520  |      |   |
|  |  | pearlitic              | 230                  | 20       | 1020      | <b>750</b>             | 590  | -    | -           | -    | -    | -           | -    | 920  | 690         | 520  | 720  | 560        | 430  |      |   |
| N  | Wrought  | Non AG                 | 60                   | 21       | -         | -                      | -    | 6560 | <b>3440</b> | 2130 | -    | -           | -    | -    | -           | -    | -    | -          | -    |      |   |
|  |  | AG                     | 100                  | 22       | -         | -                      | -    | 3220 | <b>1800</b> | 1480 | -    | -           | -    | -    | -           | -    | -    | -          | -    |      |   |
|  | Cast aluminum alloys   | Non Ag                 | 75                   | 23       | -         | -                      | -    | 5910 | <b>3120</b> | 1970 | -    | -           | -    | -    | -           | -    | -    | -          | -    |      |   |
|  |  | Si ≤ 12% AG            | 90                   | 24       | -         | -                      | -    | 3440 | <b>2130</b> | 1640 | -    | -           | -    | -    | -           | -    | -    | -          | -    |      |   |
|  |  | Si ≥ 12%               | 130                  | 25       | -         | -                      | -    | 2460 | <b>1640</b> | 1150 | -    | -           | -    | -    | -           | -    | -    | -          | -    |      |   |
|  | Copper & Copper alloys   | Pb > 1%                |                      | 110      | 26        | -                      | -    | -    | -           | -    | -    | -           | -    | -    | -           | -    | -    | -          | -    | -    |   |
|  |  |                        |                      | 90       | 27        | -                      | -    | -    | -           | -    | -    | -           | -    | -    | -           | -    | -    | -          | -    | -    |   |
|  |  |                        |                      | 100      | 28        | -                      | -    | -    | -           | -    | -    | -           | -    | -    | -           | -    | -    | -          | -    | -    |   |
| Non Metals   |  |                        | 29                   | -        | -         | -                      | -    | -    | -           | -    | -    | -           | -    | -    | -           | -    | -    | -          | -    |      |   |
|  |  |                        | 30                   | -        | -         | -                      | -    | -    | -           | -    | -    | -           | -    | -    | -           | -    | -    | -          | -    |      |   |

### Factors for M1200 Milling Cutters:



$$hm = fz \cdot \sqrt{\frac{ae}{D1}}$$

$$fz = hm \cdot \sqrt{\frac{D1}{ae}}$$

First choice starting speed (vc) are in bold type. Use corresponding feed (fz).

fz and vc are valid for  $ae \geq 0.4 D1$ .

For smaller ae, fz and vc should be multiplied by the following factors:

| ae / D1            | 0.1 | 0.2 | 0.3 | 0.4 |
|--------------------|-----|-----|-----|-----|
| <b>fz - Factor</b> | 2   | 1.5 | 1.3 | 1   |
| <b>fc - Factor</b> | 1.4 | 1.3 | 1.2 | 1.1 |

