A WIRTGEN GROUP COMPANY

WIRTGEN

WIRTGEN Cold Milling Manual

Technology and Application

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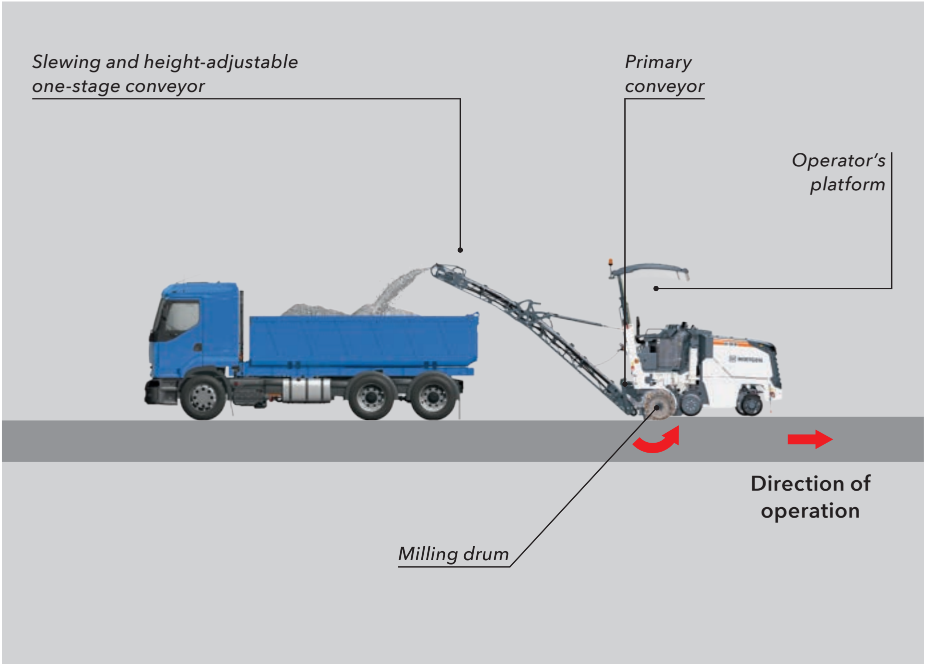
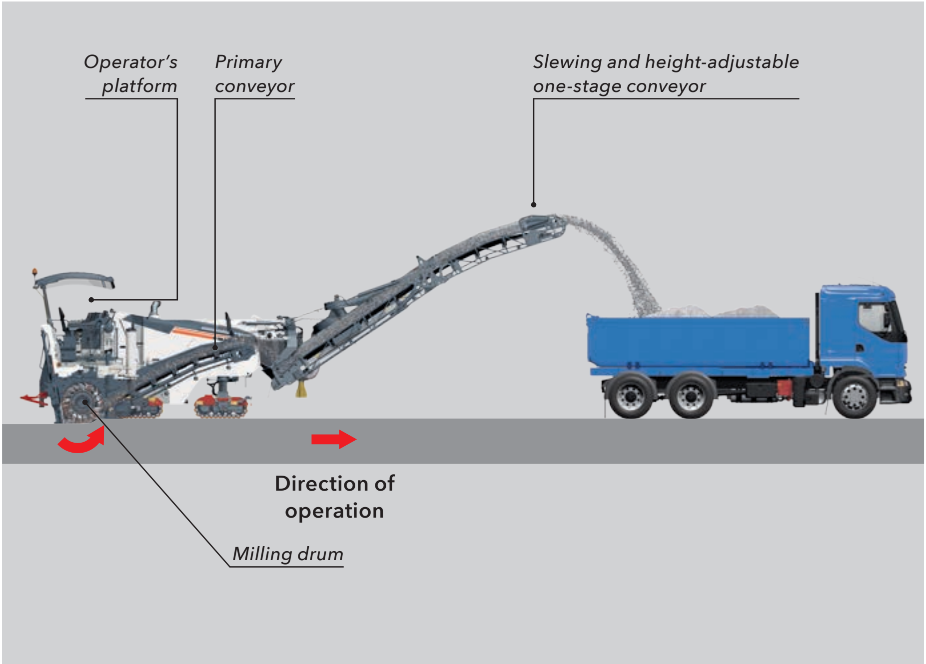
1.3.1 Small milling machines



Small milling machines provide a high degree of manoeuvrability and flexibility in application. They are equipped with wheel units and are used for working small areas and for high-precision milling in extremely restricted space conditions. The milling drum is mounted at the rear of the machine.

