


# KUPFER-LINE

FRÄSWERKZEUGE  
FÜR DIE ELEKTRODEN-  
FERTIGUNG KUPFER

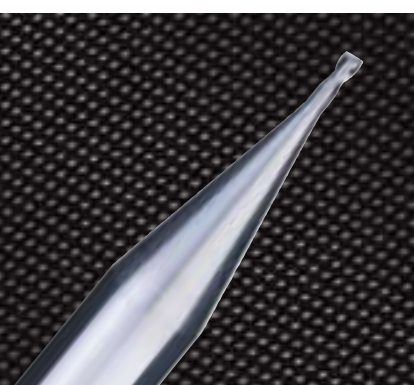
*MILLING TOOLS  
FOR  
COPPER ELECTRODES*



# KUPFER-LINE



KUPFER-LINE



## Zielsetzung:

Werkstoffoptimiertes Werkzeugprogramm für die hohen Anforderungen bei der Bearbeitung von Elektroden aus Kupfer.

## Vorteile:

Die Werkzeuge der Kupfer-Line zeichnen sich durch höchste Formgenauigkeit und Rundlaufgenauigkeit aus. Ihr besonderes Merkmal: Der Polierschliff im Spanraum und am ersten Freiwinkel des Umfangs. Hohe Standzeiten und kurze Bearbeitungszeiten machen ihren Einsatz sehr wirtschaftlich.

## Ausführungen:

Durch die große Vielfalt das richtige Werkzeug für nahezu jede Anwendung.

## Objective:

Material optimized tool program for precise machining of copper electrodes.

## Advantages:

The tools of the Copper-Line distinguish themselves with highest accuracy of shape and runout precision. The special feature: The polish grinding of the chip space and first clearance angle of the circumference. High durability and short machining times make their application economically advantageous.

## Designs:

Due to high level of diversity the correct tool for almost any application.

**Kugelfräser Z3**  
in „PIRANHA“-Geometrie mit  
ungleicher Teilung  
Kopfradius  $R = 0,5 \times d$

**Ball end mill 3F**  
with „PIRANHA“-geometry with  
unequal division  
ball radius  $R = 0,5 \times d$

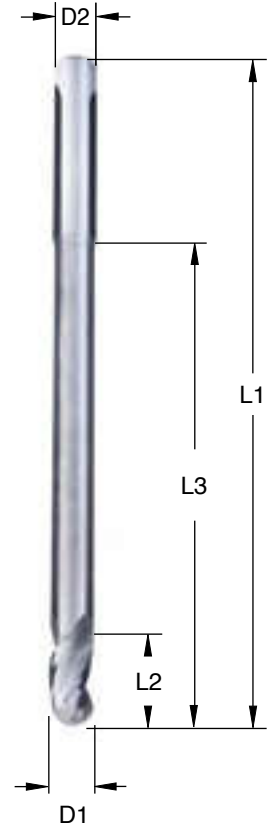
**63CWIR**

KUPFER-LINE

KUPFER-LINE



|      | BESTELL-NUMMER<br>ORDER NUMBER | D1<br>mm | D2<br>h6<br>mm | L2<br>mm | L1<br>+2<br>mm | L3<br>mm |  |  |  |
|------|--------------------------------|----------|----------------|----------|----------------|----------|--|--|--|
| 1,0  | 63CWIR01-30                    | 1        | 3              | 5        | 40             |          |  |  |  |
| 2,0  | 63CWIR02-30                    | 2        | 3              | 6        | 40             |          |  |  |  |
|      | 63CWIRL02-30                   | 2        | 3              | 15       | 75             |          |  |  |  |
|      | 63CWIRFL02-30                  | 2        | 3              | 4        | 100            | 50       |  |  |  |
| 3,0  | 63CWIR03-30                    | 3        | 3              | 10       | 40             |          |  |  |  |
|      | 63CWIRL03-30                   | 3        | 3              | 18       | 60             |          |  |  |  |
|      | 63CWIRXL03-30                  | 3        | 3              | 25       | 75             |          |  |  |  |
|      | 63CWIRFK03-30                  | 3        | 3              | 6        | 40             | 15       |  |  |  |
|      | 63CWIRF03-30                   | 3        | 3              | 6        | 60             | 30       |  |  |  |
|      | 63CWIRFL03-30                  | 3        | 3              | 6        | 100            | 50       |  |  |  |
| 4,0  | 63CWIR04-30                    | 4        | 4              | 11       | 40             |          |  |  |  |
|      | 63CWIRL04-30                   | 4        | 4              | 20       | 60             |          |  |  |  |
|      | 63CWIRXL04-30                  | 4        | 4              | 32       | 75             |          |  |  |  |
|      | 63CWIRF04-30                   | 4        | 4              | 6        | 60             | 30       |  |  |  |
|      | 63CWIRFL04-30                  | 4        | 4              | 6        | 100            | 50       |  |  |  |
| 5,0  | 63CWIR05-30                    | 5        | 5              | 13       | 50             |          |  |  |  |
|      | 63CWIRL05-30                   | 5        | 5              | 25       | 62             |          |  |  |  |
|      | 63CWIRFL05-30                  | 5        | 5              | 13       | 100            | 50       |  |  |  |
| 6,0  | 63CWIR06-30                    | 6        | 6              | 16       | 50             |          |  |  |  |
|      | 63CWIRL06-30                   | 6        | 6              | 30       | 75             |          |  |  |  |
|      | 63CWIRXL06-30                  | 6        | 6              | 40       | 100            |          |  |  |  |
|      | 63CWIRF06-30                   | 6        | 6              | 10       | 60             | 30       |  |  |  |
|      | 63CWIRFL06-30                  | 6        | 6              | 10       | 100            | 50       |  |  |  |
|      | 63CWIRFLV06-30                 | 6        | 6              | 10       | 100            | 70       |  |  |  |
| 8,0  | 63CWIR08-30                    | 8        | 8              | 19       | 63             |          |  |  |  |
|      | 63CWIRL08-30                   | 8        | 8              | 35       | 75             |          |  |  |  |
|      | 63CWIRXL08-30                  | 8        | 8              | 45       | 100            |          |  |  |  |
|      | 63CWIRF08-30                   | 8        | 8              | 12       | 75             | 35       |  |  |  |
|      | 63CWIRFL08-30                  | 8        | 8              | 12       | 100            | 50       |  |  |  |
|      | 63CWIRFXL08-30                 | 8        | 8              | 12       | 100            | 70       |  |  |  |
| 10,0 | 63CWIR10-30                    | 10       | 10             | 22       | 72             |          |  |  |  |
|      | 63CWIRL10-30                   | 10       | 10             | 40       | 89             |          |  |  |  |
|      | 63CWIRXL10-30                  | 10       | 10             | 50       | 120            |          |  |  |  |
|      | 63CWIRF10-30                   | 10       | 10             | 15       | 72             | 40       |  |  |  |
|      | 63CWIRFL10-30                  | 10       | 10             | 15       | 100            | 50       |  |  |  |
|      | 63CWIRFXL10-30                 | 10       | 10             | 15       | 100            | 70       |  |  |  |
| 12,0 | 63CWIRXL12-30                  | 12       | 12             | 60       | 150            |          |  |  |  |
|      | 63CWIRF12-30                   | 12       | 12             | 18       | 83             | 40       |  |  |  |
|      | 63CWIRFL12-30                  | 12       | 12             | 18       | 100            | 50       |  |  |  |
|      | 63CWIRFXL12-30                 | 12       | 12             | 18       | 125            | 80       |  |  |  |



