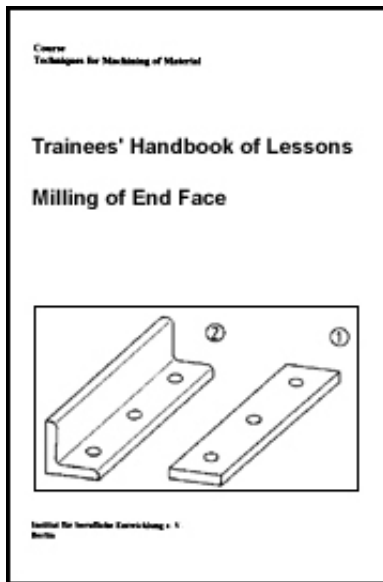


[Home](#) > [ar.cn.de.en.es.fr.id.it.ph.po.ru.sw](#)



➔ **Milling of End Face - Course: Techniques for machining of material. Trainees' handbook of lessons (Institut fr Berufliche Entwicklung, 18 p.)**

📄 **(introduction...)**

📄 **1. Purpose and importance of milling end faces**

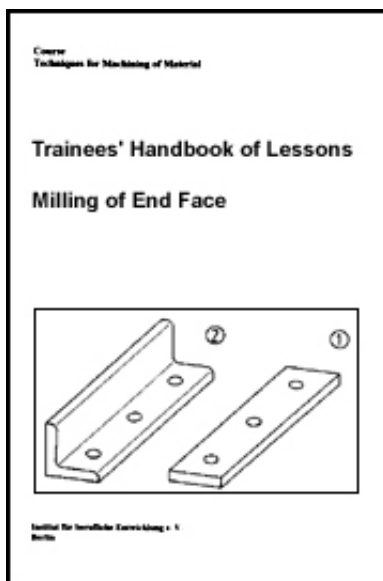
📄 **2. Types of milling tools used**

📄 **3. Preparations for milling end faces**

📄 **4. Milling of end faces**



[Home](#) > [ar.cn.de.en.es.fr.id.it.ph.po.ru.sw](#)



📖 **Milling of End Face - Course: Techniques for machining of material. Trainees' handbook of lessons (Institut fr Berufliche Entwicklung, 18 p.)**

➔ 📄 **(introduction...)**

📄 **1. Purpose and importance of milling end faces**

📄 **2. Types of milling tools used**

📄 **3. Preparations for milling end faces**

📄 **4. Milling of end faces**

**Institut fr berufliche Entwicklung e. V.
Berlin**

**Original title:
Arbeitsmaterial fr den Lernenden
"Frser von Stirnflchen"**

Author: Dieter Frank


First edition © IBE

**Institut fr berufliche Entwicklung e.V.
Parkstrae 23
13187 Berlin**

Order No.: 90-35-3303/2



[Home](#) > [ar](#).[cn](#).[de](#).[en](#).[es](#).[fr](#).[id](#).[it](#).[ph](#).[po](#).[ru](#).[sw](#)

 **Milling of End Face - Course: Techniques for machining of material. Trainees' handbook of lessons (Institut fr Berufliche Entwicklung, 18 p.)**

 **(introduction...)**

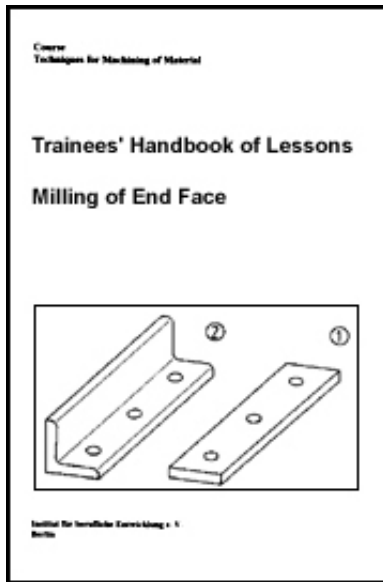
  **1. Purpose and importance of milling end faces**

 **2. Types of milling tools used**



3: Preparations for milling end faces

4: Milling of end faces



1. Purpose and importance of milling end faces

End faces are those workpiece surfaces which determine its length,

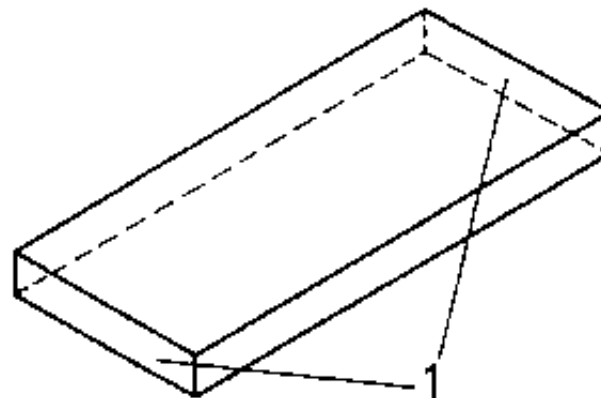


Figure 1

1 face side of a workpiece

They are characterized as left and right, or first and second end face.

The processing of end faces by means of the finishing operation "milling" takes place for the following reasons:

- to establish the dimensional length limitations of workpieces
- for utilization as a bolting surface for other workpieces, components and elements, and
- for yielding a visual working surface.

The processing of end faces can be undertaken using horizontal or vertical milling machines employing either plain or face milling procedures.