# Cutting Data

## for M1200 Milling Cutters using 5/8" I.C. Inserts

| ANSI<br>ISO<br>513 | Cutting Data for M1200 Milling Cutters                                       |                        |                      |             | COATED                 |      |      |        |      |      |        |      |      | UNCOATED |      |      |      |
|--------------------|--|------------------------|----------------------|-------------|------------------------|------|------|--------|------|------|--------|------|------|----------|------|------|------|
|                    | Cutter   |                        | Carbide Insert       |             | TN6525                 |      |      | TN6540 |      |      | TN7535 |      |      | THM-U    |      |      |      |
|                    |  |                        |                      |             | feed per tooth *(inch) |      |      |        |      |      |        |      |      |          |      |      |      |
|                    | M1200<br>Milling Cutters<br>using 5/8" I.C. Inserts                          |                        | HNGJ-09- LDJ         |             | -                      | -    | -    | -      | -    | -    | -      | -    | -    | .003     | .005 | .012 |      |
|                    |  |                        | HNGJ-09, HNPJ-09- LD |             | .004                   | .007 | .013 | .005   | .009 | .017 | .005   | .008 | .016 | -        | -    | -    |      |
|                    |  |                        | HNGJ-09, HNPJ-09- GD |             | .005                   | .008 | .016 | .007   | .011 | .022 | .006   | .010 | .020 | -        | -    | -    |      |
|                    |  |                        | HNGJ-09, HNPJ-09- HD |             | .007                   | .010 | .020 | .009   | .013 | .026 | .008   | .012 | .024 | -        | -    | -    |      |
| P                  | Work Material  | Condition              | Hardness<br>HB       | Mat.<br>Gr. | vc *(sfm)              |      |      |        |      |      |        |      |      |          |      |      |      |
|                    | Carbon steel,<br>Unalloyed<br>steel, cast<br>steel and free<br>cutting steel | < 0.25% C annealed     | 125                  | 1           | 1150                   | 890  | 750  | 950    | 720  | 620  | 1180   | 920  | 790  | -        | -    | -    |      |
|                    |  | ≥ 0.25% C annealed     | 190                  | 2           | 790                    | 590  | 520  | 660    | 490  | 430  | 820    | 620  | 540  | -        | -    | -    |      |
|                    |  | < 0.55% C heat-treated | 250                  | 3           | 660                    | 490  | 430  | 560    | 430  | 360  | 690    | 520  | 460  | -        | -    | -    |      |
|                    |  | ≥ 0.55% C              | annealed             | 220         | 4                      | 690  | 520  | 430    | 560  | 430  | 360    | 710  | 540  | 460      | -    | -    | -    |
|                    |  |                        | heat-treated         | 300         | 5                      | 560  | 430  | 360    | 460  | 330  | 300    | 590  | 430  | 360      | -    | -    | -    |
|                    | Low alloy steel<br>and cast steel  | annealed               | 200                  | 6           | 750                    | 560  | 460  | 620    | 460  | 390  | 790    | 590  | 490  | -        | -    | -    |      |
|                    |  | heat-treated           | 275                  | 7           | 560                    | 430  | 390  | 460    | 360  | 330  | 590    | 460  | 390  | -        | -    | -    |      |
|                    |  | heat-treated           | 300                  | 8           | 490                    | 390  | 330  | 430    | 330  | 260  | 520    | 390  | 330  | -        | -    | -    |      |
|                    |  | heat-treated           | 350                  | 9           | 430                    | 330  | 260  | 360    | 260  | 200  | 460    | 330  | 260  | -        | -    | -    |      |
|                    | High alloy steel, cast steel<br>& tool steel                                 | annealed               | 200                  | 10          | 560                    | 460  | 430  | 460    | 390  | 330  | 590    | 480  | 430  | -        | -    | -    |      |
|                    |  | heat-treated           | 325                  | 11          | 390                    | 300  | 230  | 330    | 230  | 200  | 390    | 300  | 230  | -        | -    | -    |      |
|                    | 400 series stainless   | FE / MA                | 200                  | 12          | 720                    | 560  | 460  | 590    | 460  | 390  | 750    | 570  | 490  | -        | -    | -    |      |
| MA                 |  | 240                    | 13.1                 | 620         | 460                    | 390  | 520  | 390    | 330  | 660  | 480    | 390  | -    | -        | -    |      |      |
| MA / PH            |  | 330                    | 13.2                 | 310         | 230                    | 200  | 260  | 200    | 160  | 330  | 250    | 200  | -    | -        | -    |      |      |
| M                  | 300 Series   | AU                     | 180                  | 14.1        | 620                    | 390  | 300  | 520    | 330  | 230  | 660    | 390  | 300  | -        | -    | -    |      |