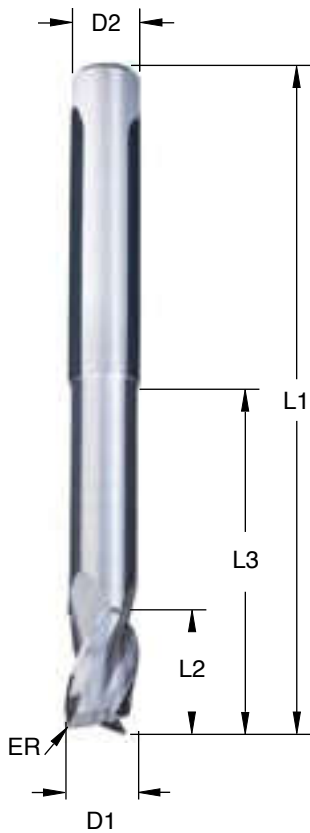
Durchmesserbereich  
diameter range  
1,0 - 12,0 mm

Mögliche Beschichtungen  
possible coatings  
TLX - Standard

Die Preise entnehmen Sie bitte unserer aktuellen Preisliste.  
Please take prices out of our actual price list.

Bei der Bestellung bitte die Bestellnummer angeben: Best.Nr.: z.B. 63CWIR03-30 und wenn gewünscht Beschichtung: z.B. TLX.  
Please indicate order number: e.g. 63CWIRXL06-30 and if wanted COATING: e.g. TLX.

**HUFSCHMIED**  
ZERSpanungssysteme



Durchmesserbereich  
*diameter range*  
 2,0 - 12,0 mm

Mögliche Beschichtungen  
*possible coatings*  
 TLX - Standard

|                 | BESTELL-NUMMER<br>ORDER NUMBER | D1<br>mm    | D2<br>h6<br>mm | L2<br>mm | L1<br>+2<br>mm | L3<br>mm | ER<br>mm |  |  |  |
|-----------------|--------------------------------|-------------|----------------|----------|----------------|----------|----------|--|--|--|
| 2,0             | 63CWI02-30                     | 2           | 3              | 6        | 40             |          | 0,3      |  |  |  |
|                 | 63CWIS02-30                    | 2           | 3              | 6        | 40             |          | 0,15     |  |  |  |
|                 | 63CWIL02025-30                 | 2           | 3              | 6        | 60             |          | 0,25     |  |  |  |
|                 | 63CWISL02-30                   | 2           | 3              | 6        | 60             |          | 0,15     |  |  |  |
|                 | 63CWIFL02-30                   | 2           | 3              | 4        | 100            | 50       | 0,3      |  |  |  |
| 3,0             | 63CWI03-30                     | 3           | 3              | 10       | 40             |          |          |  |  |  |
|                 | 63CWIS03-30                    | 3           | 3              | 10       | 40             |          | 0,15     |  |  |  |
|                 | 63CWIL03-30                    | 3           | 3              | 18       | 60             |          |          |  |  |  |
|                 | 63CWISL03-30                   | 3           | 3              | 18       | 60             |          | 0,15     |  |  |  |
|                 | 63CWXL03-30                    | 3           | 3              | 25       | 75             |          |          |  |  |  |
|                 | 63CWIF0305-30                  | 3           | 3              | 6        | 40             | 15       | 0,5      |  |  |  |
|                 | 63CWIFK0305-30                 | 3           | 3              | 6        | 60             | 30       | 0,5      |  |  |  |
|                 | 63CWIFL03-30                   | 3           | 3              | 6        | 100            | 50       | 0,5      |  |  |  |
| 4,0             | 63CWI04-30                     | 4           | 4              | 11       | 40             |          |          |  |  |  |
|                 | 63CWIS04-30                    | 4           | 4              | 11       | 40             |          | 0,2      |  |  |  |
|                 | 63CWIL04-30                    | 4           | 4              | 20       | 60             |          |          |  |  |  |
|                 | 63CWISL04-30                   | 4           | 4              | 20       | 60             |          | 0,2      |  |  |  |
|                 | 63CWXL04-30                    | 4           | 4              | 32       | 75             |          |          |  |  |  |
|                 | 63CWISXL04-30                  | 4           | 4              | 32       | 75             |          | 0,2      |  |  |  |
|                 | 63CWXL0405-30                  | 4           | 4              | 15       | 100            |          | 0,5      |  |  |  |
|                 | 63CWIFL0405-30                 | 4           | 4              | 6        | 40             | 15       | 0,5      |  |  |  |
|                 | 63CWIFK0405-30                 | 4           | 4              | 6        | 60             | 30       | 0,5      |  |  |  |
|                 | 63CWIFL04-30                   | 4           | 4              | 6        | 100            | 50       | 0,5      |  |  |  |
|                 | 5,0                            | 63CWI05-30  | 5              | 5        | 13             | 50       |          |  |  |  |
| 63CWIL05-30     |                                | 5           | 5              | 25       | 62             |          |          |  |  |  |
| 63CWXL05-30     |                                | 5           | 5              | 38       | 100            |          |          |  |  |  |
| 63CWIF0505-30   |                                | 5           | 5              | 6        | 50             | 15       | 0,5      |  |  |  |
| 63CWIFK0505-30  |                                | 5           | 5              | 6        | 62             | 30       | 0,5      |  |  |  |
| 63CWIFL05-30    |                                | 5           | 5              | 6        | 100            | 50       | 0,5      |  |  |  |
| 6,0             | 63CWI06-30                     | 6           | 6              | 16       | 50             |          |          |  |  |  |
|                 | 63CWIS06-30                    | 6           | 6              | 16       | 50             |          | 0,3      |  |  |  |
|                 | 63CWIL06-30                    | 6           | 6              | 30       | 75             |          |          |  |  |  |
|                 | 63CWISL06-30                   | 6           | 6              | 30       | 75             |          | 0,3      |  |  |  |
|                 | 63CWXL06-30                    | 6           | 6              | 40       | 100            |          |          |  |  |  |
|                 | 63CWISXL06-30                  | 6           | 6              | 40       | 100            |          | 0,3      |  |  |  |
|                 | 63CWIF0605-30                  | 6           | 6              | 10       | 60             | 30       | 0,5      |  |  |  |
|                 | 63CWIF0610-30                  | 6           | 6              | 10       | 60             | 30       | 1,0      |  |  |  |
|                 | 63CWIFL0605-30                 | 6           | 6              | 10       | 100            | 50       | 0,5      |  |  |  |
|                 | 63CWIFL0610-30                 | 6           | 6              | 10       | 100            | 50       | 1,0      |  |  |  |
|                 | 63CWIFXL0605-30                | 6           | 6              | 10       | 100            | 70       | 0,5      |  |  |  |
|                 | 63CWIFXL0610-30                | 6           | 6              | 10       | 100            | 70       | 1,0      |  |  |  |
|                 | 8,0                            | 63CWI08-30  | 8              | 8        | 19             | 63       |          |  |  |  |
|                 |                                | 63CWIL08-30 | 8              | 8        | 35             | 75       |          |  |  |  |
| 63CWXL08-30     |                                | 8           | 8              | 45       | 100            |          |          |  |  |  |
| 63CWIFL0805-30  |                                | 8           | 8              | 10       | 75             | 35       | 0,5      |  |  |  |
| 63CWIFL0810-30  |                                | 8           | 8              | 10       | 75             | 35       | 1,0      |  |  |  |
| 63CWIFL0805-30  |                                | 8           | 8              | 10       | 100            | 50       | 0,5      |  |  |  |
| 63CWIFL0810-30  |                                | 8           | 8              | 10       | 100            | 50       | 1,0      |  |  |  |
| 63CWIFXL0805-30 |                                | 8           | 8              | 10       | 100            | 70       | 0,5      |  |  |  |
| 63CWIFXL0810-30 |                                | 8           | 8              | 10       | 100            | 70       | 1,0      |  |  |  |

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Bei der Bestellung bitte die Bestellnummer angeben: Best.Nr.: z.B. 63CWISL06-30 und wenn gewünscht Beschichtung: z.B. TLX.