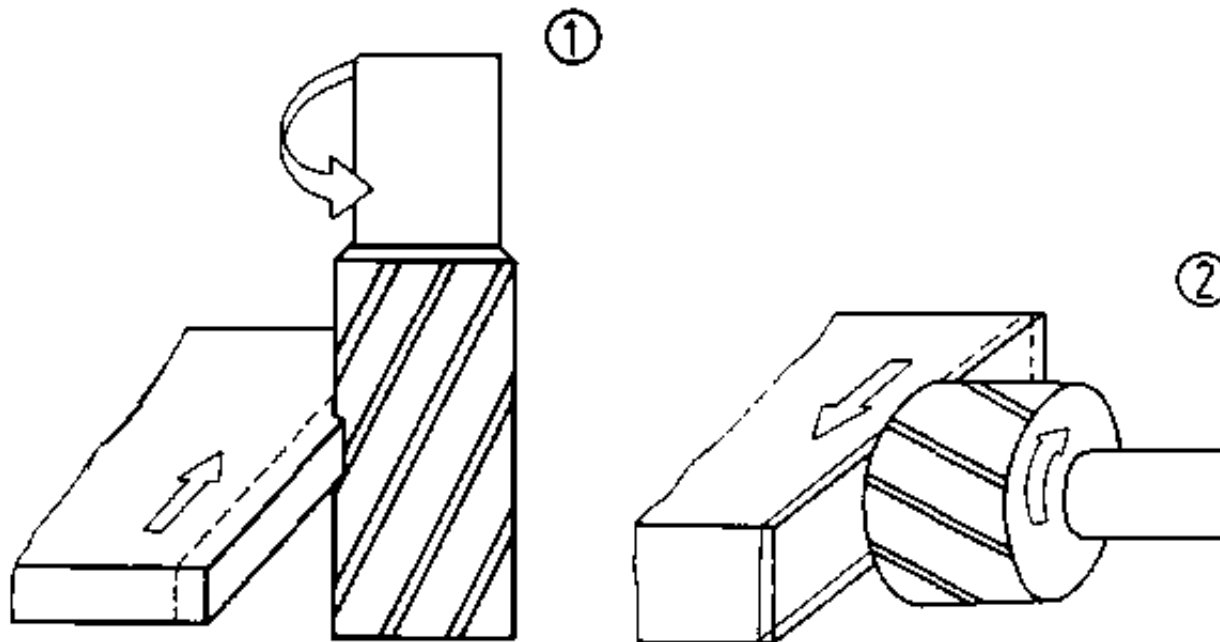


Figure 2

(1) plain milling of an end face, (2) face milling of an end face

End faces are at right angles (90°) to the longitudinal sides of the workpieces. In exceptions one deviates from the rectangular position of the end faces. In such a contingency the resultant surfaces are described as slanting surfaces or inclines,

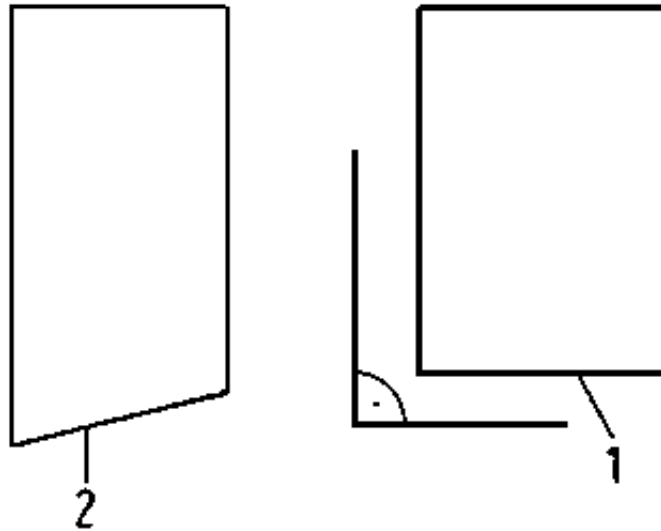


Figure 3

1 end face at right angles (90°)

2 end face as incline

Where both end faces are processed and are at right angles to the longitudinal sides, then the opposite facing surfaces are also parallel to each other (parallel surfaces).

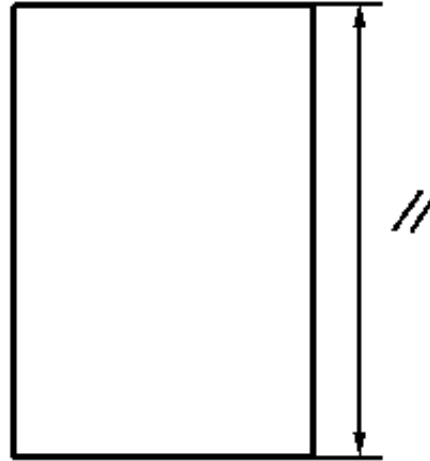


Figure 4 End faces as parallel faces

End faces can be milled:

- **independently of one another in single-piece clamping**
- **independently of one another in multi-piece clamping (package)**
- **by means of a portal milling machine, a two-spindle milling machine or a horizontal milling machine (with gang cutter) by simultaneously working two end faces. In such a case too, single or multi-piece clamping of workpieces is possible.**

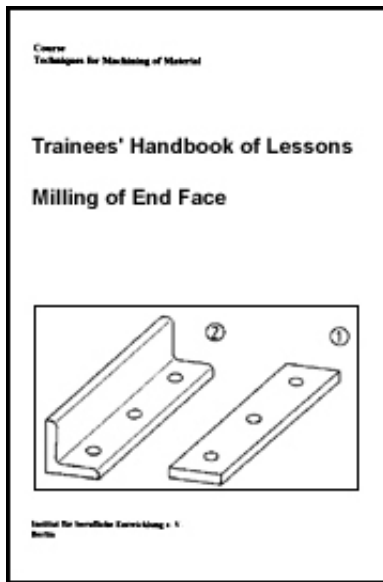
Where are the end faces of a workpiece?