- Compact dimensions and low transport weights
- Extremely small milling radius, ideal for milling around road fixtures or obstacles and for use in narrow bends
- Wide range of applications in the rehabilitation of industrial sites and building floors
- Particular strengths in partial pavement repair (patching)
- Milling of rumble strips, slots and tie-ins
- Placing or removing road marking

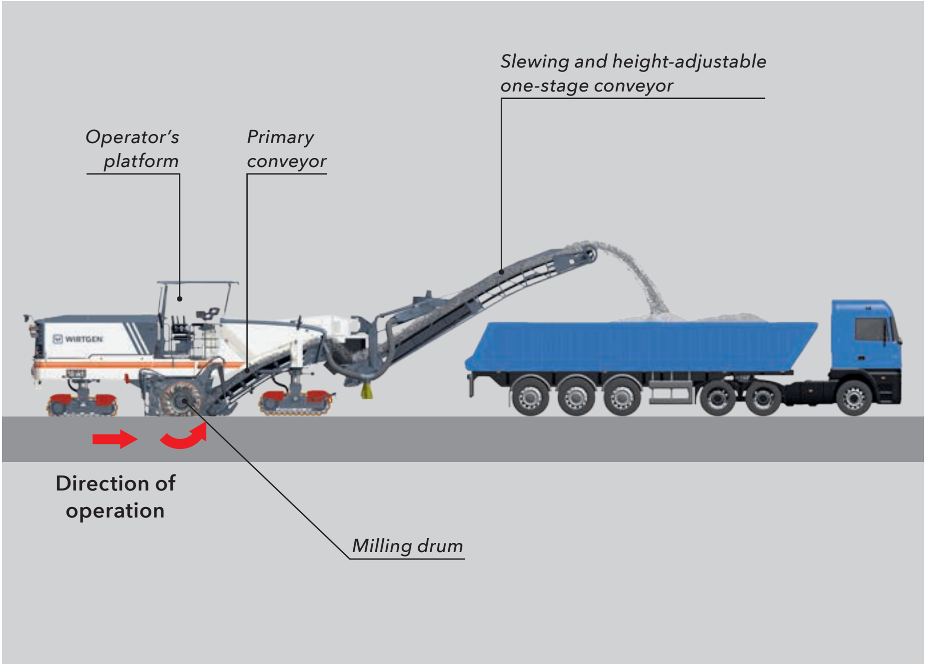
1.3.2 Compact milling machines



Compact milling machines combine the advantages of the small and large milling machine classes and are extremely flexible in use. The low-weight, highly manoeuvrable front loaders are powerful machines which can be used in extremely restricted space conditions and cater to a wide range of applications. They are equipped with wheel or track units.

- Milling operations in restricted space conditions
- Partial pavement repairs
- Layer-by-layer removal of pavement surfaces
- Full pavement removal
- Creation of specific surface textures (fine milling)
- Levelling of irregularities in the surface course

1.3.3 Large milling machines



Offering high milling performance, large milling machines are particularly suitable for use in large-scale rehabilitation projects. The front loaders are equipped with hydraulically steerable, height-adjustable track units; the milling drum is mounted in the central part of the machine.