Please indicate order number: e.g. 63CWIXL08-30 and if wanted COATING: e.g. TLX.

**Torusfräser Z3**  
in „PIRANHA“-Geometrie mit  
ungleicher Teilung

**Toric end mill 3F**  
with „PIRANHA“-geometry with  
unequal division

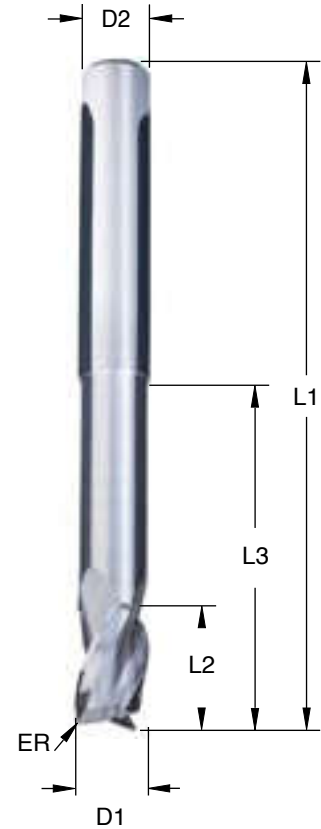
**63CWI**

KUPFER-LINE

KUPFER-LINE



|                 | BESTELL-NUMMER<br>ORDER NUMBER | D1<br>mm   | D2<br>h6<br>mm | L2<br>mm | L1<br>+2<br>mm | L3<br>mm | ER<br>mm |  |  |
|-----------------|--------------------------------|------------|----------------|----------|----------------|----------|----------|--|--|
| 10,0            | 63CWI10-30                     | 10         | 10             | 22       | 72             |          |          |  |  |
|                 | 63CWIL10-30                    | 10         | 10             | 40       | 89             |          |          |  |  |
|                 | 63CWIXL10-30                   | 10         | 10             | 50       | 120            |          |          |  |  |
|                 | 63CWIF1005-30                  | 10         | 10             | 15       | 72             | 40       | 0,5      |  |  |
|                 | 63CWIF1010-30                  | 10         | 10             | 15       | 72             | 40       | 1,0      |  |  |
|                 | 63CWIFL1005-30                 | 10         | 10             | 15       | 100            | 50       | 0,5      |  |  |
|                 | 63CWIFL1010-30                 | 10         | 10             | 15       | 100            | 50       | 1,0      |  |  |
|                 | 63CWIFXL1005-30                | 10         | 10             | 15       | 100            | 70       | 0,5      |  |  |
|                 | 63CWIFXL1010-30                | 10         | 10             | 15       | 100            | 70       | 1,0      |  |  |
|                 | 12,0                           | 63CWI12-30 | 12             | 12       | 26             | 83       |          |  |  |
| 63CWIL12-30     |                                | 12         | 12             | 50       | 100            |          |          |  |  |
| 63CWIXL12-30    |                                | 12         | 12             | 60       | 150            |          |          |  |  |
| 63CWIF1205-30   |                                | 12         | 12             | 18       | 83             | 40       | 0,5      |  |  |
| 63CWIF1210-30   |                                | 12         | 12             | 18       | 83             | 40       | 1,0      |  |  |
| 63CWIFL1205-30  |                                | 12         | 12             | 18       | 100            | 50       | 0,5      |  |  |
| 63CWIFL1210-30  |                                | 12         | 12             | 18       | 100            | 50       | 1,0      |  |  |
| 63CWIFXL1205-30 |                                | 12         | 12             | 18       | 125            | 70       | 0,5      |  |  |
| 63CWIFXL1210-30 |                                | 12         | 12             | 18       | 125            | 70       | 1,0      |  |  |



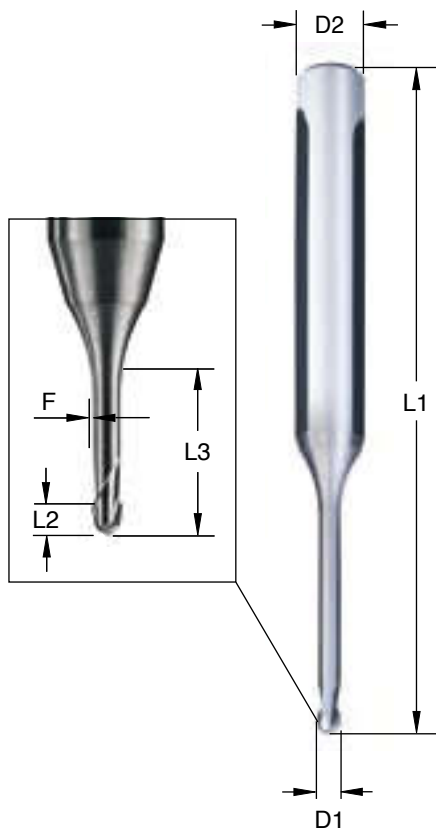
Durchmesserbereich  
diameter range  
2,0 - 12,0 mm

Mögliche Beschichtungen  
possible coatings  
TLX - Standard

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Bei der Bestellung bitte die Bestellnummer angeben: Best.Nr.: z.B. 63CWISL06-30 und wenn  
gewünscht Beschichtung: z.B. TLX.  
Please indicate order number: e.g. 63CWIXL08-30 and if wanted COATING: e.g. TLX.