For which purpose (examples) are end faces processed?

Which milling machines are suited for processing end faces?



[Home](#) > [ar](#).[cn](#).[de](#).[en](#).[es](#).[fr](#).[id](#).[it](#).[ph](#).[po](#).[ru](#).[sw](#)



 **Milling of End Face - Course: Techniques for machining of material. Trainees' handbook of lessons (Institut für Berufliche Entwicklung, 18 p.)**

 **(introduction...)**

 **1. Purpose and importance of milling end faces**

 **2. Types of milling tools used**

 **3. Preparations for milling end faces**

 **4. Milling of end faces**

2. Types of milling tools used

End face milling ensues either through hobbing or face milling. Commensurately, milling tools employed for treating flat or parallel surfaces are used, i.e.

- **plain milling cutters and end face mills**
- **end mill cutters**
- **cylindrical cutters are gang cutters, combined**

- milling heads (cutter heads)

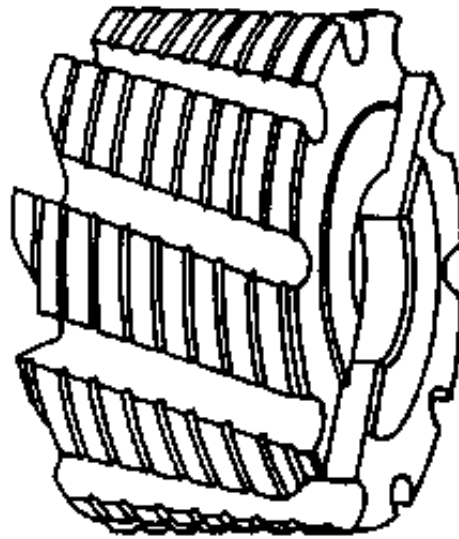


Figure 5 End face mill

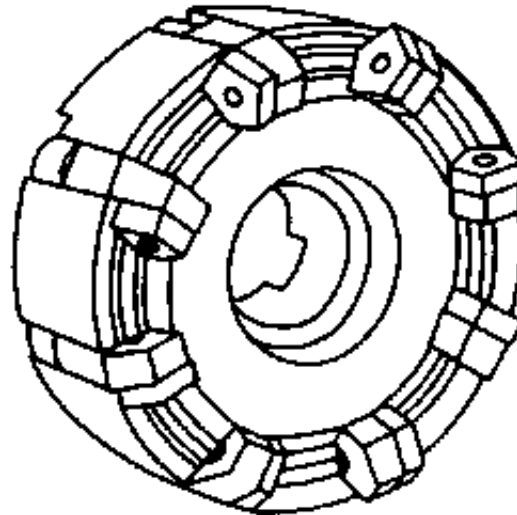


Figure 6 Flat milling head (face milling cutter)