|                    | Stainless  | DU                     | 230                  | 14.2        | 490                    | 300  | 230  | 430    | 260  | 200  | 520    | 310  | 230  | -        | -    | -    |      |
|                    | Duplex   | S-AU                   | 200                  | 14.3        | 390                    | 230  | 160  | 330    | 200  | 130  | 390    | 230  | 180  | -        | -    | -    |      |
|                    | Stainless  | AU-PH                  | 330                  | 14.4        | 330                    | 200  | 130  | 260    | 160  | 130  | 330    | 200  | 150  | -        | -    | -    |      |
| K                  | Grey cast iron   | ferrit./pearl.         | 180                  | 15          | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -        | -    | -    |      |
|                    |  | pearlitic              | 260                  | 16          | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -        | -    | -    |      |
|                    | Nodular cast iron  | ferritic               | 160                  | 17          | 790                    | 590  | 520  | 660    | 490  | 430  | 820    | 620  | 540  | -        | -    | -    |      |
|                    |  | pearlitic              | 250                  | 18          | 660                    | 490  | 430  | 560    | 430  | 360  | 690    | 520  | 460  | -        | -    | -    |      |
|                    | Malleable cast iron  | ferritic               | 130                  | 19          | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -        | -    | -    |      |
| pearlitic          |  | 230                    | 20                   | -           | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -        | -    |      |      |
| N                  | Wrought  | Non AG                 | 60                   | 21          | -                      | -    | -    | -      | -    | -    | -      | -    | -    | 5910     | 3120 | 1940 |      |
|                    |  | AG                     | 100                  | 22          | -                      | -    | -    | -      | -    | -    | -      | -    | -    | 2890     | 1640 | 1330 |      |
|                    | Cast aluminum<br>alloys  | Non Ag                 | 75                   | 23          | -                      | -    | -    | -      | -    | -    | -      | -    | -    | 5250     | 2820 | 1770 |      |
|                    |  | Si ≤ 12%               | AG                   | 90          | 24                     | -    | -    | -      | -    | -    | -      | -    | -    | -        | 3120 | 1940 | 1480 |
|                    |  |                        | Si ≥ 12%             | 130         | 25                     | -    | -    | -      | -    | -    | -      | -    | -    | -        | 2230 | 1480 | 1030 |
|                    | Copper &<br>Copper alloys  | Pb > 1%                |                      | 110         | 26                     | -    | -    | -      | -    | -    | -      | -    | -    | -        | 2200 | 1640 | 1020 |
|                    |  |                        |                      | 90          | 27                     | -    | -    | -      | -    | -    | -      | -    | -    | -        | 2300 | 2000 | 1640 |
|                    |  |                        | 100                  | 28          | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -        | 2460 | 2170 | 1770 |
| Non Metals         |  |                        | 29                   | -           | -                      | -    | -    | -      | -    | -    | -      | -    | -    | 2460     | 2130 | 1740 |      |
|                    |  |                        | 30                   | -           | -                      | -    | -    | -      | -    | -    | -      | -    | -    | 2300     | 2150 | 1640 |      |
| S                  | High Temp  | G                      | 200                  | 31          | -                      | -    | -    | 200    | 160  | 150  | -      | -    | -    | -        | -    | -    |      |
|                    | Alloy FE   | AG                     | 280                  | 32          | -                      | -    | -    | 160    | 130  | 110  | -      | -    | -    | -        | -    | -    |      |
|                    | High Temp  | G                      | 250                  | 33          | -                      | -    | -    | 110    | 80   | 70   | -      | -    | -    | -        | -    | -    |      |
|                    | Alloy  | AG                     | 350                  | 34          | -                      | -    | -    | 100    | 70   | 50   | -      | -    | -    | -        | -    | -    |      |
|                    | Ni / Co  | GO                     | 320                  | 35          | -                      | -    | -    | 100    | 70   | 50   | -      | -    | -    | -        | -    | -    |      |
|                    | Titanium alloys  |                        |                      | 36          | -                      | -    | -    | 260    | 160  | 130  | -      | -    | -    | -        | -    | -    |      |
|                    | TiAl6V4  | AG                     |                      | 37          | -                      | -    | -    | 230    | 150  | 110  | -      | -    | -    | -        | -    | -    |      |

