

BETAMATIK -120

Commutator full automatic mica undercutter



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Automatic UNDERCUTTING UNIT for commutators

mod : BETAMATIK-120

Table of contents:

- 1. GENERAL FEATURES - TECHNICAL SPECIFICATIONS**
- 2. LOADING THE ARMATURE ON THE UNDERCUTTING UNIT**
- 3-4 INDEXING THE COMMUTATOR BARS**
- 5. MONITORING SYSTEM AND MACHINE DIAGNOSTICS**
- 7. CUTTING SPINDLES**
- 8-9 ADJUSTING THE UNDERCUTTING PARAMETERS**
- 10-11 ERGONOMIC FEATURES - SAFETY - NOISINESS - DUST SUCTION**
- 12 UNDERCUTTING PROGRAMMES**
- 13. USING TUNGSTEN CARBIDE CUTTERS**
- 14. OPTICAL FIBRE FRONT READING DEVICE**
- 15. MISCELLANEOUS**

1. GENERAL FEATURES

The Betamatik series of undercutting units were expressly designed to undercut armatures under direct current. Their functions have been expressly designed for use with motors powering railway vehicles such as trains, subways and street cars.

1.1 Technical specifications of the undercutting unit

Commutator diameter	100 – 900 mm
Armature diameter	100 – 1200 mm
Undercutting length	0 – 400 mm
Armature weight	4000 Kg
Distance between the bearing blocks	1500 mm
Distance between the centres	-----
Milling depth	0 – 2,0 mm
Cutter thickness	0,4 - 2,0 mm
Milling speed – spindle return	0 – 50 mm/sec
Bar indexing speed	0 – 200 steps / min
Cutter rotation speed	4,500 r.p.m. (optionally 0-5,000 r.p.m.)
Machine weight	1100 kg
Aspirator weight	80 kg
Overall dimensions	2800 x 1500 x 1700 mm (LxWxH)
Machine noisiness :	less than 85 db
Electric supply :	v.380 / 415 3ph 50 hz
Installed power :	3.5 kw

T-20 aspirator

Suction pressure	1,600 mm / water
Delivery	250 mc /h
Filter	5,500 cm ² 4 microns
Weight	80 kg

2. LOADING THE ARMATURE ON THE UNDERCUTTING UNIT

The machine can be configured to have either the armature supported by bearing blocks or placed between the centres.

The first solution is preferable in the case of large armatures weighing more than 600-800 kg as these can be more easily loaded by a crane directly on the bearing blocks.

The second is instead preferable in the case of smaller armatures (maximum weight 800 - 1,000 kg) as regulations are faster since there is no need to adjust the blocks vertically according to the difference in diameter of the armature shaft.

3. ARMATURE ROTARY SYSTEM

If the armature is loaded on bearing blocks, a driving chain situated directly on the armature bar is used. In this way, possible slacks caused by flat belts can be avoided. The chain is driven by the gear motor group powered by the step motor and is tensioned by a special system with adjusting wheel.

The two bearing blocks can be vertically adjusted to offset any difference regarding shaft diameters. To correctly position the axis vertically and centre it with respect to the cutter, special rulers are used. These are positioned on the blocks and are graduated according to the diameter of the shaft.

If the armature is to be positioned between the centres, the one situated at the left of the operator is rotated by the reduction gear powered by the step-motor that rotates the armature.

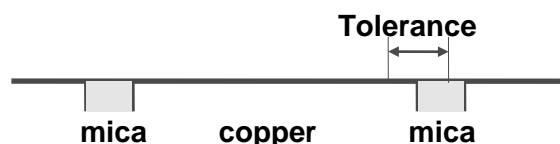
The shaft is driven by means of special interchangeable female cones that can accommodate shafts of different diameters.

4. INDEXING THE COMMUTATOR BARS

The bar indexing device includes a special photocell that can position the edge of the mica with 0.1 mm precision. This photocell and the relevant reading optical equipment work at about 130 mm distance from the commutator. It is therefore far away from the point where dust or shavings are produced. Furthermore, to avoid that the tolerances of the mica/copper thickness influence the reading precision, the reading point is focused on the same bar that will be mill-cut (the bar read by the photocell is the one that will be mill-cut and not the adjacent one !).