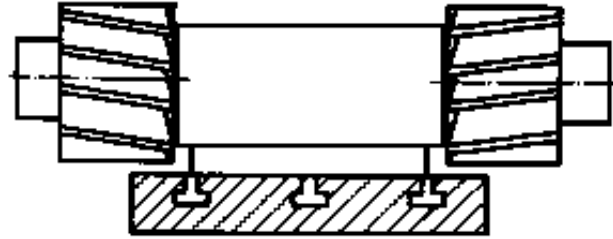


Figure 7 End face mill on the two-spindle milling machine

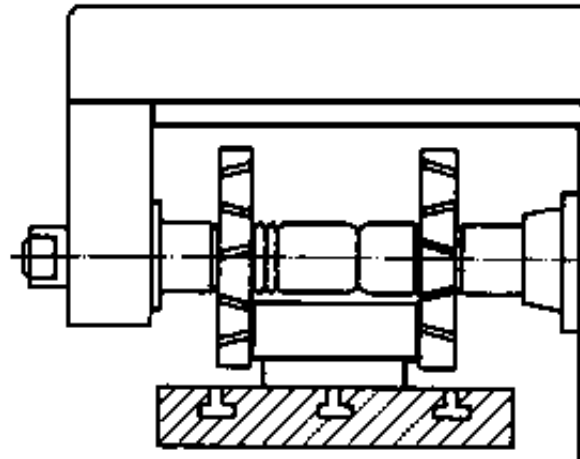


Figure 8 Two cylindrical cutters combined as gang cutter

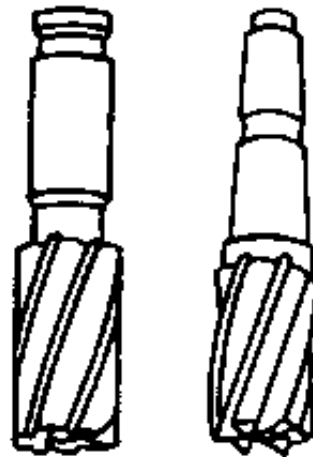
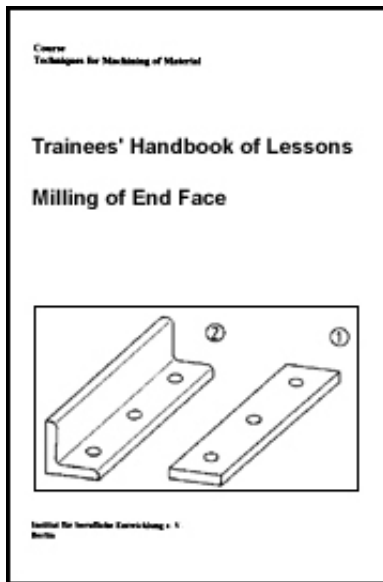



Figure 9 End mill cutter

These milling tools shall be selected and used together with the commensurate tool clamping means and clamping possibilities on horizontal or vertical milling machines in line with the specific work assignment.



[Home](#) > [ar.cn.de.en.es.fr.id.it.ph.po.ru.sw](#)



 **Milling of End Face - Course: Techniques for machining of material. Trainees' handbook of lessons (Institut für Berufliche Entwicklung, 18 p.)**

 **(introduction...)**

 **1. Purpose and importance of milling end faces**

 **2. Types of milling tools used**

 **➔ 3. Preparations for milling end faces**

 **4. Milling of end faces**

3. Preparations for milling end faces

Preparations for milling end faces envisage the following:

- conceptual sequence planning for the work process for milling end faces**

- **selection of the commensurate milling machine (horizontal or vertical milling machine)**
- **selection of the milling and clamping tools, similarly also the required measuring and testing means**
- **positioning the necessary tools, accessories and measuring and testing means heeding the prerequisites for orderly depositing**
- **ensuring the functionality and safety of the tools to be used, measuring, testing equipment and accessories. Everything must be checked prior to usage. Discard worn or impaired tools must be removed.**
- **the milling machine envisaged for milling end faces must also be thoroughly inspected in respect of functionality and safety. Oil level control and lubrication of the milling machine shall be undertaken according to the prevailing lubrication instructions.**

Clamping the tools for milling end faces

The most frequent clamping possibilities are

- **clamping in the machine vice, and**
- **clamping directly onto the machine table (for milling end faces).**

Both clamping possibilities are suited for processing the work-pieces in single or multi-piece clamping (package clamping).

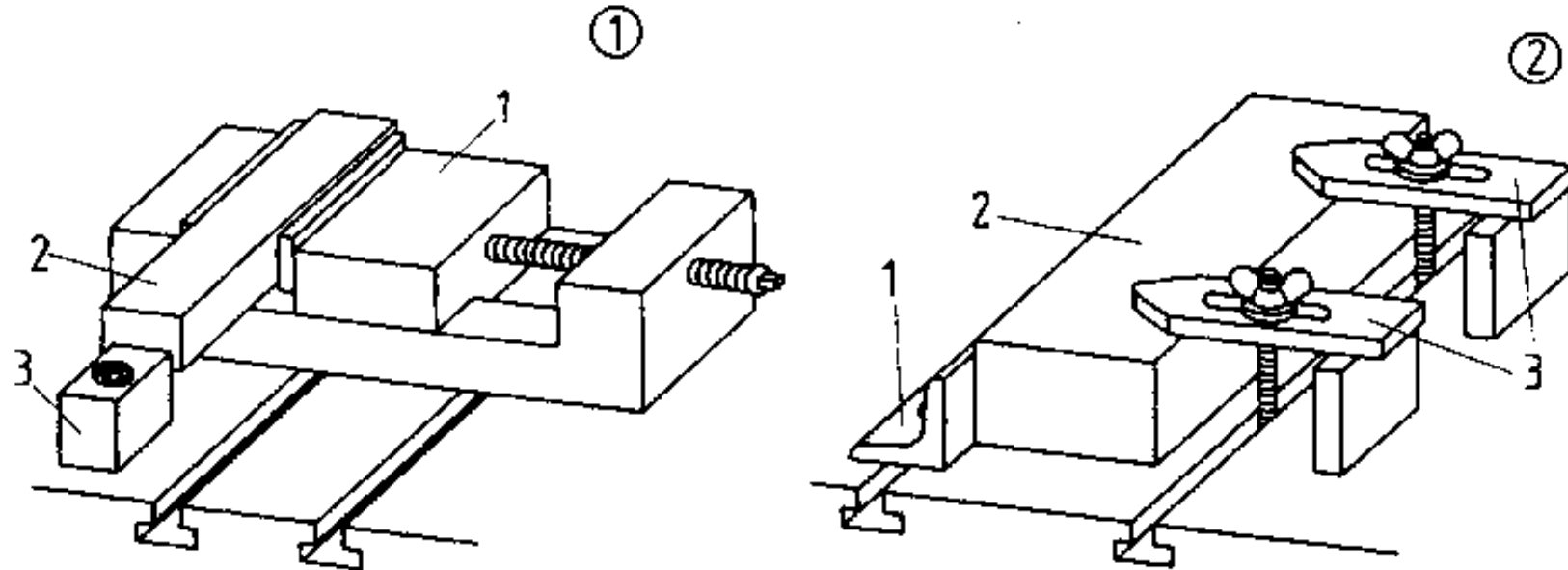


Figure 10 Milling variants

(1) in the machine vice; 1 machine vice, 2 workpiece, 3 stop

(2) directly on the milling machine table; 1 stop strip, 2 workpiece, 3 clamp

When employing the multi-piece clamping methods, ensure that the workpieces are neatly positioned alongside the stop, moreover cleanly and uniformly with the opposite side to the end face to be processed. This makes certain that all package-clamped work-pieces attain a uniform length following processing.