# Cutting Data

## for M1200 Milling Cutters using 5/8" I.C. Inserts

| ANSI ISO 513                                  | Cutting Data for M1200 Milling Cutters                           |                |                      |          | COATED                 |      |      |        |      |      |        |      |      |        |      |      |   |   |
|---|--|----------------|----------------------|----------|------------------------|------|------|--------|------|------|--------|------|------|--------|------|------|---|---|
|   | Cutter   |                | Carbide Insert       |          | TN5515                 |      |      | TN6501 |      |      | TN6510 |      |      | TN6520 |      |      |   |   |
|   |  |                |                      |          | feed per tooth *(inch) |      |      |        |      |      |        |      |      |        |      |      |   |   |
| M1200 Milling Cutters using 5/8" I.C. Inserts |  |                | HNGJ-09- LDJ         |          | -                      | -    | -    | .003   | .005 | .012 | -      | -    | -    | -      | -    | -    | - | - |
|   |  |                | HNGJ-09, HNPJ-09- LD |          | .005                   | .008 | .016 | -      | -    | -    | .005   | .009 | .017 | .006   | .009 | .019 |   |   |
|   |  |                | HNGJ-09, HNPJ-09- GD |          | .006                   | .010 | .020 | -      | -    | -    | .007   | .011 | .022 | .007   | .011 | .023 |   |   |
|   |  |                | HNGJ-09, HNPJ-09- HD |          | .008                   | .012 | .024 | -      | -    | -    | .009   | .013 | .026 | .009   | .014 | .027 |   |   |
| P   | Work Material  | Condition      | Hardness HB          | Mat. Gr. | vc *(sfm)              |      |      |        |      |      |        |      |      |        |      |      |   |   |
|   | Carbon steel, Unalloyed steel, cast steel and free cutting steel | < 0.25% C      | annealed             | 125      | 1                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | - | - |
|   |  | ≥ 0.25% C      | annealed             | 190      | 2                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | - | - |
|   |  | < 0.55% C      | heat-treated         | 250      | 3                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | - | - |
|   |  | ≥ 0.55% C      | annealed             | 220      | 4                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | - | - |
|   |  |                | heat-treated         | 300      | 5                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | - | - |
|   | Low alloy steel and cast steel                                   | annealed       | 200                  | 6        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | - |   |
|   |  | heat-treated   | 275                  | 7        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | - |   |
|   |  | heat-treated   | 300                  | 8        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | - |   |
|   |  | heat-treated   | 350                  | 9        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | - |   |
|   | High alloy steel, cast steel & tool steel                        | annealed       | 200                  | 10       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | - |   |
|   |  | heat-treated   | 325                  | 11       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | - |   |
| 400 series stainless                          | FE / MA  | 200            | 12                   | -        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    |   |   |
|   | MA   | 240            | 13.1                 | -        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    |   |   |
|   | MA / PH  | 330            | 13.2                 | -        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    |   |   |
| M   | 300 Series   | AU             | 180                  | 14.1     | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    |   |   |
|   | Stainless  | DU             | 230                  | 14.2     | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    |   |   |
|   | Duplex   | S-AU           | 200                  | 14.3     | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    |   |   |
|   | Stainless  | AU-PH          | 330                  | 14.4     | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    |   |   |
| K   | Grey cast iron   | ferrit./pearl. | 180                  | 15       | 1740                   | 1280 | 920  | -      | -    | -    | 1570   | 1150 | 820  | 1250   | 920  | 660  |   |   |
|   |  | pearlitic      | 260                  | 16       | 1350                   | 1020 | 750  | -      | -    | -    | 1210   | 920  | 690  | 980    | 720  | 560  |   |   |
|   | Nodular cast iron  | ferritic       | 160                  | 17       | 1510                   | 1020 | 750  | -      | -    | -    | 1380   | 920  | 690  | 1120   | 720  | 560  |   |   |
|   |  | pearlitic      | 250                  | 18       | 980                    | 720  | 560  | -      | -    | -    | 890    | 660  | 490  | 720    | 520  | 390  |   |   |
|   | Malleable cast iron  | ferritic       | 130                  | 19       | 1210                   | 950  | 720  | -      | -    | -    | 1120   | 850  | 660  | 890    | 690  | 520  |   |   |
| pearlitic                                     |  | 230            | 20                   | 1020     | 750                    | 590  | -    | -      | -    | 920  | 690    | 520  | 720  | 560    | 430  |      |   |   |
| N   | Wrought  | Non AG         | 60                   | 21       | -                      | -    | -    | 6560   | 3440 | 2130 | -      | -    | -    | -      | -    | -    |   |   |
|   |  | AG             | 100                  | 22       | -                      | -    | -    | 3220   | 1800 | 1480 | -      | -    | -    | -      | -    | -    |   |   |
|   | Cast aluminum alloys   | Non Ag         | 75                   | 23       | -                      | -    | -    | 5910   | 3120 | 1970 | -      | -    | -    | -      | -    | -    |   |   |
|   |  | Si ≤ 12%       | AG                   | 90       | 24                     | -    | -    | -      | 3440 | 2130 | 1640   | -    | -    | -      | -    | -    |   |   |
|   |  | Si ≥ 12%       |                      | 130      | 25                     | -    | -    | -      | 2460 | 1640 | 1150   | -    | -    | -      | -    | -    |   |   |
|   | Copper & Copper alloys   | Pb > 1%        |                      | 110      | 26                     | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    |   |   |
|   |  |                |                      | 90       | 27                     | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    |   |   |
|   |  |                |                      | 100      | 28                     | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    |   |   |
| Non Metals                                    |  |                | 29                   | -        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      |      |      |   |   |
|   |  |                | 30                   | -        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      |      |      |   |   |
| S   | High Temp  | G              | 200                  | 31       |                        |      |      |        |      |      |        |      |      |        |      |      |   |   |
|   | Alloy FE   | AG             | 280                  | 32       |                        |      |      |        |      |      |        |      |      |        |      |      |   |   |
|   | High Temp  | G              | 250                  | 33       |                        |      |      |        |      |      |        |      |      |        |      |      |   |   |
|   | Alloy  | AG             | 350                  | 34       |                        |      |      |        |      |      |        |      |      |        |      |      |   |   |
|   | Ni / Co  | GO             | 320                  | 35       |                        |      |      |        |      |      |        |      |      |        |      |      |   |   |
|   | Titanium alloys  |                |                      | 36       |                        |      |      |        |      |      |        |      |      |        |      |      |   |   |
|   | TiAL6V4  | AG             |                      | 37       |                        |      |      |        |      |      |        |      |      |        |      |      |   |   |