- Construction projects are completed more quickly due to high volume performance – traffic disruptions are minimized
- Front loading of the milled material optimizes the loading process, enabling the milling operation to continue non-stop:
  - Continuous loading of trucks as a result of "on-the-fly" truck changes
  - Trucks pull in and out smoothly in the direction of traffic
- Layer-by-layer removal of pavement surfaces
- Full pavement removal at milling depths of up to 35 cm
- Creation of specific surface textures (fine milling)
- Levelling of irregularities in the surface course
- Improvement of skid resistance


2+1

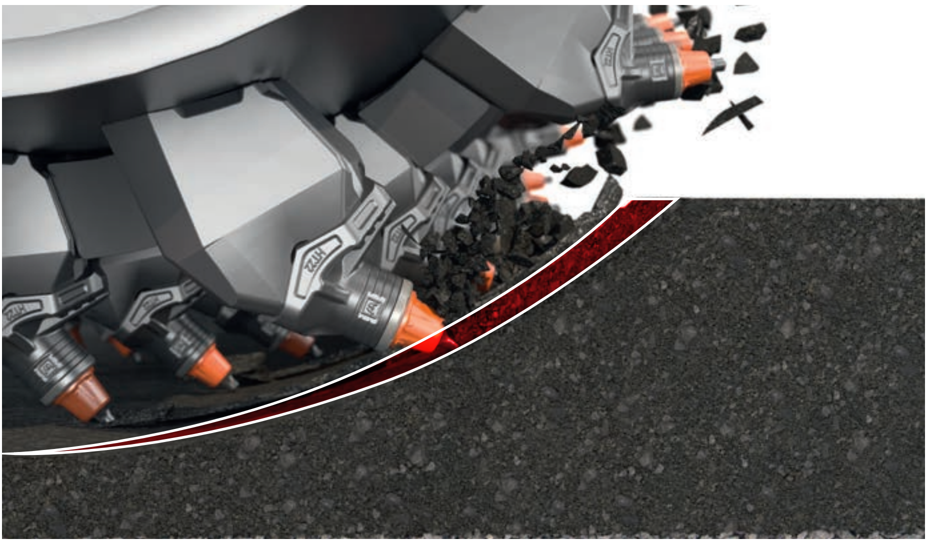
3.1 THE CUTTING PROCESS

Cutting technology is one of WIRTGEN's key technologies in the development and production of cold milling machines. It has a decisive influence on the quality, cost and efficiency of the milling process.

3.1.1 The comma chip

During the cutting process, the rotating milling drum fitted with rotating picks operates against the machine's direction of travel, which means that the picks cut into the material from the bottom up. From when the pick enters the material to when it exits, a progressively thickening chip, the so-called comma chip, is formed. The size of the separated chip depends on the machine's milling speed and adjusted milling depth.

During the actual cutting process, the forces generated at the pick increase with increasing chip thickness: the more material is separated, the higher the use of energy. It is low when the pick enters the material and reaches its maximum value shortly before separation of the comma chip. The amount of energy applied is reduced to zero directly afterwards.



Cross-section of a comma chip in the cutting process

3.1.2 Forces in the cutting process

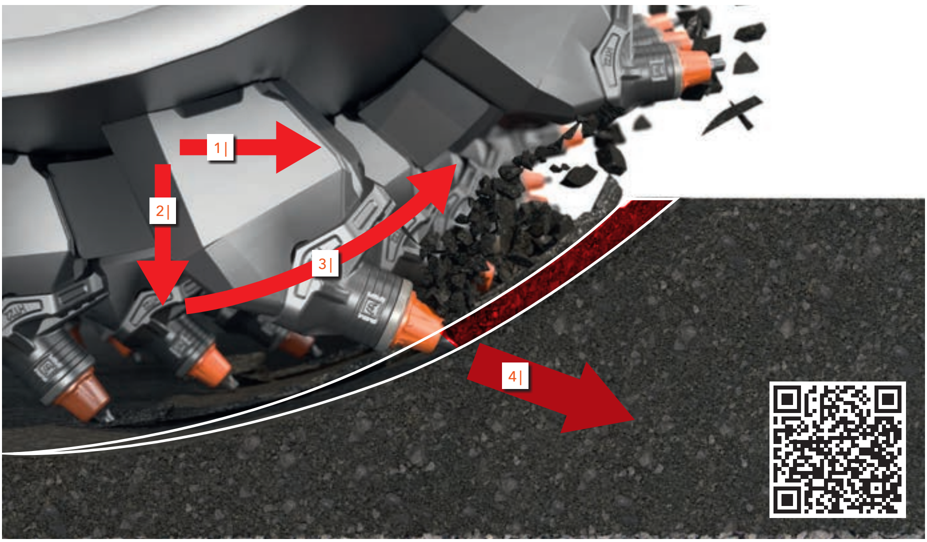
During the cutting process, enormous shear forces and impact forces act on the pick. They are dependent on the following factors.

