

摆线铣削CARBLoop
完美调整，实现最大切削深度

Trochoidal milling with CARBLoop
Perfectly adjusted for maximum cutting depth

通过摆线铣削提升新性能

与传统铣槽和铣边不同，在摆线铣削期间，刀具并非以恒定进刀量，执行直线进给运动。而是通过弯曲路线路径快速移动，即所述的摆线。

进给运动和圆周运动的叠加对加工作业条件产生积极影响。进刀量 f_z 、径向切削深度 a_e 、压力角 β 持续发生变化。编程系统将这些参数组合起来，确保平均切屑厚度、切削刃应力在整个加工过程期间保持恒定。这可以避免切削刃和机床主轴的过度受力和分布不均匀。

New performance boosts trough trochoidal milling

As opposed to conventional slot and edge milling, during trochoidal milling this tool does not perform linear feed motions with constant chip load. It rather moves very quickly on curved paths, the so-called trochoids.

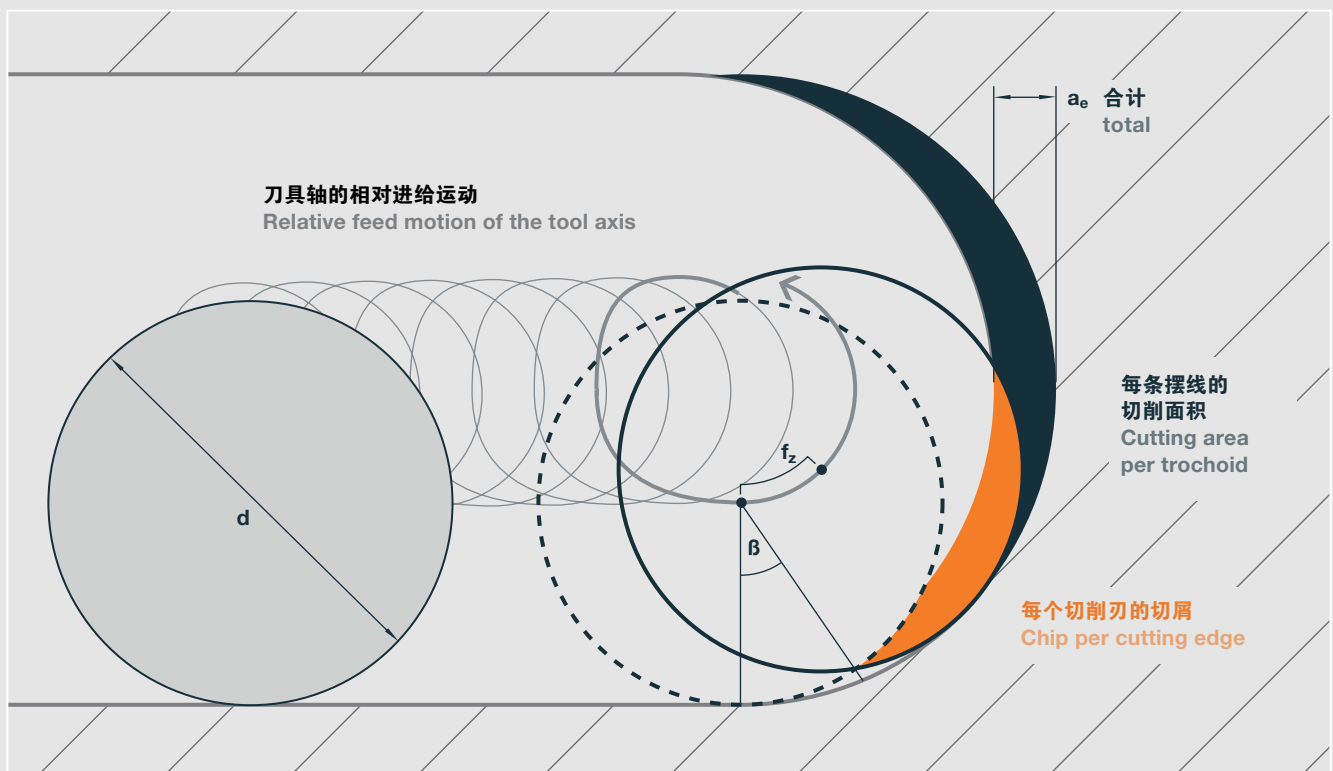
The superposition of feed and circular motion has a positive impact on the operation conditions. The chip load f_z , the radial depth of cut a_e and the pressure angle β constantly change. The programming system combines these parameters in such a way that the average chip thickness and thus the stress on the cutting edges remain constant over the entire process. This avoids an excessive and uneven distribution of force on the cutting edges and the machine spindle.