# Cutting Data

## for M1200 High Feed Milling Cutters using 5/8" I.C. Inserts

| ANSI<br>ISO<br>513 | Cutting Data for M1200 Milling Cutters                           |                        |                |          | COATED                 |      |        |      |      | UNCOATED |      |      |      |      |
|--------------------|--|------------------------|----------------|----------|------------------------|------|--------|------|------|----------|------|------|------|------|
|                    | Cutter   |                        | Carbide Insert |          | TN6540                 |      | TN7535 |      |      | THM-U    |      |      |      |      |
|                    |  |                        |                |          | feed per tooth *(inch) |      |        |      |      |          |      |      |      |      |
|                    | M1200 High Feed Milling Cutters using 5/8" I.C. Inserts          |                        | - LDJ          |          | -                      | -    | -      | -    | -    | -        | .008 | .018 | .039 |      |
|                    |  |                        | - LD           |          | .016                   | .030 | .061   | .014 | .026 | .055     | -    | -    | -    |      |
|                    |  |                        | - GD           |          | .022                   | .039 | .079   | .020 | .034 | .071     | -    | -    | -    |      |
|                    |  |                        | - HD           |          | .028                   | .051 | .110   | .026 | .047 | .098     | -    | -    | -    |      |
| P                  | Work Material  | Condition              | Hardness HB    | Mat. Gr. | vc *(sfm)              |      |        |      |      |          |      |      |      |      |
|                    | Carbon steel, Unalloyed steel, cast steel and free cutting steel | < 0.25% C annealed     | 125            | 1        | 950                    | 720  | 620    | 1180 | 920  | 790      | -    | -    | -    |      |
|                    |  | ≥ 0.25% C annealed     | 190            | 2        | 660                    | 490  | 430    | 820  | 620  | 540      | -    | -    | -    |      |
|                    |  | < 0.55% C heat-treated | 250            | 3        | 560                    | 430  | 360    | 690  | 520  | 460      | -    | -    | -    |      |
|                    |  | ≥ 0.55% C              | annealed       | 220      | 4                      | 560  | 430    | 360  | 710  | 540      | 460  | -    | -    | -    |
|                    |  |                        | heat-treated   | 300      | 5                      | 460  | 330    | 300  | 590  | 430      | 360  | -    | -    | -    |
|                    | Low alloy steel and cast steel                                   | annealed               | 200            | 6        | 620                    | 460  | 390    | 790  | 590  | 490      | -    | -    | -    |      |
|                    |  | heat-treated           | 275            | 7        | 460                    | 360  | 330    | 590  | 460  | 390      | -    | -    | -    |      |
|                    |  | heat-treated           | 300            | 8        | 430                    | 330  | 260    | 520  | 390  | 330      | -    | -    | -    |      |
|                    |  | heat-treated           | 350            | 9        | 360                    | 260  | 200    | 460  | 330  | 260      | -    | -    | -    |      |
|                    | High alloy steel, cast steel & tool steel                        | annealed               | 200            | 10       | 460                    | 390  | 330    | 590  | 480  | 430      | -    | -    | -    |      |
|                    |  | heat-treated           | 325            | 11       | 330                    | 230  | 200    | 390  | 300  | 230      | -    | -    | -    |      |
|                    | 400 series stainless   | FE / MA                | 200            | 12       | 590                    | 460  | 390    | 750  | 570  | 490      | -    | -    | -    |      |
| MA                 |  | 240                    | 13.1           | 520      | 390                    | 330  | 660    | 480  | 390  | -        | -    | -    |      |      |
| MA / PH            |  | 330                    | 13.2           | 260      | 200                    | 160  | 330    | 250  | 200  | -        | -    | -    |      |      |
| M                  | 300 Series   | AU                     | 180            | 14.1     | 520                    | 330  | 230    | 660  | 390  | 300      | -    | -    | -    |      |