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ZERSpanungssysteme



Durchmesserbereich  
diameter range  
0,2 - 2,0 mm

Mögliche Beschichtungen  
possible coatings  
TLX - Standard

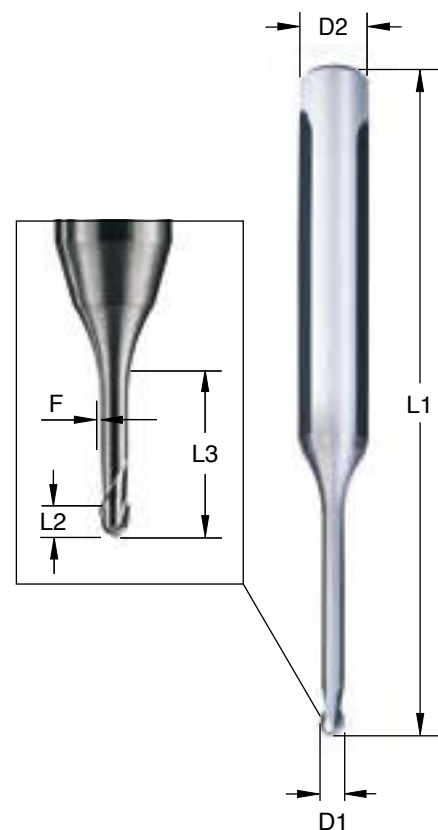
|     | BESTELL-NUMMER<br>ORDER NUMBER | D1<br>mm | D2<br>h6<br>mm | L2<br>mm | L1<br>+2<br>mm | L3<br>mm | F<br>mm |  |  |
|-----|--------------------------------|----------|----------------|----------|----------------|----------|---------|--|--|
| 0,2 | HM915MFE002                    | 0,2      | 6              | 0,3      | 60             |          |         |  |  |
| 0,3 | HM915M0032                     | 0,3      | 3              | 0,5      | 38             |          |         |  |  |
|     | HM915MF003                     | 0,3      | 4              | 0,3      | 50             | 3        | 0,01    |  |  |
|     | HM915MFL003                    | 0,3      | 4              | 0,3      | 50             | 6        | 0,01    |  |  |
|     | HM915MFEL003                   | 0,3      | 6              | 0,4      | 60             | 1        | 0,01    |  |  |
| 0,4 | HM915M0042                     | 0,4      | 3              | 0,6      | 38             |          |         |  |  |
|     | HM915MF004                     | 0,4      | 4              | 0,4      | 50             | 3        | 0,01    |  |  |
|     | HM915MFZ004                    | 0,4      | 4              | 0,4      | 50             | 4        | 0,01    |  |  |
|     | HM915MFL004                    | 0,4      | 4              | 0,4      | 50             | 8        | 0,01    |  |  |
|     | HM915MFEL004                   | 0,4      | 6              | 0,5      | 60             | 1,2      | 0,01    |  |  |
|     | HM915MFEXL004                  | 0,4      | 6              | 0,5      | 60             | 4        | 0,01    |  |  |
| 0,5 | HM915M0052                     | 0,5      | 3              | 0,8      | 38             |          |         |  |  |
|     | HM915ML0052                    | 0,5      | 4              | 1,5      | 50             |          |         |  |  |
|     | HM915L005                      | 0,5      | 3              | 0,5      | 40             | 2,5      | 0,01    |  |  |
|     | HM915XL005                     | 0,5      | 3              | 0,5      | 40             | 4        | 0,01    |  |  |
|     | HM915MF005                     | 0,5      | 4              | 0,5      | 50             | 5        | 0,01    |  |  |
|     | HM915MFVL005                   | 0,5      | 4              | 0,5      | 50             | 7,5      | 0,01    |  |  |
|     | HM915MFL005                    | 0,5      | 4              | 0,5      | 50             | 10       | 0,01    |  |  |
|     | HM915MFEL005                   | 0,5      | 6              | 0,5      | 60             | 3,3      | 0,01    |  |  |
|     | HM915MFEXL005                  | 0,5      | 6              | 0,5      | 60             | 5,1      | 0,01    |  |  |
| 0,6 | HM915M0062                     | 0,6      | 3              | 0,9      | 38             |          |         |  |  |
|     | HM915ML0062                    | 0,6      | 4              | 1,8      | 50             |          |         |  |  |
|     | HM915L006                      | 0,6      | 3              | 0,6      | 40             | 3        | 0,01    |  |  |
|     | HM915XL006                     | 0,6      | 3              | 0,6      | 40             | 5        | 0,01    |  |  |
|     | HM915MFZ006                    | 0,6      | 4              | 0,6      | 50             | 7        | 0,01    |  |  |
|     | HM915MFVL006                   | 0,6      | 4              | 0,6      | 50             | 9        | 0,01    |  |  |
|     | HM915MFL006                    | 0,6      | 4              | 0,6      | 50             | 12       | 0,01    |  |  |
|     | HM915MFEL006                   | 0,6      | 6              | 0,6      | 60             | 4,5      | 0,01    |  |  |
|     | HM915MFEXL006                  | 0,6      | 6              | 0,6      | 60             | 6,2      | 0,01    |  |  |
| 0,8 | HM915M0082                     | 0,8      | 3              | 1,2      | 38             |          |         |  |  |
|     | HM915ML0082                    | 0,8      | 4              | 2,4      | 50             |          |         |  |  |
|     | HM915L008                      | 0,8      | 3              | 0,8      | 40             | 4        | 0,01    |  |  |
|     | HM915XL008                     | 0,8      | 3              | 0,8      | 40             | 7        | 0,01    |  |  |
|     | HM915MF008                     | 0,8      | 4              | 0,8      | 50             | 5        | 0,01    |  |  |
|     | HM915MFZ008                    | 0,8      | 4              | 0,8      | 50             | 8        | 0,01    |  |  |
|     | HM915MFL008                    | 0,8      | 4              | 0,8      | 50             | 10       | 0,01    |  |  |
|     | HM915MFVL008                   | 0,8      | 4              | 0,8      | 50             | 12       | 0,01    |  |  |
|     | HM915MFXL008                   | 0,8      | 4              | 0,8      | 50             | 16       | 0,01    |  |  |
|     | HM915MFEL008                   | 0,8      | 6              | 0,8      | 60             | 5,2      | 0,01    |  |  |
|     | HM915MFEXL008                  | 0,8      | 6              | 0,8      | 60             | 8        | 0,01    |  |  |

Die Preise entnehmen Sie bitte unserer aktuellen Preisliste.  
Please take prices out of our actual price list.

Bei der Bestellung bitte die Bestellnummer angeben: Best.Nr.: z.B. HM915MFL008 und wenn gewünscht Beschichtung: z.B. TLX.  
Please indicate order number: e.g. HM915L006 and if wanted COATING: e.g. TLX.