Strength of the material to be cut

> Asphalt: bitumen quality and bitumen content
> Concrete: cement quality and cement content
> Quality of the mineral aggregate: strength, wear resistance, aggregate content and aggregate size
> Fines content in the material
> Ambient temperature
> Material density

Milling performance of the machine

> Cutting speed at the pick
> Type of milling drum used (tool spacing)
> Force per pick (milling depth)
> Type of pick used (pick design)



1| Traction force

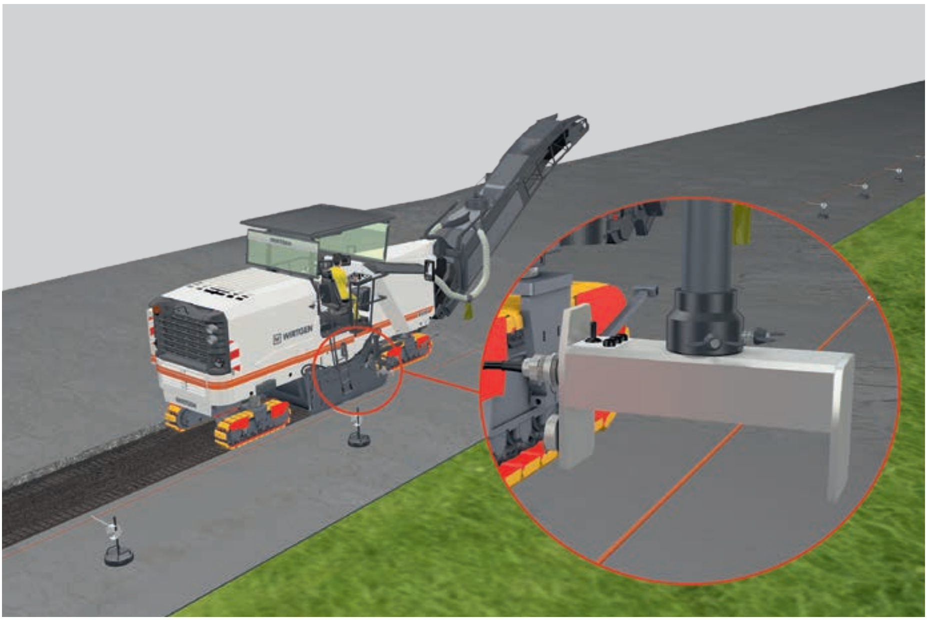
2| Force of machine weight

3| Force of milling drum rotation

4| Resulting cutting force

Relative line reference (e. g. stringline or kerb)