|                    | Stainless  | DU                     | 230            | 14.2     | 430                    | 260  | 200    | 520  | 310  | 230      | -    | -    | -    |      |
|                    | Duplex   | S-AU                   | 200            | 14.3     | 330                    | 200  | 130    | 390  | 230  | 180      | -    | -    | -    |      |
|                    | Stainless  | AU-PH                  | 330            | 14.4     | 260                    | 160  | 130    | 330  | 200  | 150      | -    | -    | -    |      |
| K                  | Grey cast iron   | ferrit./pearl.         | 180            | 15       | -                      | -    | -      | -    | -    | -        | -    | -    | -    |      |
|                    |  | pearlitic              | 260            | 16       | -                      | -    | -      | -    | -    | -        | -    | -    | -    |      |
|                    | Nodular cast iron  | ferritic               | 160            | 17       | 660                    | 490  | 430    | 820  | 620  | 540      | -    | -    | -    |      |
|                    |  | pearlitic              | 250            | 18       | 560                    | 430  | 360    | 690  | 520  | 460      | -    | -    | -    |      |
|                    | Malleable cast iron  | ferritic               | 130            | 19       | -                      | -    | -      | -    | -    | -        | -    | -    | -    |      |
| pearlitic          |  | 230                    | 20             | -        | -                      | -    | -      | -    | -    | -        | -    | -    |      |      |
| N                  | Wrought  | Non AG                 | 60             | 21       | -                      | -    | -      | -    | -    | -        | 5910 | 3120 | 1940 |      |
|                    |  | AG                     | 100            | 22       | -                      | -    | -      | -    | -    | -        | 2890 | 1640 | 1330 |      |
|                    | Cast aluminum alloys   | Non Ag                 | 75             | 23       | -                      | -    | -      | -    | -    | -        | 5250 | 2820 | 1770 |      |
|                    |  | Si ≤ 12%               | AG             | 90       | 24                     | -    | -      | -    | -    | -        | -    | 3120 | 1940 | 1480 |
|                    |  |                        | Si ≥ 12%       | 130      | 25                     | -    | -      | -    | -    | -        | -    | 2230 | 1480 | 1030 |
|                    | Copper & Copper alloys   | Pb > 1%                |                | 110      | 26                     | -    | -      | -    | -    | -        | -    | 2200 | 1640 | 1020 |
|                    |  |                        |                | 90       | 27                     | -    | -      | -    | -    | -        | -    | 2300 | 2000 | 1640 |
|                    |  |                        |                | 100      | 28                     | -    | -      | -    | -    | -        | -    | 2460 | 2170 | 1770 |
| Non Metals         |  |                        | 29             | -        | -                      | -    | -      | -    | -    | 2460     | 2130 | 1740 |      |      |
|                    |  |                        |                | 30       | -                      | -    | -      | -    | -    | 2300     | 2150 | 1640 |      |      |
| S                  | High Temp  | G                      | 200            | 31       | 200                    | 160  | 150    | -    | -    | -        | -    | -    | -    |      |
|                    | Alloy FE   | AG                     | 280            | 32       | 160                    | 130  | 110    | -    | -    | -        | -    | -    | -    |      |
|                    | High Temp  | G                      | 250            | 33       | 110                    | 80   | 70     | -    | -    | -        | -    | -    | -    |      |
|                    | Alloy  | AG                     | 350            | 34       | 100                    | 70   | 50     | -    | -    | -        | -    | -    | -    |      |
|                    | Ni / Co  | GO                     | 320            | 35       | 100                    | 70   | 50     | -    | -    | -        | -    | -    | -    |      |
|                    | Titanium alloys  |                        |                | 36       | 260                    | 160  | 130    | -    | -    | -        | -    | -    | -    |      |
|                    | TiAL6V4  | AG                     |                | 37       | 230                    | 150  | 110    | -    | -    | -        | -    | -    | -    |      |