|     | BESTELL-NUMMER<br>ORDER NUMBER | D1<br>mm | D2<br>h6<br>mm | L2<br>mm | L1<br>+2<br>mm | L3<br>mm | F<br>mm |  |  |
|-----|--------------------------------|----------|----------------|----------|----------------|----------|---------|--|--|
| 1,0 | HM915M0102                     | 1        | 3              | 1,5      | 38             |          |         |  |  |
|     | HM915ML0102                    | 1        | 4              | 3        | 50             |          |         |  |  |
|     | HM915L010                      | 1        | 3              | 1        | 40             | 5        | 0,01    |  |  |
|     | HM915XL010                     | 1        | 3              | 1        | 40             | 8,5      | 0,01    |  |  |
|     | HM915MFZ010                    | 1        | 4              | 1        | 50             | 10       | 0,01    |  |  |
|     | HM915MFVL010                   | 1        | 4              | 1        | 50             | 15       | 0,01    |  |  |
|     | HM915MFZL010                   | 1        | 4              | 1        | 50             | 20       | 0,01    |  |  |
|     | HM915MF010                     | 1        | 6              | 1        | 60             | 6        | 0,01    |  |  |
|     | HM915MFEL010                   | 1        | 6              | 1        | 60             | 8        | 0,01    |  |  |
|     | HM915MFL010                    | 1        | 6              | 1        | 60             | 11       | 0,01    |  |  |
|     | HM915MFEXL010                  | 1        | 6              | 1        | 60             | 15       | 0,01    |  |  |
|     | HM915MFXL010                   | 1        | 6              | 1        | 60             | 20       | 0,01    |  |  |
| 1,2 | HM915M0122                     | 1,2      | 3              | 1,8      | 38             |          |         |  |  |
|     | HM915ML0122                    | 1,2      | 4              | 3,8      | 50             |          |         |  |  |
|     | HM915L012                      | 1,2      | 3              | 1,2      | 40             | 6        | 0,01    |  |  |
|     | HM915XL012                     | 1,2      | 3              | 1,2      | 40             | 10       | 0,01    |  |  |
|     | HM915MFEL012                   | 1,2      | 6              | 1,2      | 60             | 8        | 0,01    |  |  |
| 1,5 | HM915M0152                     | 1,5      | 3              | 2,3      | 38             |          |         |  |  |
|     | HM915ML0152                    | 1,5      | 4              | 4,2      | 50             |          |         |  |  |
|     | HM915L015                      | 1,5      | 3              | 1,5      | 40             | 7,5      | 0,01    |  |  |
|     | HM915XL015                     | 1,5      | 3              | 1,5      | 40             | 12       | 0,01    |  |  |
|     | HM915MFZ015                    | 1,5      | 4              | 1,5      | 50             | 16       | 0,01    |  |  |
|     | HM915MFVL015                   | 1,5      | 4              | 1,5      | 50             | 20       | 0,01    |  |  |
|     | HM915MF015                     | 1,5      | 6              | 1,5      | 60             | 7        | 0,01    |  |  |
|     | HM915MFEL015                   | 1,5      | 6              | 1,5      | 60             | 9,5      | 0,01    |  |  |
|     | HM915MFL015                    | 1,5      | 6              | 1,5      | 60             | 15       | 0,01    |  |  |
|     | HM915MFXL015                   | 1,5      | 6              | 1,5      | 60             | 20       | 0,01    |  |  |
| 2,0 | HM915M0202                     | 2        | 3              | 3        | 38             |          |         |  |  |
|     | HM915ML0202                    | 2        | 4              | 6        | 50             |          |         |  |  |
|     | HM915L020                      | 2        | 3              | 2        | 50             | 12       | 0,01    |  |  |
|     | HM915XL020                     | 2        | 3              | 2        | 50             | 16       | 0,01    |  |  |
|     | HM915SL020                     | 2        | 3              | 2        | 50             | 20       | 0,01    |  |  |
|     | HM915MFA020                    | 2        | 4              | 2        | 60             | 15       | 0,01    |  |  |
|     | HM915MFZ020                    | 2        | 4              | 2        | 60             | 20       | 0,01    |  |  |
|     | HM915MF020                     | 2        | 6              | 2        | 60             | 7        | 0,01    |  |  |
|     | HM915MFEL020                   | 2        | 6              | 2        | 60             | 9,5      | 0,01    |  |  |
|     | HM915MFL020                    | 2        | 6              | 2        | 60             | 15       | 0,01    |  |  |
|     | HM915MFXL020                   | 2        | 6              | 2        | 60             | 20       | 0,01    |  |  |
|     | HM915MFZL020                   | 2        | 6              | 2        | 75             | 30       | 0,01    |  |  |

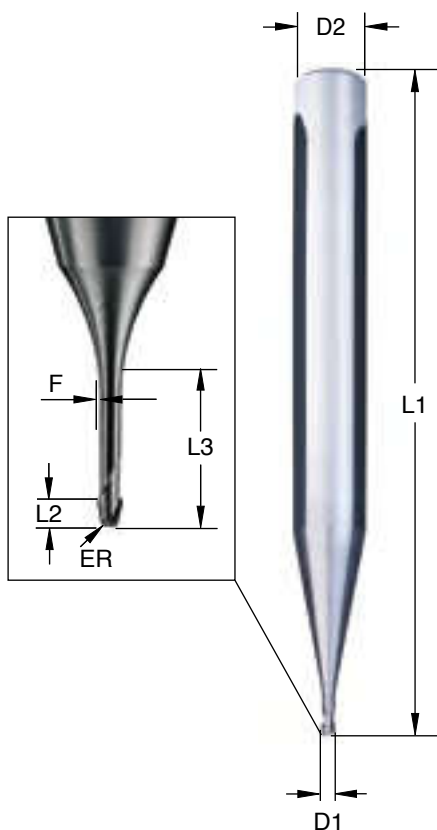


Durchmesserbereich  
diameter range  
0,2 - 2,0 mm

Mögliche Beschichtungen  
possible coatings  
TLX - Standard

Die Preise entnehmen Sie bitte unserer aktuellen Preisliste.  
Please take prices out of our actual price list.

Bei der Bestellung bitte die Bestellnummer angeben: Best.Nr.: z.B. HM915MFL008 und wenn gewünscht Beschichtung: z.B. TLX.  
Please indicate order number: e.g. HM915L006 and if wanted COATING: e.g. TLX.