摆线切削保证经济的机械加工

- 通过提高加工效率，促进制造成本降低
- 更小、更稳定的切屑截面积，实现更低的切削力
- 节约加工时间达70%
- 刀具使用寿命延长超300%
- 粗加工和精加工有各种优势

Trochoidal milling guarantees economic machining

- Drastic reduction of manufacturing costs through high processing speed
- Low cutting forces due to smaller and more constant chip cutting sections
- Reduction of processing times by up to 70 %
- Increase of tool life by more than 300 % possible
- Advantages for roughing and finishing



摆线铣削的进给运动和切屑形成

Feed motion and chip formation in trochoidal milling

利美特菲特采用CARBLoop系列全新开发的这款刀具，具有最大切削深度（3 x Ø和5 x Ø）以及理想的几何槽型，非常适合各种材料的摆线铣削。

适合短切屑的理想断屑槽，保证正确排屑

在摆线铣削应用中，大体积切屑可能导致切屑堵塞，给用户带来严峻挑战。CARBLoop优化断屑槽，为您提供以下优势：

- 切屑体积减少一半，即使高切削量条件下，也确保顺利去除切屑
- 断屑槽的设计将磨损降至最低
- 此外，大量断屑槽可以显著减少振动
- 每个切削刃偏置断屑槽，保证光滑表面，因此刀具也可用于后续半精加工

适合不同应用的综合加工程序

新型CARBLoop适用于ISO-P和ISO-K（CARBLoop Steel）和ISO-M（CARBLoop INOX）。由于带有2 mm的材料余量，该刀具在保持最大切削深度的同时，可进行多次磨削。

几何形状、切削材质和涂层的最佳组合

为确保在不同应用领域（ISO-P和ISO-M）实现最佳铣削效果，CARBLoop经过专门设计，CARBLoop Steel和CARBLoop INOX的几何形状、切削材质和涂层各有差异，适合各种加工材料及应用。针对不同应用，各种特征以最佳组合保证卓越的切削性能。

With the CARBLoop, LMT Fette has developed a tool which, thanks to its maximum cutting depth (3 x Ø and 5 x Ø) and the ideally matched geometry, is perfectly suited to trochoidal milling in various materials.

Ideal chip breakers for short chips and proper removal

In trochoidal milling, the particularly large chip volume presents a challenge and can cause the chips to jam. With the optimized chip breakers of the CARBLoop you benefit from the following advantages:

- The chip volume has been reduced by half and ensures a smooth chip removal even at high cutting values
- The chip breaker is designed in such a way that wear is reduced to a minimum
- In addition, the large number of chip breakers ensures a significant reduction in vibration
- The offset mounting of the chip breakers on each cutting edge also guarantees clean and smooth surfaces, so that the tool can also be used for subsequent semi-finishing

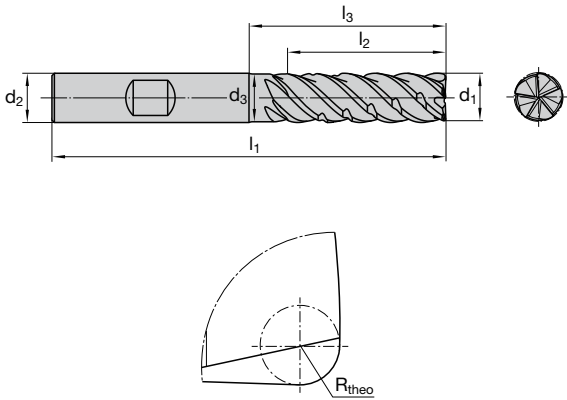
Comprehensive program for different applications

The new CARBLoop is available for ISO-P and ISO-K (CARBLoop Steel) and for ISO-M (CARBLoop INOX). Thanks to a material allowance of 2 mm, the tool can be reground several times while retaining its maximum cutting depth.