# Cutting Data

## for M1200 High Feed Milling Cutters using 5/8" I.C. Inserts

| ANSI ISO 513         | Cutting Data for M1200 Milling Cutters                           |                        |                |          | COATED                 |      |      |        |      |      |        |      |      |        |      |      |        |      |      |
|----------------------|--|------------------------|----------------|----------|------------------------|------|------|--------|------|------|--------|------|------|--------|------|------|--------|------|------|
|                      | Cutter   |                        | Carbide Insert |          | TN5515                 |      |      | TN6501 |      |      | TN6510 |      |      | TN6520 |      |      | TN6525 |      |      |
|                      |  |                        |                |          | feed per tooth *(inch) |      |      |        |      |      |        |      |      |        |      |      |        |      |      |
|                      | M1200 High Feed Milling Cutters using 5/8" I.C. Inserts          |                        | - LDJ          |          | -                      | -    | -    | .008   | .018 | .039 | -      | -    | -    | -      | -    | -    | -      | -    | -    |
|                      |  |                        | - LD           |          | .014                   | .026 | .055 | -      | -    | -    | .016   | .028 | .061 | .016   | .030 | .059 | .012   | .022 | .047 |
|                      |  |                        | - GD           |          | .020                   | .034 | .071 | -      | -    | -    | .022   | .037 | .077 | .024   | .039 | .079 | .016   | .030 | .060 |
|                      |  |                        | - HD           |          | .026                   | .047 | .098 | -      | -    | -    | .028   | .051 | .108 | .030   | .053 | .110 | .022   | .039 | .079 |
| P                    | Work Material  | Condition              | Hardness HB    | Mat. Gr. | vc *(sfm)              |      |      |        |      |      |        |      |      |        |      |      |        |      |      |
|                      | Carbon steel, Unalloyed steel, cast steel and free cutting steel | < 0.25% C annealed     | 125            | 1        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | 1150   | 890  | 750  |
|                      |  | ≥ 0.25% C annealed     | 190            | 2        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | 790    | 590  | 520  |
|                      |  | < 0.55% C heat-treated | 250            | 3        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | 660    | 490  | 430  |
|                      |  | ≥ 0.55% C annealed     | 220            | 4        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | 690    | 520  | 430  |
|                      |  | heat-treated           | 300            | 5        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | 560    | 430  | 360  |
|                      | Low alloy steel and cast steel                                   | annealed               | 200            | 6        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | 750    | 560  | 460  |
|                      |  | heat-treated           | 275            | 7        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | 560    | 430  | 390  |
|                      |  | heat-treated           | 300            | 8        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | 490    | 390  | 330  |
|                      |  | heat-treated           | 350            | 9        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | 430    | 330  | 260  |
|                      | High alloy steel, cast steel & tool steel                        | annealed               | 200            | 10       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | 560    | 460  | 430  |
|                      |  | heat-treated           | 325            | 11       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | 390    | 300  | 230  |
| 400 series stainless | FE / MA  | 200                    | 12             | -        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | 720  | 560    | 460  |      |
|                      | MA   | 240                    | 13.1           | -        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | 620  | 460    | 390  |      |
|                      | MA / PH  | 330                    | 13.2           | -        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | 310  | 230    | 200  |      |
| M                    | 300 Series   | AU                     | 180            | 14.1     | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | 620  | 390    | 300  |      |
|                      | Stainless  | DU                     | 230            | 14.2     | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | 490  | 300    | 230  |      |