Durchmesserbereich  
diameter range  
0,2 - 2,0 mm

Mögliche Beschichtungen  
possible coatings  
TLX - Standard

|               | BESTELL-NUMMER<br>ORDER NUMBER | D1<br>mm   | D2<br>h6<br>mm | L2<br>mm | L1<br>+2<br>mm | L3<br>mm | F<br>mm | ER<br>mm |
|---------------|--------------------------------|------------|----------------|----------|----------------|----------|---------|----------|
| 0,2           | HM905M0022                     | 0,2        | 3              | 0,4      | 38             |          |         |          |
|               | HM905ML0022                    | 0,2        | 4              | 0,4      | 50             |          |         |          |
|               | HM905MFE002                    | 0,2        | 6              | 0,3      | 60             |          |         |          |
| 0,3           | HM905M0032                     | 0,3        | 3              | 0,9      | 38             |          |         |          |
|               | HM905ML0032                    | 0,3        | 4              | 0,9      | 50             |          |         |          |
|               | HM905MF003                     | 0,3        | 6              | 0,4      | 60             |          |         |          |
|               | HM905MFEL003                   | 0,3        | 6              | 0,4      | 60             | 1        | 0,01    |          |
| 0,4           | HM905M0042                     | 0,4        | 3              | 1,2      | 38             |          |         |          |
|               | HM905ML0042                    | 0,4        | 4              | 1,2      | 50             |          |         |          |
|               | HM905MFL004                    | 0,4        | 4              | 0,5      | 50             | 2        | 0,01    | 0,05     |
|               | HM905MFZL004                   | 0,4        | 4              | 0,5      | 50             | 4        | 0,01    | 0,05     |
|               | HM905MFEL004                   | 0,4        | 6              | 0,5      | 60             | 1,2      | 0,01    | 0,1      |
|               | HM905MFEXL004                  | 0,4        | 6              | 0,5      | 60             | 4        | 0,01    | 0,1      |
| 0,5           | HM905M0052                     | 0,5        | 3              | 1,5      | 38             |          |         |          |
|               | HM905ML0052                    | 0,5        | 4              | 1,5      | 50             |          |         |          |
|               | HM905L005                      | 0,5        | 3              | 0,7      | 40             | 2,5      | 0,01    | 0,05     |
|               | HM905XL005                     | 0,5        | 3              | 0,7      | 40             | 4        | 0,01    | 0,05     |
|               | HM905MF005                     | 0,5        | 4              | 0,5      | 50             | 5        | 0,01    | 0,05     |
|               | HM905MFZL005                   | 0,5        | 4              | 0,5      | 50             | 7,5      | 0,01    | 0,05     |
|               | HM905MFL005                    | 0,5        | 4              | 0,5      | 50             | 10       | 0,01    | 0,05     |
|               | HM905MFEL005                   | 0,5        | 6              | 0,5      | 60             | 3,3      | 0,01    | 0,1      |
|               | HM905MFEXL005                  | 0,5        | 6              | 0,5      | 60             | 5        | 0,01    | 0,1      |
|               | 0,6                            | HM905M0062 | 0,6            | 3        | 1,8            | 38       |         |          |
| HM905ML0062   |                                | 0,6        | 4              | 1,8      | 50             |          |         |          |
| HM905L006     |                                | 0,6        | 3              | 0,9      | 40             | 3        | 0,01    | 0,05     |
| HM905XL006    |                                | 0,6        | 3              | 0,9      | 40             | 5        | 0,01    | 0,05     |
| HM905MFZ006   |                                | 0,6        | 4              | 0,6      | 50             | 7        | 0,01    | 0,05     |
| HM905MFZL006  |                                | 0,6        | 4              | 0,6      | 50             | 9        | 0,01    | 0,05     |
| HM905MFL006   |                                | 0,6        | 4              | 0,6      | 50             | 12       | 0,01    | 0,05     |
| HM905MFEL006  | 0,6                            | 6          | 0,6            | 60       | 4,5            | 0,01     | 0,1     |          |
| HM905MFEXL006 | 0,6                            | 6          | 0,6            | 60       | 6,2            | 0,01     | 0,1     |          |
| 0,8           | HM905M0082                     | 0,8        | 3              | 2,4      | 38             |          |         |          |
|               | HM905ML0082                    | 0,8        | 4              | 2,4      | 50             |          |         |          |
|               | HM905L008                      | 0,8        | 3              | 1,2      | 40             | 4        | 0,01    | 0,05     |
|               | HM905XL008                     | 0,8        | 3              | 1,2      | 40             | 7        | 0,01    | 0,05     |
|               | HM905MFZ008                    | 0,8        | 4              | 0,8      | 50             | 8        | 0,01    | 0,1      |
|               | HM905MFL008                    | 0,8        | 4              | 0,8      | 50             | 10       | 0,01    | 0,1      |
|               | HM905MFZL008                   | 0,8        | 4              | 0,8      | 50             | 12       | 0,01    | 0,1      |
|               | HM905MFXL008                   | 0,8        | 4              | 0,8      | 50             | 16       | 0,01    | 0,1      |
|               | HM905MFEL008                   | 0,8        | 6              | 0,8      | 60             | 5,2      | 0,01    | 0,1      |
|               | HM905MFEXL008                  | 0,8        | 6              | 0,8      | 60             | 8        | 0,01    | 0,1      |

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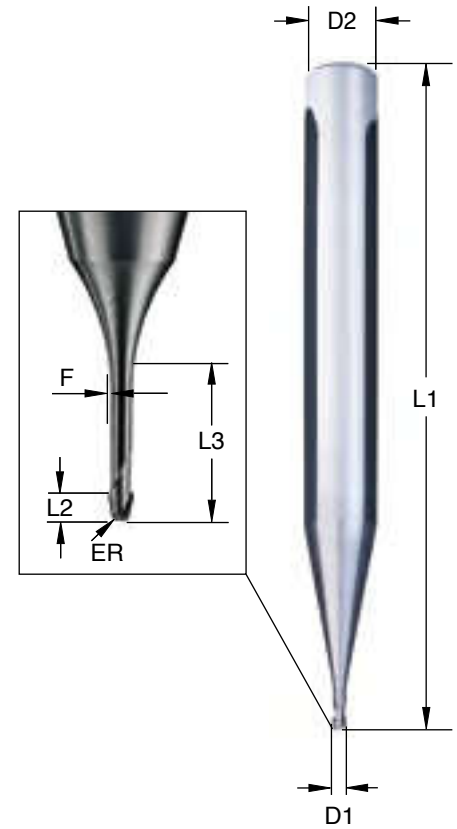
Bei der Bestellung bitte die Bestellnummer angeben: Best.Nr.: z.B. HM905MFL008 und wenn gewünscht Beschichtung: z.B. TLX.

Please indicate order number: e.g. HM905L006 and if wanted COATING: e.g. TLX.





|     | BESTELL-NUMMER<br>ORDER NUMBER | D1<br>mm | D2<br>h6<br>mm | L2<br>mm | L1<br>+2<br>mm | L3<br>mm | F<br>mm | ER<br>mm |
|-----|--------------------------------|----------|----------------|----------|----------------|----------|---------|----------|
| 1,0 | HM905M0102                     | 1        | 3              | 3        | 38             |          |         |          |
|     | HM905ML0102                    | 1        | 4              | 3        | 50             |          |         |          |
|     | HM905L010                      | 1        | 3              | 1,5      | 40             | 5        | 0,01    | 0,1      |
|     | HM905XL010                     | 1        | 3              | 1,5      | 40             | 8,5      | 0,01    | 0,1      |
|     | HM905MFZL010                   | 1        | 4              | 1,5      | 50             | 10       | 0,01    | 0,1      |
|     | HM905MFSL010                   | 1        | 4              | 1,5      | 50             | 15       | 0,01    | 0,1      |
|     | HM905MFZXL010                  | 1        | 4              | 1,5      | 50             | 20       | 0,01    | 0,1      |
|     | HM905MF010                     | 1        | 6              | 1        | 60             | 5        | 0,01    | 0,1      |
|     | HM905MFL010                    | 1        | 6              | 1        | 60             | 10       | 0,01    | 0,1      |
|     | HM905MFXL010                   | 1        | 6              | 1        | 60             | 20       | 0,01    | 0,1      |
| 1,2 | HM905M0122                     | 1,2      | 3              | 3,8      | 38             |          |         |          |
|     | HM905ML0122                    | 1,2      | 4              | 3,8      | 50             |          |         |          |
|     | HM905L012                      | 1,2      | 3              | 1,8      | 40             | 6        | 0,01    | 0,1      |
|     | HM905XL012                     | 1,2      | 3              | 1,8      | 40             | 10       | 0,01    | 0,1      |
|     | HM905MFEL012                   | 1,2      | 6              | 1,2      | 60             | 8        | 0,01    | 0,1      |
| 1,5 | HM905M0152                     | 1,5      | 3              | 4,2      | 38             |          |         |          |
|     | HM905ML0152                    | 1,5      | 4              | 4,2      | 50             |          |         |          |
|     | HM905L015                      | 1,5      | 3              | 2,2      | 40             | 7,5      | 0,01    | 0,15     |
|     | HM905XL015                     | 1,5      | 3              | 2,2      | 40             | 12       | 0,01    | 0,15     |
|     | HM905MFZL015                   | 1,5      | 4              | 2,2      | 50             | 15       | 0,01    | 0,15     |
|     | HM905MFSL015                   | 1,5      | 4              | 2,2      | 50             | 20       | 0,01    | 0,15     |
|     | HM905MFZXL015                  | 1,5      | 4              | 2,2      | 60             | 25       | 0,05    | 0,15     |
|     | HM905MFEL015                   | 1,5      | 6              | 1,5      | 60             | 9,5      | 0,01    | 0,1      |
|     | HM905MFL015                    | 1,5      | 6              | 1,5      | 60             | 15       | 0,01    | 0,15     |
|     | HM905MFXL015                   | 1,5      | 6              | 1,5      | 75             | 25       | 0,01    | 0,15     |
| 2,0 | HM905M0202                     | 2        | 3              | 6        | 38             |          |         |          |
|     | HM905ML0202                    | 2        | 4              | 6        | 50             |          |         |          |
|     | HM905LE020                     | 2        | 3              | 4        | 50             | 12       | 0,01    | 0,2      |
|     | HM905XL020                     | 2        | 3              | 4        | 50             | 16       | 0,01    | 0,2      |
|     | HM905SL020                     | 2        | 3              | 4        | 50             | 20       | 0,01    | 0,2      |
|     | HM905MFZL020                   | 2        | 4              | 2        | 60             | 20       | 0,01    | 0,2      |
|     | HM905MFL020                    | 2        | 6              | 2        | 60             | 15       | 0,01    | 0,2      |
|     | HM905MFXL020                   | 2        | 6              | 2        | 75             | 30       | 0,01    | 0,2      |