Best possible combination of geometry, cutting material and coating

In order to achieve the best milling results in the various application areas (ISO-P and ISO-M), the CARBLoop has been specially adapted to the materials and applications to be machined. The CARBLoop Steel and CARBLoop INOX therefore differ in their geometries, cutting materials and coatings. The best possible combination of these properties for the respective application ensures outstanding cutting performance.

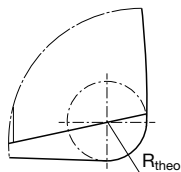
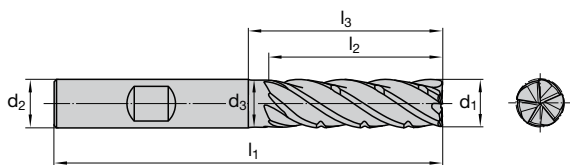




| 目录号 Cat.-No. | | | | | | | | 1901C | |
|----------------|----------------|----------------|----------------|----------------|----------------|---|------------------------------|---------|-----------------------------|
| P | | | | | | | | ■ | |
| M | | | | | | | | | |
| K | | | | | | | | □ | |
| N | | | | | | | | | |
| S | | | | | | | | | |
| H | | | | | | | | | |
| O | | | | | | | | | |
| d ₁ | d ₃ | l ₂ | l ₁ | l ₃ | d ₂ | z | R _{theo} (+0,05) | 物料号 | LMT-编号 |
| 3 x Ø | | | | | | | | | |
| 6 | 5,8 | 20 | 65 | 27 | 6 | 5 | 0,5 | 7355268 | EM-LOOP3P 6x20/27 5R0.5B |
| 8 | 7,8 | 26 | 70 | 33 | 8 | 5 | 0,5 | 7355269 | EM-LOOP3P 8x26/33 5R0.5B |
| 10 | 9,7 | 32 | 80 | 39 | 10 | 5 | 0,5 | 7355270 | EM-LOOP3P 10x32/39 5R0.5B |
| 12 | 11,7 | 38 | 93 | 47 | 12 | 5 | 0,5 | 7355271 | EM-LOOP3P 12x38/47 5R0.5B |
| 16 | 15,7 | 50 | 108 | 59 | 16 | 5 | 0,5 | 7355272 | EM-LOOP3P 16x50/59 5R0.5B |
| 20 | 19,7 | 62 | 126 | 75 | 20 | 5 | 0,5 | 7355273 | EM-LOOP3P 20x62/75 5R0.5B |
| 5 x Ø | | | | | | | | | |
| 6 | 5,8 | 32 | 80 | 43 | 6 | 5 | 0,5 | 7355274 | EM-LOOP5P 6x32/43 5R0.5B |
| 8 | 7,8 | 42 | 90 | 53 | 8 | 5 | 0,5 | 7355275 | EM-LOOP5P 8x42/53 5R0.5B |
| 10 | 9,7 | 52 | 100 | 59 | 10 | 5 | 0,5 | 7355276 | EM-LOOP5P 10x52/59 5R0.5B |
| 12 | 11,7 | 62 | 120 | 74 | 12 | 5 | 0,5 | 7355277 | EM-LOOP5P 12x62/74 5R0.5B |
| 16 | 15,7 | 82 | 140 | 91 | 16 | 5 | 0,5 | 7355278 | EM-LOOP5P 16x82/91 5R0.5B |
| 20 | 19,7 | 102 | 165 | 114 | 20 | 5 | 0,5 | 7355279 | EM-LOOP5P 20x102/114 5R0.5B |