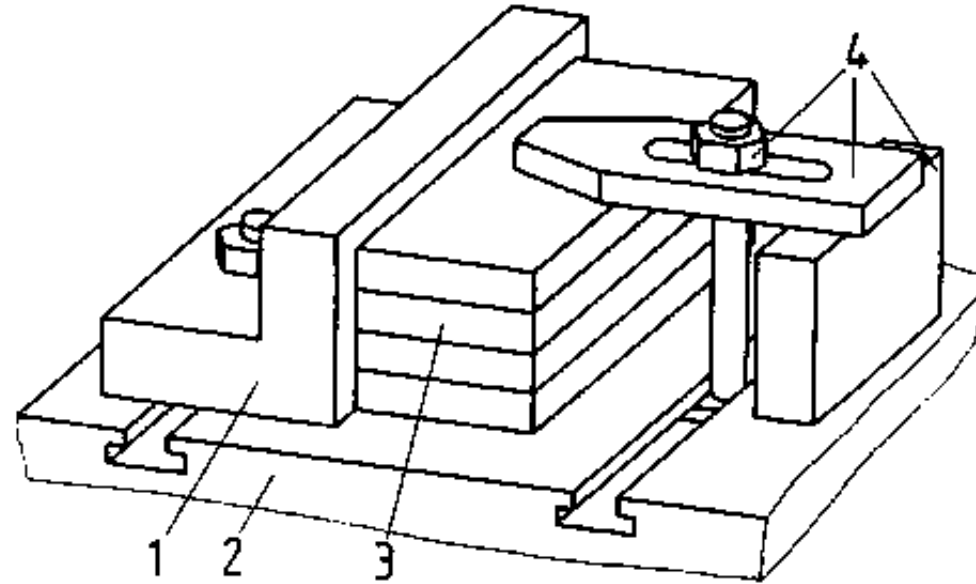


Figure 11 Multi-piece clamping (package clamping)

- 1 stop strip,**
- 2 support surface of the milling table,**
- 3 four workpieces superimposed,**
- 4 clamping elements**

Proper cleanliness of the workpieces is a necessary precondition for proper execution of the work process. Prior to clamping, the workpiece must be freed from chips and burrs. Metal chips inbetween the workpiece surfaces or burr on the already handled surfaces leads to surface damages (imprints) and dimensional deviations, similarly angular discrepancies in respect of the longitudinal surfaces of the workpieces.

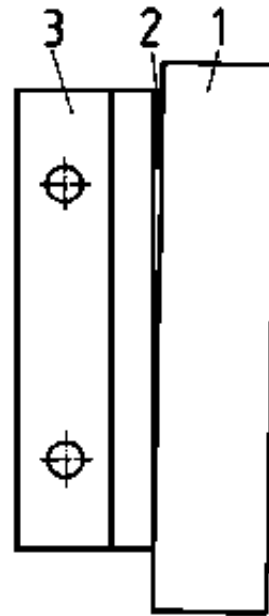


Figure 12 Soiling when clamping the workpiece

- 1 workpiece,**
- 2 soiling (i.e. metal chips),**
- 3 stop strip**

Considerable attention must be given to proper positioned determination (workpiece bearing and support surfaces) in order to attain the required angularity of the end faces to the longitudinal sides of the workpieces. The workpiece clamping means shall be aligned by means of tongues. Fine alignment of the accuracy requirements in regard to angularity with 0.02 - 0.05 mm permitted deviation over 100 mm testing length must be undertaken using a dial gauge.

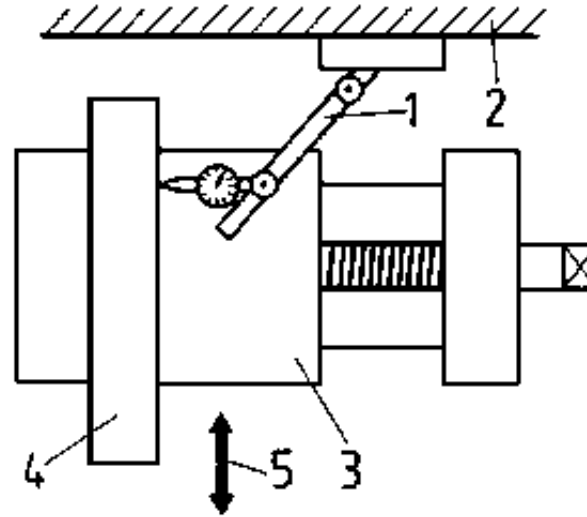


Figure 13 Alignment with the dial gauge

- 1 dial gauge stand with dial gauge,**
- 2 slideway to the machine stand,**
- 3 machine vice,**
- 4 parallel piece in the machine vice,**
- 5 movement direction of the saddle**

- When clamping the workpieces in a machine vice in order to mill end faces, it is essential to ensure that the bearing surfaces of the workpieces (parallel pieces or direct vice supports) are clean and undamaged. In this conjunction, heed the following :

- . The angularity of the end faces to be milled depends on a clean workpiece support in the workpiece clamping means.**
- . The angularity of the end faces to be milled depends on the**

positional determination of the workpiece clamping means (machine vice must be angularly aligned to the slideways of the machine stand),

. The angularity of the end faces to be milled depends on the cleanliness of the workpieces to be clamped and the vice jaws. Soiling or workpiece burrs which have not been removed cause positional deviations and, thereby, lead to discrepancies in respect of the required angularity of the end faces.