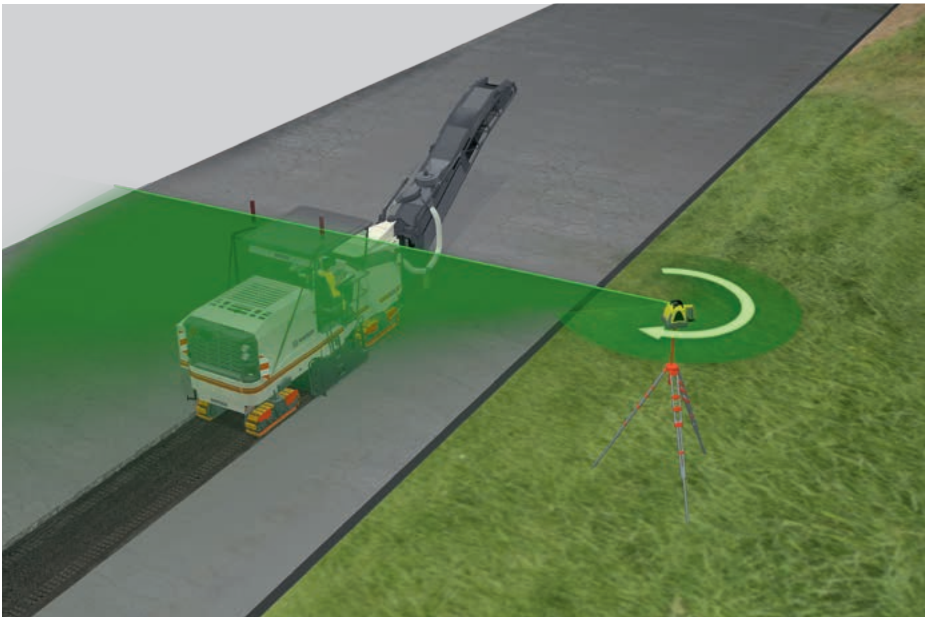
The reference is a previously specified contour, such as a stringline or kerb. If a stringline has been installed, continuous scanning is effected via a distance sensor permanently attached to the machine frame. The change in distance between the stringline and the machine frame provides the measure for correcting the milling depth. Any deviation of the machine height is forwarded to the control system which translates the information into a corresponding corrective action. The result is a surface parallel in level to the the stringline. Scanning along the level of a kerb is effected according to the same principle.



Typical reference line on a stringline when scanning via the distance sensor (Sonic-Ski sensor)

Relative reference (e.g. optical laser)

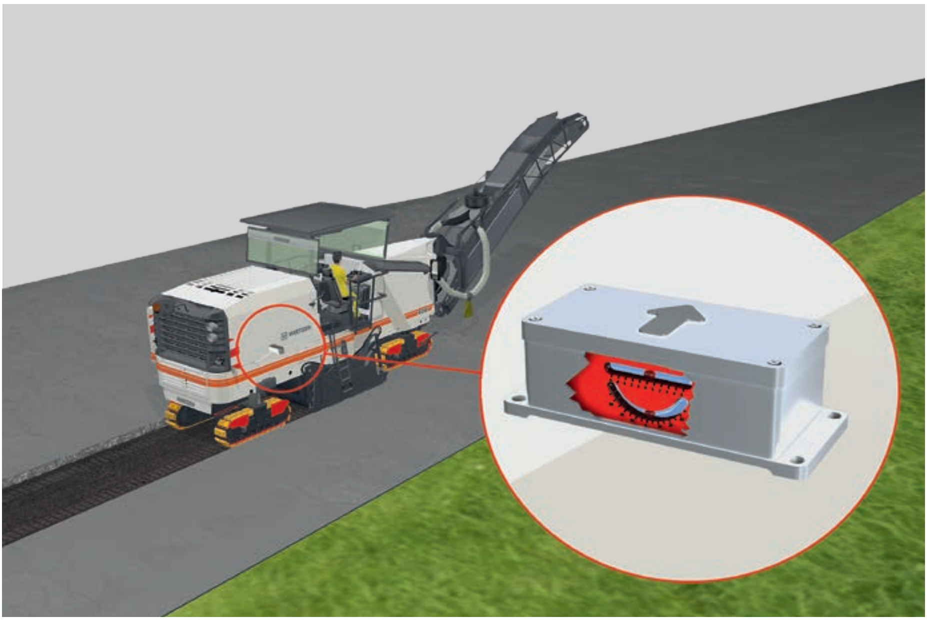
The beam emitted by a stationary rotary laser creates an artificial plane that one or optionally two laser sensors mounted on the machine use as a reference for realizing the specified milling depth. The laser sensors continuously measure the distance of the machine to the previously created laser reference plane. If the measured values deviate from the previously specified plane, corresponding signals are forwarded to the automatic levelling system, and the height is corrected. A range of up to 300 m can be achieved depending on the rotary laser system used.