切削参数推荐值参见第6页
Cutting data recommendations see page 6

■ = 第一选择 First choice
□ = 第二选择 Second choice



| 目录号 Cat.-No. | | | | | | | | 1911C | |
|----------------|----------------|----------------|----------------|----------------|----------------|---|------------------------------|---------|-----------------------------|
| P | | | | | | | | | |
| M | | | | | | | | ■ | |
| K | | | | | | | | | |
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| H | | | | | | | | | |
| O | | | | | | | | | |
| d ₁ | d ₃ | l ₂ | l ₁ | l ₃ | d ₂ | z | R _{theo} (+0,05) | 物料号 | LMT-编号 |
| 3 x Ø | | | | | | | | | |
| 6 | 5,8 | 20 | 65 | 27 | 6 | 5 | 0,5 | 7355280 | EM-LOOP3M 6x20/27 5R0.5B |
| 8 | 7,8 | 26 | 70 | 33 | 8 | 5 | 0,5 | 7355281 | EM-LOOP3M 8x26/33 5R0.5B |
| 10 | 9,7 | 32 | 80 | 39 | 10 | 5 | 0,5 | 7355282 | EM-LOOP3M 10x32/39 5R0.5B |
| 12 | 11,7 | 38 | 93 | 47 | 12 | 5 | 0,5 | 7355283 | EM-LOOP3M 12x38/47 5R0.5B |
| 16 | 15,7 | 50 | 108 | 59 | 16 | 5 | 0,5 | 7355284 | EM-LOOP3M 16x50/59 5R0.5B |
| 20 | 19,7 | 62 | 126 | 75 | 20 | 5 | 0,5 | 7355285 | EM-LOOP3M 20x62/75 5R0.5B |
| 5 x Ø | | | | | | | | | |
| 6 | 5,8 | 32 | 80 | 43 | 6 | 5 | 0,5 | 7355286 | EM-LOOP5M 6x32/43 5R0.5B |
| 8 | 7,8 | 42 | 90 | 53 | 8 | 5 | 0,5 | 7355287 | EM-LOOP5M 8x42/53 5R0.5B |
| 10 | 9,7 | 52 | 100 | 59 | 10 | 5 | 0,5 | 7355288 | EM-LOOP5M 10x52/59 5R0.5B |
| 12 | 11,7 | 62 | 120 | 74 | 12 | 5 | 0,5 | 7355289 | EM-LOOP5M 12x62/74 5R0.5B |
| 16 | 15,7 | 82 | 140 | 91 | 16 | 5 | 0,5 | 7355290 | EM-LOOP5M 16x82/91 5R0.5B |
| 20 | 19,7 | 102 | 165 | 114 | 20 | 5 | 0,5 | 7355291 | EM-LOOP5M 20x102/114 5R0.5B |

切削参数推荐值参见第6页
Cutting data recommendations see page 6

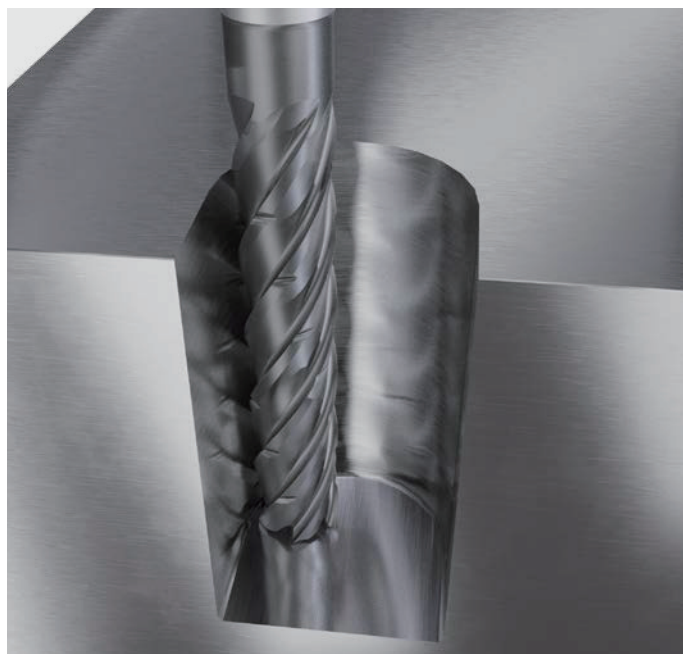
■ = 第一选择 First choice
□ = 第二选择 Second choice