- Workpiece clamping directly onto the machine table (direct clamping onto the milling machine table) ensues by means of the stop strip and chucking square.

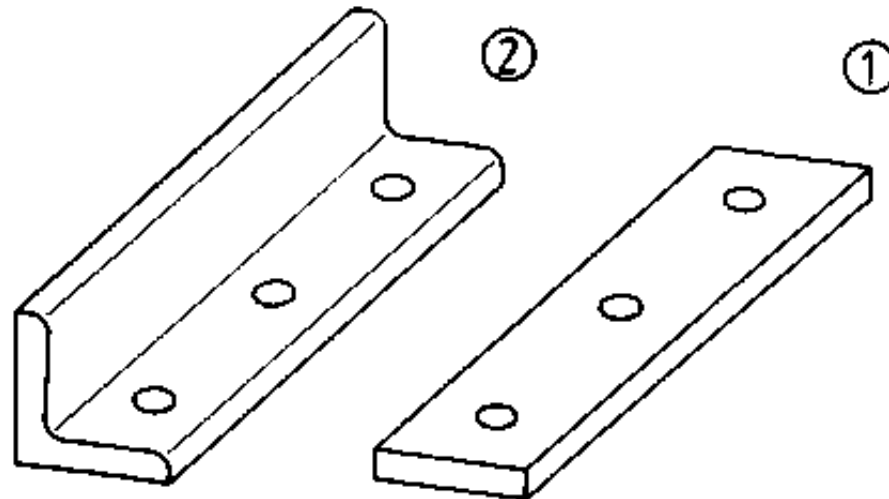


Figure 14 Stop possibilities

(1) stop strip (flat)

(2) stop strip (angular)

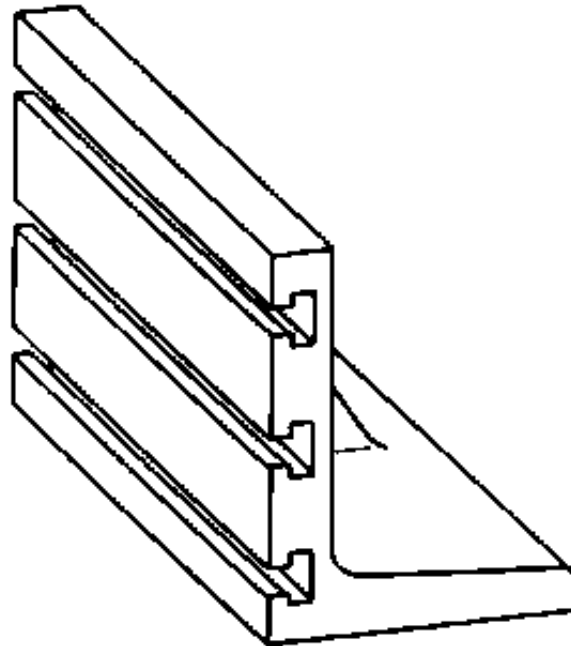


Figure 15 Chucking square

The following hints must be heeded in this respect:

- The angularity of the end faces to be milled depends on the accuracy of the positional determination and stability of the stop strip.**

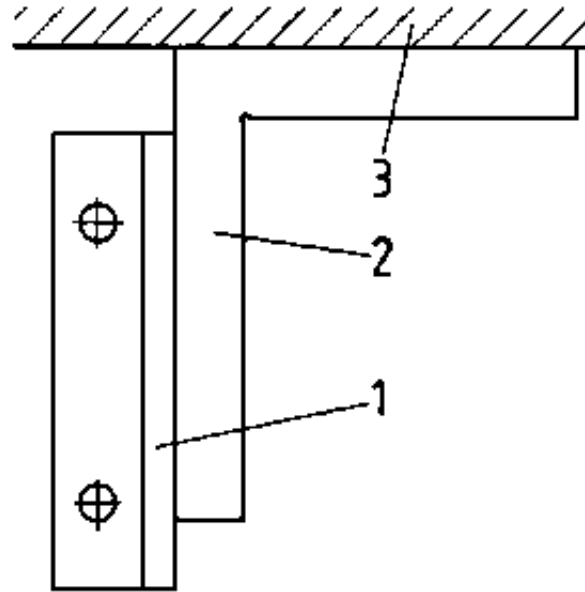


Figure 16 Positional determination (alignment) of a stop strip using the try square

- 1 stop strip,**
- 2 try square,**
- 3 slideway to the machine stand**

- The angularity of the end faces for milling depends on the cleanliness and burr-freeness of the workpieces for processing, in particular their supporting and bearing surfaces.