The transition from one mica to another is controlled by a step-motor that performs the rotation and whose speed can be adjusted as needed. This stage includes an acceleration/deceleration phase allowing to stop the rotation with the slightest possible inertia effect.

The passing from one bar to another is monitored by a microprocessing unit that supervises the general functions. In particular, a tolerance can be set as needed for the photocell to find the mica. If this does not happen, the cycle is interrupted and the display will show the anomaly that caused it.



5. MONITORING SYSTEM

The control cabinet contains an operator interface complete with display and polycarbonate keyboard tightly protected against dust or dirt. Up to 100 different undercutting programs can be entered by means of this keyboard. Furthermore, all the necessary operating values can be stored under each programme number. These include the position of the centres, the commutator diameter, the undercutting length and others. Adjustments are simplified by the possibility to retrieve these data, especially when shifting between armatures featuring different characteristics. Once the data regarding an individual armature have been stored, the adjustments for a different armature will not take the operator more than 10 minutes. In the case the armatures are the same, adjustment time goes down near to zero as the operations are restricted to loading and unloading and to possible adjustments of the undercutting depth.

6. DIAGNOSTICS

During service, the display shows the phase that the machine is performing. In the case of irregularities or malfunctions, the necessary checks and tests are suggested to the operator. Furthermore, routine inspections to carry out correct preventive maintenance are also available.

7. CUTTING SPINDLES

Machine can fit two sizes of spindles:

Spindle 21/7: (this is the standard type supplied with the machine)

This spindle is suitable for cutters whose external diameter ranges from 21 to 25 mm and 7 mm hole.

On request, the spindle can be supplied for use with different cutter sizes or for sizes in inches.

Spindle 15/5:

This spindle is suitable for cutters 15 mm diameter and 5 mm hole. This spindle allows to cut the commutator up to about 5 or 6 mm from the riser.

These spindles rotate at 4,500 r.p.m. They are particularly suitable for use with tungsten carbide cutters. Being the cutter supported from both sides, it can work under the best cutting conditions (vibrations are reduced and quality improved).

On request, this spindle can be equipped with continuous speed adjustment from 0 to 5,000 r.p.m.

The spindle advance and return speeds are individually adjustable between 0 and 30 mm/sec. As soon as the established undercutting length has been reached, the spindle rises to avoid undercutting again the same section with the risk of creating burrs or damaging its surface. To avoid wasting time, rotation can take place or the next bar can be selected while in the return phase.

8. ADJUSTING THE CUTTING DEPTH

The position of the spindle with respect to the commutator diameter is servo-assisted by a gear motor. Furthermore the undercutting depth can be accurately adjusted by means of a 0,1 mm precision vernier.

Optionally, this depth can be shown on a large digit display (precision 0.1 mm) for a simple but effective check of the measure obtained.

9. ADJUSTING THE UNDERCUTTING LENGTH

Special cams allow to adjust both the position where the cutting is to start and end. This adjustment takes very little time. Each stop consists of two parts: an electric proximity switch and a mechanical safety stop.

10. ERGONOMIC FEATURES

The design of this machine reflects the ergonomic studies made to provide constant working height regardless of the size of the armature machined. Both the cutter and all the operating controls are grouped in the same area and can readily be reached from the working position. This solution is of great help for the operator.

11. SAFETY - NOISINESS - DUST SUCTION

The machine's electric, electronic and mechanical systems comply to the current machine regulations. Each machine carries a plate stating conformity to CE European regulations.

Noise has particularly been cared for, especially as regards its main source, the aspirator.

The aspirator is equipped with a filter capturing 4 micron dust particles. On request, filtering units down to 0.6 microns can be supplied.

12. UNDERCUTTING PROGRAMMES

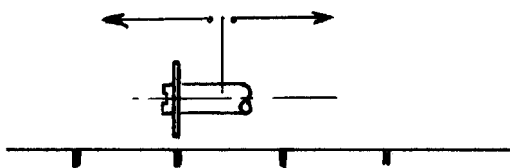
The following cutting programs can be used:

12.1 Oscillating spindle

This is suitable for both new commutators and for those needing reconditioning. In this last case, the mica must be merely decreased to the necessary depth to follow the track of the previous undercutting (see paragraph 13).