CARBLoop
切削参数推荐值
Cutting data recommendations

| | 材料 | Material | 材料编号 Material No. | DIN 旧版说明 DIN Description Old | R _m /UTS (N/mm ²) | DIN 新版说明 DIN Description New |
|--------|------------------------|--|----------------------|---------------------------------------|---|---------------------------------------|
| P | 氮化钢和热处理钢 | Nitriding steel and heat-treatment steel | 1.7225 | 42CrMo4 | 950-1400 | 42CrMo4 |
| | | | 1.2344 | X40CrMoV5.1 | -900 | X40CrMoV5-1 |
| | | | 1.4104 | X12CrMoS17 | 500-950 | X14CrMoS17 |
| | | | 1.8504 | 34CrAl6 | 950-1400 | 34CrAl6 |
| | 工具钢 | Tool steel | 1.2343 | X38CrMoV5 1 | 950-1400 | X37CrMoV5-1 |
| | | | 1.6580 | 30CrNiMo8 | 950-1400 | 30CrNiMo8 |
| | | | 1.2379 | X155CrVMo12 1 | -950 | X153CrMoV12-1 |
| | | | 1.2080 | X210Cr12 | 950-1400 | X210Cr12 |
| | | | 1.2311 | 40CrMnMo7 | -1100 | 40CrMnMo7 |
| | | | 1.2312 | 40CrMnNiMoS8.6 | -1150 | 40CrMnNiMoS8-6 |
| | | | 1.2738 | 45CrMnNiMo8.6.4 | 950-1150 | 45CrMnNiMo8-6-4 |
| | | | 1.2358 | 60CrMoV18-5 | 850-1000 | 60CrMoV18-5 |
| | | | 1.2714 | 55NiCrMoV7 | 1100-1350 | 55NiCrMoV7 |
| | | | K | 灰口铸铁 | Grey cast iron | 0.6025 |
| 合金灰口铸铁 | Alloyed grey cast iron | 0.6678 | | GGL-NiCr35 2 | 150-250 (160-230 HB) | EN-GJLA-XNiCr35-2 |
| 球墨铸铁 | Nodular cast iron | 0.7060 0.7070 | | GGG60 GGG70L | 400-800 (120-310 HB) | EN-GJS-600-3 EN-GJS-700-2U |
| 可锻铸铁 | Malleable cast iron | 0.8155 | | GTS55 | 350-700 (150-280 HB) | EN-GJMB-550-4 |
| M | 不锈钢, 奥氏体 | Stainless steel, austenitic | 1.4301 | X2CrNiMo17-12-2 | 500-950 | X5CrNiMo18-10 |
| | | | 1.4404 | X6CrNiMoTi17-12-2 | | X2CrNiMo17-12-2 |
| | | | 1.4571 | X10CrNiMoTi18 | | X10CrNiMoTi18 |
| | 不锈钢, 铁素体, 马氏体 | Stainless steel, ferritic, martensitic | 1.4024 | X15Cr13 | 500-950 | X15Cr13 |
| | | | 1.4057 | X17CrNi16-2 | | X17CrNi16-2 |
| | | | 1.4122 | X35CrMo17 | | X35CrMo17 |
| | 不锈钢, 马氏体 | Stainless steel, martensitic steel | 1.2709 | X3NiCoMoTi18-9-5 | 800-1000 | X3NiCoMoTi18-9-5 |
| | | | 1.4542 | X5CrNiCuNb16-4 | | X5CrNiCuNb16-4 |
| | | | 1.4568 | X7CrNiAl17-7 | | X7CrNiAl17-7 |

所述切削参数表示初始值, 必须根据实际情况进行调整。

The cutting data indicated are starting values based and must be adjusted to the prevailing conditions.