- The angularity of the end faces for milling depends on the positional determination of the clamped workpieces. Insufficient clamping force permits an undesired "shifting" (positional change) of the workpiece during milling. Direction of feed and of rotation of the milling tool must be so selected that the clamping pressure is directed against the stop strip. This prevents the workpiece from being shifted.

When clamping the workpieces for simultaneous milling of the end faces on a two-spindle milling machine, a portal milling device or a horizontal milling machine with a gang cutter, the following shall be heeded:

- **The angularity of the end faces to be milled depends on sound positional determination and stability of the workpiece clamping means and the workpieces.**
- **The angularity of the end faces to be milled also depends on the cleanliness and burr-freeness of the workpiece and their clamping means.**
- **The workpiece clamping means (machine vice or stop strip) must be shorter (smaller) than the workpiece length required in order, thereby, to rule out damage or destruction of the clamping means and milling tools.**

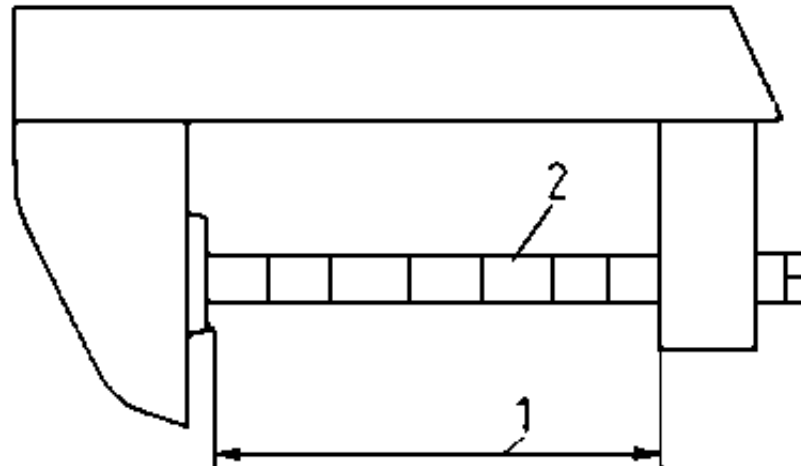


Figure 17 Length limitation when milling using a gang cutter

1 maximum distance between milling spindle and end support bearing block,

2 milling machine arbor collar

The requirements concerning labour safety must be heeded irrespective of the workpiece clamping means used or the type of processing (single or simultaneous milling of end faces)!

In order to avoid eye injuries it is essential to employ milling protective devices or a chip catch.

When deburring the workpieces only use proper files (file handles must be undamaged and fit snugly).

Workpieces with burrs shall only be moved wearing gloves or using rags in order to avoid hand injuries.

Which workpiece clamping means can be used for milling end faces?

What must at all costs be heeded when clamping workpieces?

How can workpiece clamping means for workpieces be aligned presupposing high accuracy demands concerning angularity?

Clamping tools for milling end faces

The milling tools must be clamped securely (vibration-free). When milling using the horizontal milling machine employ short stub cutter arbors, if possible. The mill may, however, also be clamped directly to the milling spindle.

When milling on the horizontal milling machine, the milling tools should be positioned as close as possible to the milling spindle and a second end support used where long stub cutter arbors are employed.

Always wear gloves or use rags when clamping the milling tools in order to avoid hand cuts.

Which clamping possibilities are there for the milling tools for treating end faces?

What must be heeded in particular when clamping milling tools?

Selection and utilization of measuring and testing means

Use the following items in order to check the milled end faces in respect of dimensional and positional deviations:

- vernier caliper (size depends on workpiece length)**
- bevelled edge square or try square**
- rolled measure (for workpiece over 2000 mm long)**

In order to test attained angularity of the processed end faces it is best to use the try square or bevelled edge square. Checking ensues according to the light slit method. Prior to checking clean and deburr the workpiece in order to avoid testing errors caused by soiling.