Cutter oscillating movement

To introduce the cutter into the commutator at exactly the point set by the photocell, the spindle remains locked until the cutter has gone into the commutator by 5 to 8 mm. It is subsequently released and to be free to oscillate and adapt to the skew of the mica.



The spindle oscillating device is useful to conform to the skew of the mica. It consists of a spindle carrier pivoting on a rotary axis allowing to adjust to possible slopes (± 2 mm) of the mica.

Excellent results have been obtained as the necessary force to the movement is very little (50 g) and been achieved by means of bearings. Furthermore, the absence of springs or of other devices allows the cutter to move perfectly free.

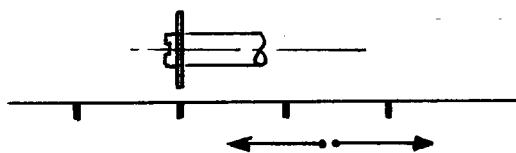
12.2 Locked spindle

This is suitable for both new commutators and for those needing reconditioning. In this case, the spindle is locked to work only along the undercutting axis. (If the machine is equipped with bearing blocks, the skew of the commutator bars can be offset by tilting the armature axis. This is obtained by lowering of one of the two blocks).

12.3 Corridor program

This programme can be used with new commutators where the spindle adapts to the mica as the photocell constantly monitors the position of the cutter with respect to the mica. That is, the photocell follows the contour of the mica thus allowing to conform to skewed bars with respect to the commutator axis.

Commutator is driven by step motor and controlled in position by the photocell
Spindle is locked.



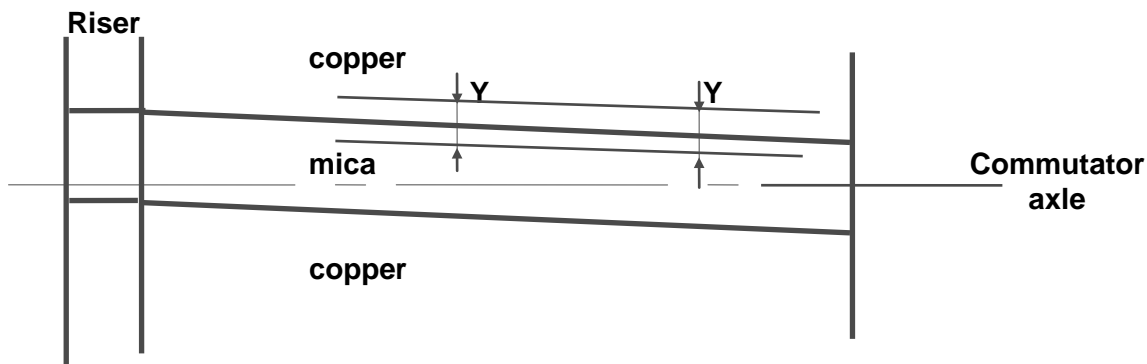
When the bars are skewed or curved to obtain perfectly centred undercutting in the mica, the machine can be used to follow the mica line on a point to point basis.

To this purpose, the spindle is locked. During the cutting, the photocell detects the moment where the skew is such that the cutting has reached the copper instead of the mica.

At this point, the step-motor in control of the commutator's rotation runs until the spindle is again on the mica.

Any faulty reading of the photocell may make the spindle depart from the real line of the mica. To avoid this, a cutting "corridor Y" (Reglable in width) is set up in the machine.

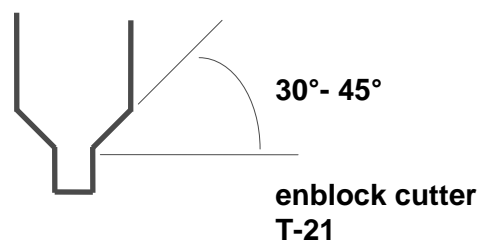
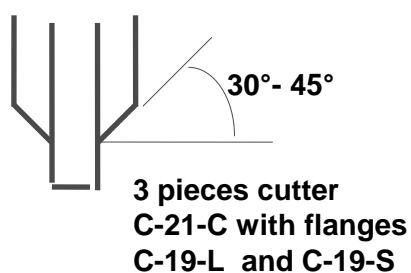
This represents the maximum admitted deviation during machining; if exceeded, the machine will automatically stop.