Laser reference plane (green) for realizing a level milling depth

Absolute reference (e. g. gravitation)

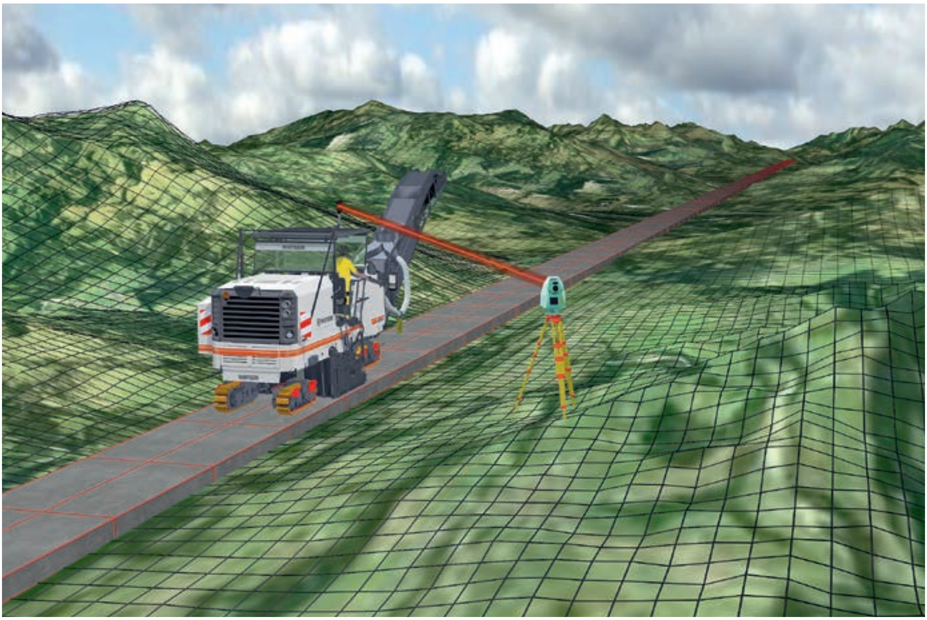
The measurement is performed according to the operating principle of an electronic spirit level: the sensor measures the cross slope in relation to the absolute horizontal plane. Gravitation is used as a reference. Deviations from the reference gravitation are detected by the sensor and immediately forwarded to the machine control system. The machine's transverse inclination is matched to a predefined inclination and corrected in an automated process.



Absolute gravitational reference for determining the cross slope

Absolute reference (e. g. use of digital geodata)

A new surface model is created using 3D positioning data generated by a surveying office. This permits the ideal milling depth to be transmitted to the 3D computer and subsequently to the levelling system of the milling machine with maximum position accuracy. The quality of the previously created data model has a decisive influence on the quality of the milling result. Following a single position determination, the current machine position and milling depth are determined using a high-precision angle and distance measuring unit (total station) and then transmitted to the 3D computers on the cold milling machine for further processing.



Absolute geodetic reference for determining the milling depth with maximum position accuracy

6.6 TRENCH MILLING

6.6.1 W 100 CFi – Trench milling

Milling application:
The laying of a fibre optic cable required a 58-cm deep trench to be milled along a 700-m long stretch of road using a deep-milling unit.

Particularities:
FCS enables the W 100 CFi cold milling machine to be equipped with the deep-milling unit within 1.5 hours. In the process, a housing with a narrow cutting ring fitted with W6 standard picks is mounted behind the rear right, pivoted-in wheel or track unit. A cutting diameter of 1,620 mm permits slots to be milled to a depth of up to 600 mm and to a width of up to 300 mm. The milled material is removed from the trench by the rotating cutting ring and discharged next to the trench by means of a guide plate and chute.

Project details	
Total length in m	700
Milling depth in m	0.58
Milling volume in m³	40.6
Machine details	
Machine model	W 100 CFi
Milling width in m	0.1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