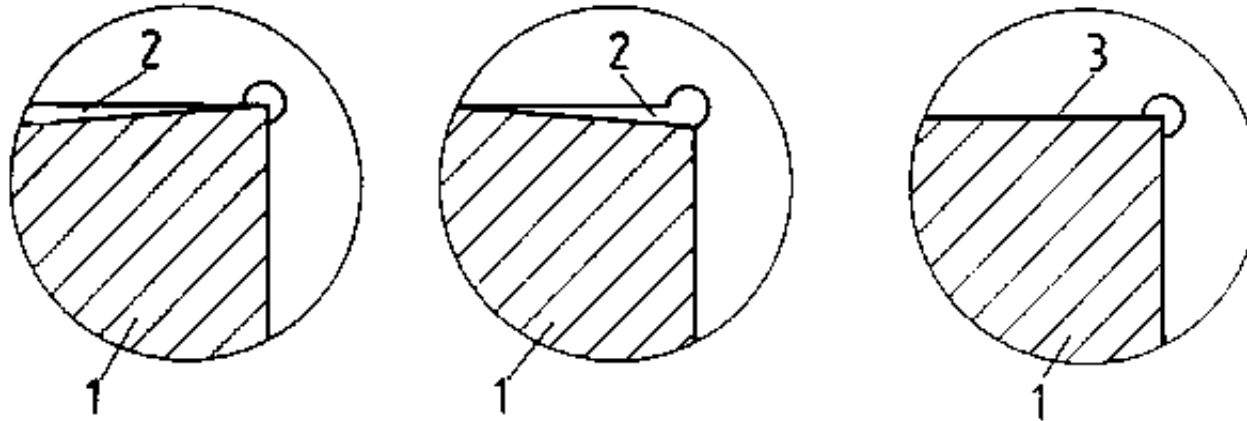


Figure 18 Test shots according to the light slit method

1 workpiece, 2 light slit (left or right), 3 workpiece is angular

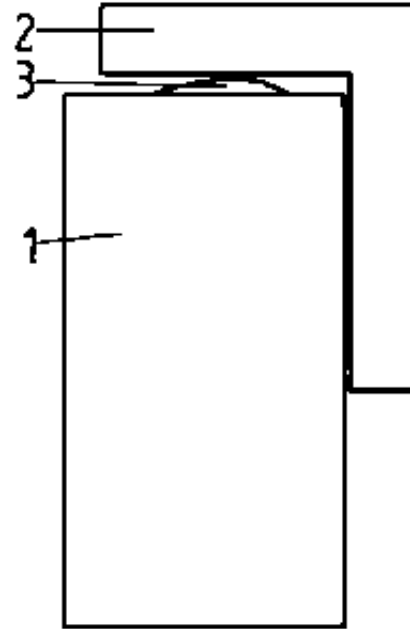


Figure 19 Test errors through soiling

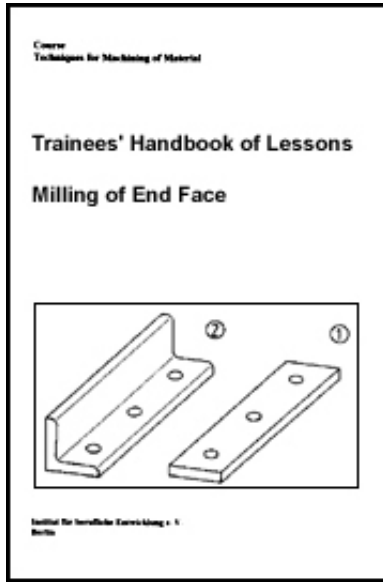
**1 workpiece,
2 try square,
3 soiling (i.e. metal chips)**

Prior to commencing work activities carefully position all measuring and testing means. Their service life depends markedly on proper handling. The measuring result shall not be mitigated by impaired measuring and testing means.



[Home](#) > [ar](#).[cn](#).[de](#).[en](#).[es](#).[fr](#).[id](#).[it](#).[ph](#).[po](#).[ru](#).[sw](#)

 **Milling of End Face - Course: Techniques for machining of**



material. Trainees' handbook of lessons (Institut für Berufliche Entwicklung, 18 p.)

 **(introduction...)**

 **1. Purpose and importance of milling end faces**

 **2. Types of milling tools used**

 **3. Preparations for milling end faces**

 **➔ 4. Milling of end faces**

4. Milling of end faces

The setting-up of the milling machine and the milling of end faces ensues as follows:

- **Check the functionality of the milling machine to be used (oil level control and lubrication according to the lubrication plan).**
- **Position the clamping elements (clamps, chucking screws and bolts, washers and accessories), the tools (chucking wrench, vice crank, milling tools, clamping means for milling tools) and the measuring and testing means.**
- **Check that the workpieces conform to the accompanying data sheets (dimensions and numbers).**

- **Align the workpiece clamping means (machine vice), the stopping means (stop strip, stop) and clamp the workpieces in single or multi-piece clamps.**
- **Clamp the milling tool onto the stub cutter arbor or directly into the milling spindle.**
- **Set the cutting values (rotational speed and rate of feed).**
- **Set up the cooling unit.**
- **Position the milling protective device or position the chip catch.**
- **Position the milling machine table in the processing location to the milling tools (X-Y-Z direction).**
- **Scratching, setting the milling depth and end face rough milling.**
- **Dimensional inspection, adjusting to the required length and end face final milling.**
- **Unclamp the workpiece, deburr the cutting edges and clean, control size accuracy and angularity.**
- **If necessary, undertake dimensional inspection and angular controls. Otherwise mill the end faces of all workpieces according to "position", that is to say rough and final milling ensues in accordance with the marked scale setting (manual adjustment of the saddle). Accordingly, it is necessary that the workpieces are positioned directly at a stop rest. In the**

absence of a stop, the required size would have to be reset for each workpiece.

- If a second end face must be milled on the workpiece then proceed as for the first face side.

- When handling measuring and testing means, heed the ambient temperature for measuring and testing. Workpieces which warmed up during milling shall only be checked at normal room temperature.

If workpieces are measured and tested at a temperature over 20° C measurement errors may result because of length extension!

- Where end faces are simultaneously milled on a horizontal milling machine the required workpiece length is attained by means of a gang cutter. The gang cutter consists of two cylindrical cutters and the inbetween positioned milling arbor and spacers. These end faces are immediately milled to their final length in one work process. Rough milling becomes unnecessary when gang cutters are used. The maximum workpiece length which can be processed by using gang cutters is limited by the length of the stub cutter arbor (cutter arbor - long).

- After having completed the work process the milling machine and all tools, measuring, testing and accessory equipment must be cleaned.

Which preconditions must be fulfilled for attaining the angularity of end faces?

Which measuring and testing means are employed to check dimensional and positional deviations of milled end faces?

What limits the length of the processed end faces when using gang cutters?

How can cutting injuries be avoided when handling sharp-edged workpieces (burr at the cutting edges)?