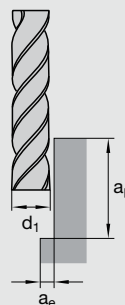


3 x Ø



a_e Steel = 0,1 x d₁
a_e Inox = 0,05 x d₁
a_{p max} = 3 x d₁

5 x Ø

a_e Steel = 0,05 x d₁
a_e Inox = 0,03 x d₁
a_{p max} = 5 x d₁



a_e = 切削宽度 (单位mm)
Width of cut in mm
a_p = 切削深度 (单位mm)
Depth of cut in mm
d₁ = 切削直径 (单位mm)
Cutter diameter in mm

| | 压力角 Pressure angle β | 径向切削深度 Radial depth of cut a_e | | 切削速度 Cutting speed v_c (m/min) | | 切削直径(mm) Cutting diameter (mm) 每齿进刀量 Feed per tooth f_z (mm/z.) | | |
|--------|--|--|--|---|-----------------|---|-------------------|-------------------|
| | | 3 x \emptyset | 5 x \emptyset | 3 x \emptyset | 5 x \emptyset | \emptyset 6-8 | \emptyset 10-12 | \emptyset 16-20 |
| | | 35-45° | 0,1 x d_1  | 0,05 x d_1  | 280-320 | 200-250 | 0,06-0,1 | 0,1-0,15 |
| 35-45° | 0,1 x d_1 | 0,05 x d_1 | 280-320 | 200-250 | 0,06-0,1 | 0,1-0,15 | 0,15-0,25 | |
| | | | 280-320 | 200-250 | 0,06-0,1 | 0,1-0,15 | 0,15-0,25 | |
| | | | 280-320 | 200-250 | 0,06-0,1 | 0,1-0,15 | 0,15-0,25 | |
| | | | 280-320 | 200-250 | 0,06-0,1 | 0,1-0,15 | 0,15-0,25 | |
| | | | 250-300 | 180-230 | 0,05-0,1 | 0,1-0,15 | 0,15-0,25 | |
| | | | 250-300 | 180-230 | 0,05-0,1 | 0,1-0,15 | 0,15-0,25 | |
| | | | 250-300 | 180-230 | 0,05-0,1 | 0,1-0,15 | 0,15-0,25 | |
| | | | 250-300 | 180-230 | 0,05-0,1 | 0,1-0,15 | 0,15-0,25 | |
| | | | 250-300 | 180-230 | 0,05-0,1 | 0,1-0,15 | 0,15-0,25 | |
| | | | 250-300 | 180-230 | 0,05-0,1 | 0,1-0,15 | 0,15-0,25 | |
| | | | 230-280 | 160-200 | 0,05-0,1 | 0,08-0,15 | 0,12-0,2 | |
| | | | 230-280 | 160-200 | 0,05-0,1 | 0,08-0,15 | 0,12-0,2 | |
| 35-45° | 0,1 x d_1 | 0,05 x d_1 | 400-450 | 320-370 | 0,2-0,25 | 0,25-0,3 | 0,3-0,4 | |
| | | | 350-400 | 280-230 | 0,15-0,2 | 0,2-0,25 | 0,25-0,35 | |
| | | | 300-350 | 240-290 | 0,15-0,2 | 0,2-0,25 | 0,25-0,35 | |
| | | | 280-320 | 220-260 | 0,10-0,15 | 0,15-0,2 | 0,2-0,3 | |
| 35-45° | 0,05 x d_1  | 0,03 x d_1  | 120-140 | 100-120 | 0,05-0,12 | 0,08-0,15 | 0,12-0,2 | |
| | | | 100-140 | 80-120 | 0,05-0,1 | 0,08-0,12 | 0,1-0,2 | |
| | | | 80-120 | 70-100 | 0,05-0,1 | 0,08-0,12 | 0,1-0,2 | |



干式加工、空气冷却具有优势。
Dry machining, air-blast cooling is advantageous



湿式加工，需要足够体积的乳状液
Wet machining, sufficient emulsion volume required

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利美特金属加工技术（中国）有限公司
LMT China Co., Ltd.

南京市江宁区秣陵街道盛通路9号(邮编: 211111)
9 Shengtong Road, Moling Sub-District,
Jiangning Development Zone, Nanjing, 211111, PRC
电话:025-52128866
传真:025-52106376
Email:info.cn@lmt-tools.com
www.lmt-tools.com.cn



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