|                      | Duplex   | S-AU                   | 200            | 14.3     | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | 390  | 230    | 160  |      |
|                      | Stainless  | AU-PH                  | 330            | 14.4     | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | 330  | 200    | 130  |      |
| K                    | Grey cast iron   | ferrit./pearl.         | 180            | 15       | 1740                   | 1280 | 920  | -      | -    | -    | 1570   | 1150 | 820  | 1250   | 920  | 660  | -      | -    | -    |
|                      |  | pearlitic              | 260            | 16       | 1350                   | 1020 | 750  | -      | -    | -    | 1210   | 920  | 690  | 980    | 720  | 560  | -      | -    | -    |
|                      | Nodular cast iron  | ferritic               | 160            | 17       | 1510                   | 1020 | 750  | -      | -    | -    | 1380   | 920  | 690  | 1120   | 720  | 560  | 790    | 590  | 520  |
|                      |  | pearlitic              | 250            | 18       | 980                    | 720  | 560  | -      | -    | -    | 890    | 660  | 490  | 720    | 520  | 390  | 660    | 490  | 430  |
|                      | Malleable cast iron  | ferritic               | 130            | 19       | 1210                   | 950  | 720  | -      | -    | -    | 1120   | 850  | 660  | 890    | 690  | 520  | -      | -    | -    |
| pearlitic            |  | 230                    | 20             | 1020     | 750                    | 590  | -    | -      | -    | 920  | 690    | 520  | 720  | 560    | 430  | -    | -      | -    |      |
| N                    | Wrought  | Non AG                 | 60             | 21       | -                      | -    | -    | 6560   | 3440 | 2130 | -      | -    | -    | -      | -    | -    | -      | -    |      |
|                      |  | AG                     | 100            | 22       | -                      | -    | -    | 3220   | 1800 | 1480 | -      | -    | -    | -      | -    | -    | -      | -    |      |
|                      | Cast aluminum alloys   | Non Ag                 | 75             | 23       | -                      | -    | -    | 5910   | 3120 | 1970 | -      | -    | -    | -      | -    | -    | -      | -    |      |
|                      |  | Si ≤ 12% AG            | 90             | 24       | -                      | -    | -    | 3440   | 2130 | 1640 | -      | -    | -    | -      | -    | -    | -      | -    |      |
|                      |  | Si ≥ 12%               | 130            | 25       | -                      | -    | -    | 2460   | 1640 | 1150 | -      | -    | -    | -      | -    | -    | -      | -    |      |
|                      | Copper & Copper alloys   | Pb > 1%                | 110            | 26       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    |      |
|                      |  |                        | 90             | 27       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    |      |
|                      |  |                        | 100            | 28       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    |      |
| Non Metals           |  |                        | 29             | -        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | -      |      |      |
|                      |  |                        | 30             | -        | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | -      |      |      |
| S                    | High Temp  | G                      | 200            | 31       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | -      |      |      |
|                      | Alloy FE   | AG                     | 280            | 32       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | -      |      |      |
|                      | High Temp  | G                      | 250            | 33       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | -      |      |      |
|                      | Alloy  | AG                     | 350            | 34       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | -      |      |      |
|                      | Ni / Co  | GO                     | 320            | 35       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | -      |      |      |
|                      | Titanium alloys  |                        |                | 36       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | -      |      |      |
|                      | TiAL6V4  | AG                     |                | 37       | -                      | -    | -    | -      | -    | -    | -      | -    | -    | -      | -    | -    | -      |      |      |