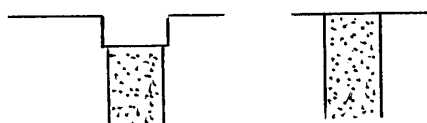
After every correction, the machine will automatically reset the tolerance from the very position of the last correction.

13. USING TUNGSTEN CARBIDE CUTTERS

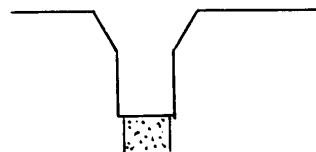
To cut and chamfer the bars, we suggest to use C-21-C cutters assembled with the relevant side flanges (at a 30° or 45° angle), C-19-L and C-19-S, or enblock cutters type T-21. The cutters are normally used to recondition or repair the commutators when the necessary undercutting depth must be restored; to adapt to possible skew of the bars, we suggest to use the "Oscillating spindle" mode.



Before undercut

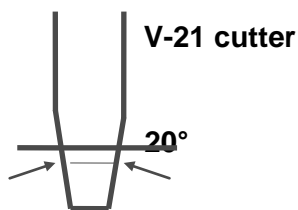


After undercut

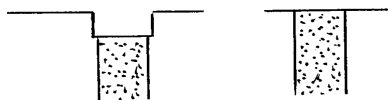


When, on the contrary, the commutator is new, to adapt to the slopes of the mica we advise to use V-21 and T-21 cutters together with the "Corridor" programme. In any case, these cutters last longer and feature better undercutting quality (less burrs) compared to the C-21-C type.

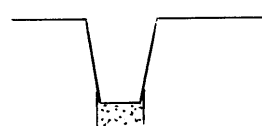
Obviously, these cutters can be used with the oscillating spindle too with no problem.



Before undercut

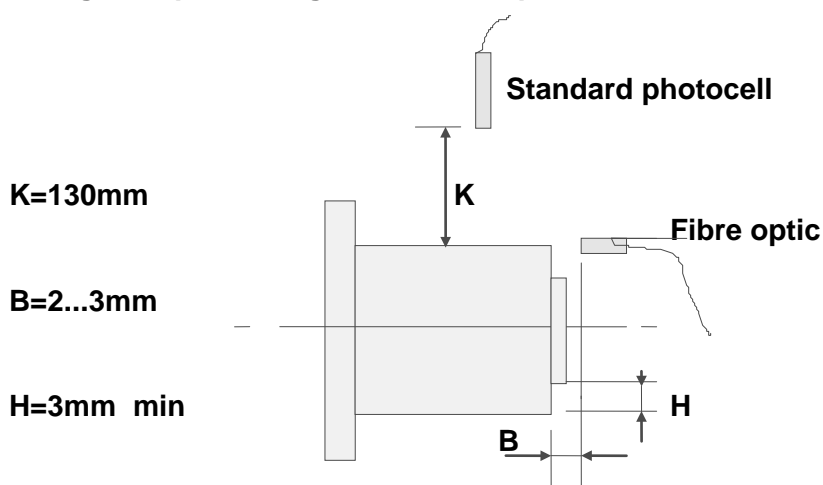


After undercut



14. COMMUTATOR FRONT READING DEVICE

This device is used when the height of the commutator riser (Size K) exceeds 130 mm, or when the undercutting groove has been totally obstructed by the copper burrs during facing thus preventing the standard photocell from reading.



The machine is already equipped with the necessary outlets and grips on which the front optical fibre is to be secured.

A special switch on the control panel allows to select the bar index by means of the standard photocell or the front optical fibre.

It takes no more than 10 minutes to mount the optical fibre device.

15. MISCELLANEOUS

15.1 Commutator condition before undercutting :

**Commutator brush surface must be perfectly clean from oxidation , therefore , before undercut copper has to be skinned on lathe.
AS last alternative could be used emery cloth.**

If ,while commutator turning , the copper burrs will fill the groove by copper chips avoiding photocell correct reading it is better to use the fibre-optic equipment reading on the front of commutator (See at paragraph 14), front could be skinned on lathe or by emery cloth.

15.2 Machine painting : Green RAL 6011 (Other colours available on request)

15.3 Machine foundations : Any foundations is required

15.4 Machine handbooks : Available in two copies in the following languages

**ITALIAN
FRENCH
ENGLISH
GERMAN**