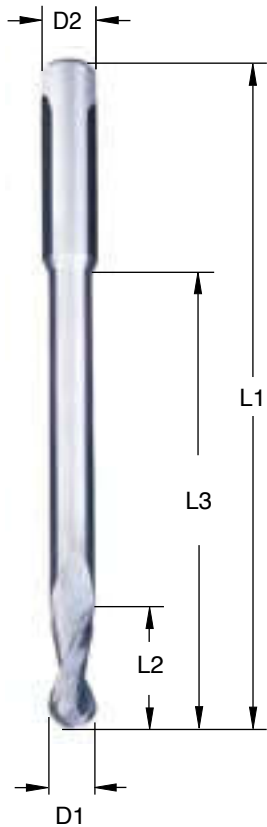


Durchmesserbereich  
diameter range  
0,2 - 2,0 mm

Mögliche Beschichtungen  
possible coatings  
TLX - Standard

Die Preise entnehmen Sie bitte unserer aktuellen Preisliste.  
Please take prices out of our actual price list.

Bei der Bestellung bitte die Bestellnummer angeben: Best.Nr.: z.B. HM905MFL008 und wenn gewünscht Beschichtung: z.B. TLX.  
Please indicate order number: e.g. HM905L006 and if wanted COATING: e.g. TLX.



Durchmesserbereich  
diameter range  
1,0 - 12,0 mm

Mögliche Beschichtungen  
possible coatings  
TLX - Standard

| BESTELL-NUMMER<br>ORDER NUMBER |          | D1<br>mm | D2<br>h6<br>mm | L2<br>mm | L1<br>+2<br>mm | L3<br>mm |  |  |  |
|--------------------------------|----------|----------|----------------|----------|----------------|----------|--|--|--|
| 1,0                            | 97C01    | 1        | 3              | 5        | 40             |          |  |  |  |
| 1,5                            | 97C015   | 1,5      | 3              | 6        | 40             |          |  |  |  |
| 2,0                            | 97C02    | 2        | 3              | 6        | 40             |          |  |  |  |
|                                | 97CL02   | 2        | 3              | 15       | 75             |          |  |  |  |
| 3,0                            | 97C03    | 3        | 3              | 8        | 40             |          |  |  |  |
|                                | 97CL03   | 3        | 3              | 18       | 60             |          |  |  |  |
|                                | 97CXL03  | 3        | 3              | 25       | 75             |          |  |  |  |
|                                | 97CF03   | 3        | 3              | 6        | 40             | 15       |  |  |  |
|                                | 97CFL03  | 3        | 3              | 6        | 60             | 30       |  |  |  |
|                                | 97CFSL03 | 3        | 3              | 10       | 100            | 70       |  |  |  |
|                                | 97MB03   | 3        | 6              | 3        | 57             | 15       |  |  |  |
| 4,0                            | 97C04    | 4        | 4              | 10       | 40             |          |  |  |  |
|                                | 97CL04   | 4        | 4              | 20       | 60             |          |  |  |  |
|                                | 97CXL04  | 4        | 4              | 32       | 75             |          |  |  |  |
|                                | 97CF04   | 4        | 4              | 6        | 40             | 15       |  |  |  |
|                                | 97CFL04  | 4        | 4              | 6        | 60             | 30       |  |  |  |
|                                | 97CFSL04 | 4        | 4              | 12       | 100            | 70       |  |  |  |
|                                | 97MB04   | 4        | 6              | 4        | 57             | 15       |  |  |  |
| 5,0                            | 97C05    | 5        | 5              | 12       | 50             |          |  |  |  |
|                                | 97CL05   | 5        | 5              | 25       | 62             |          |  |  |  |
|                                | 97CXL05  | 5        | 5              | 38       | 100            |          |  |  |  |
|                                | 97CF05   | 5        | 5              | 8        | 50             | 25       |  |  |  |
|                                | 97CFL05  | 5        | 5              | 8        | 75             | 40       |  |  |  |
|                                | 97MB05   | 5        | 6              | 5        | 57             | 15       |  |  |  |
|                                | 97CFSL05 | 5        | 6              | 15       | 100            | 70       |  |  |  |
| 6,0                            | 97C06    | 6        | 6              | 14       | 50             |          |  |  |  |
|                                | 97CL06   | 6        | 6              | 30       | 75             |          |  |  |  |
|                                | 97CXL06  | 6        | 6              | 40       | 100            |          |  |  |  |
|                                | 97CF06   | 6        | 6              | 10       | 50             | 25       |  |  |  |
|                                | 97CFL06  | 6        | 6              | 10       | 100            | 70       |  |  |  |
|                                | 97CFSL06 | 6        | 6              | 25       | 150            | 100      |  |  |  |
|                                | 97CFXL06 | 6        | 6              | 40       | 200            | 150      |  |  |  |
| 8,0                            | 97C08    | 8        | 8              | 16       | 63             |          |  |  |  |
|                                | 97CL08   | 8        | 8              | 35       | 75             |          |  |  |  |
|                                | 97CXL08  | 8        | 8              | 45       | 100            |          |  |  |  |
|                                | 97CF08   | 8        | 8              | 10       | 75             | 35       |  |  |  |
|                                | 97CFL08  | 8        | 8              | 10       | 100            | 70       |  |  |  |
|                                | 97CFXL08 | 8        | 8              | 25       | 200            | 120      |  |  |  |
|                                | 97CFSL08 | 8        | 10             | 25       | 150            | 100      |  |  |  |

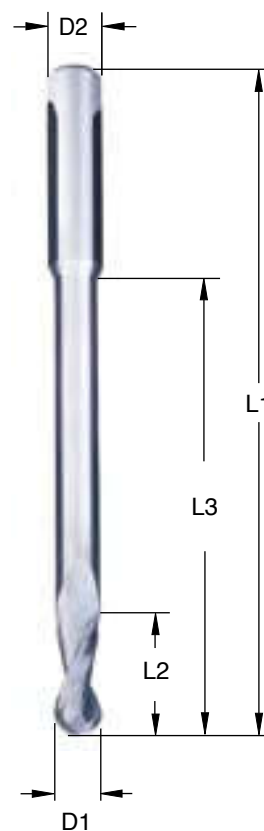
Die Preise entnehmen Sie bitte unserer aktuellen Preisliste.  
Please take prices out of our actual price list.

Bei der Bestellung bitte die Bestellnummer angeben: Best.Nr.: z.B. 97CL03 und wenn gewünscht Beschichtung: z.B. TLX.

Please indicate order number: e.g. 97CXL04 and if wanted COATING: e.g. TLX.



| BESTELL-NUMMER<br>ORDER NUMBER |          | D1<br>mm | D2<br>h6<br>mm | L2<br>mm | L1<br>+2<br>mm | L3<br>mm |  |  |  |
|--------------------------------|----------|----------|----------------|----------|----------------|----------|--|--|--|
| 10,0                           | 97C10    | 10       | 10             | 19       | 72             |          |  |  |  |
|                                | 97CL10   | 10       | 10             | 40       | 89             |          |  |  |  |
|                                | 97CXL10  | 10       | 10             | 50       | 120            |          |  |  |  |
|                                | 97CF10   | 10       | 10             | 10       | 72             | 40       |  |  |  |
|                                | 97CFL10  | 10       | 10             | 10       | 100            | 70       |  |  |  |
|                                | 97CFXL10 | 10       | 10             | 50       | 200            | 120      |  |  |  |
|                                | 97CFSL10 | 10       | 12             | 25       | 150            | 100      |  |  |  |
| 12,0                           | 97C12    | 12       | 12             | 22       | 83             |          |  |  |  |
|                                | 97CL12   | 12       | 12             | 50       | 100            |          |  |  |  |
|                                | 97CXL12  | 12       | 12             | 60       | 150            |          |  |  |  |
|                                | 97CF12   | 12       | 12             | 10       | 83             | 40       |  |  |  |
|                                | 97CFL12  | 12       | 12             | 10       | 100            | 70       |  |  |  |



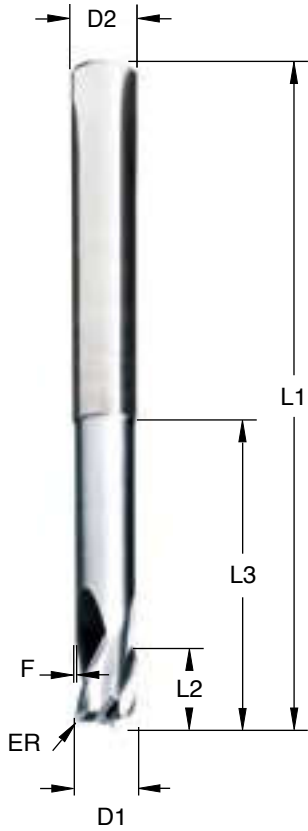
Durchmesserbereich  
diameter range  
1,0 - 12,0 mm

Mögliche Beschichtungen  
possible coatings  
TLX - Standard

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Bei der Bestellung bitte die Bestellnummer angeben: Best.Nr.: z.B. 97CL03 und wenn gewünscht Beschichtung: z.B. TLX.  
Please indicate order number: e.g. 97CXL04 and if wanted COATING: e.g. TLX.

KUPFER-LINE



Durchmesserbereich  
diameter range  
2,0 - 20,0 mm

Mögliche Beschichtungen  
possible coatings  
TLX - Standard

|      | BESTELL-NUMMER<br>ORDER NUMBER | D1<br>mm | D2<br>h6<br>mm | L2<br>mm | L1<br>+2<br>mm | L3<br>mm | F<br>mm | ER<br>mm |  |
|------|--------------------------------|----------|----------------|----------|----------------|----------|---------|----------|--|
| 2,0  | JH910020                       | 2        | 3              | 3        | 40             | 6        | 0,05    | 0,2      |  |
|      | JH910L020                      | 2        | 3              | 3        | 60             | 10       | 0,05    | 0,2      |  |
| 2,5  | JH910025                       | 2,5      | 3              | 4        | 40             | 6        | 0,05    | 0,2      |  |
| 3,0  | JH910030                       | 3        | 3              | 4        | 40             | 7        | 0,1     | 0,2      |  |
|      | JH91003001                     | 3        | 3              | 4        | 40             | 7        | 0,1     | 0,1      |  |
|      | JH910L030                      | 3        | 3              | 4        | 60             | 14       | 0,1     | 0,2      |  |
| 3,5  | JH910035                       | 3,5      | 6              | 5        | 50             | 9        | 0,15    | 0,2      |  |
| 4,0  | JH910040                       | 4        | 6              | 5        | 50             | 9        | 0,15    | 0,2      |  |
|      | JH91004003                     | 4        | 6              | 5        | 50             | 9        | 0,15    | 0,3      |  |
|      | JH91004005                     | 4        | 6              | 5        | 50             | 9        | 0,15    | 0,5      |  |
|      | JH910L040                      | 4        | 6              | 5        | 60             | 18       | 0,15    | 0,2      |  |
| 5,0  | JH910050                       | 5        | 6              | 6        | 50             | 11       | 0,2     | 0,2      |  |
|      | JH910L050                      | 5        | 6              | 6        | 60             | 22       | 0,2     | 0,2      |  |
| 6,0  | JH910060                       | 6        | 6              | 7        | 60             | 14       | 0,2     | 0,3      |  |
|      | JH91006002                     | 6        | 6              | 7        | 60             | 14       | 0,2     | 0,2      |  |
|      | JH91006005                     | 6        | 6              | 7        | 60             | 14       | 0,2     | 0,5      |  |
|      | JH910L060                      | 6        | 6              | 7        | 80             | 26       | 0,2     | 0,3      |  |
| 8,0  | JH910080                       | 8        | 8              | 9        | 60             | 18       | 0,3     | 0,5      |  |
|      | JH91008002                     | 8        | 8              | 9        | 60             | 18       | 0,3     | 0,2      |  |
|      | JH910L080                      | 8        | 8              | 9        | 85             | 36       | 0,3     | 0,5      |  |
| 10,0 | JH910100                       | 10       | 10             | 12       | 70             | 25       | 0,3     | 0,5      |  |
|      | JH91010002                     | 10       | 10             | 12       | 70             | 25       | 0,3     | 0,2      |  |
|      | JH91010010                     | 10       | 10             | 12       | 70             | 25       | 0,3     | 1,0      |  |
|      | JH910L100                      | 10       | 10             | 12       | 100            | 45       | 0,3     | 0,5      |  |
| 12,0 | JH910120                       | 12       | 12             | 15       | 80             | 30       | 0,3     | 0,6      |  |
|      | JH91012005                     | 12       | 12             | 15       | 80             | 30       | 0,3     | 0,5      |  |
|      | JH91012010                     | 12       | 12             | 15       | 80             | 30       | 0,3     | 1,0      |  |
|      | JH91012015                     | 12       | 12             | 15       | 80             | 30       | 0,3     | 1,5      |  |
|      | JH910L120                      | 12       | 12             | 15       | 125            | 54       | 0,3     | 0,6      |  |
|      | JH910L12005                    | 12       | 12             | 15       | 125            | 54       | 0,3     | 0,5      |  |
| 16,0 | JH910160                       | 16       | 16             | 18       | 90             | 38       | 0,3     | 0,6      |  |
|      | JH91016010                     | 16       | 16             | 18       | 90             | 38       | 0,3     | 1,0      |  |
| 20,0 | JH910200                       | 20       | 20             | 22       | 100            | 40       | 0,4     | 0,8      |  |
|      | JH91020010                     | 20       | 20             | 22       | 100            | 40       | 0,4     | 1,0      |  |