

TRUING COMMUTATORS and SLIP-RINGS

Any deformation of a commutator or slip-ring of rotating machines results in operational difficulties which sometimes appear suddenly and in various ways:

- Sparking at the brushes,
- Scoring of segments,
- Heating of the commutator or slip-rings,
- Rapid brush wear with or without breakage of saddles, pressure plates and shearing of flexibles,
- Deformation and breakage of brush-holder springs.

The higher the speed of rotation of the machine is the more serious these defects become. For this reason, it is desirable to take immediate action.

The deformation of a commutator may develop in various ways:

- Eccentricity or ovalisation, commonly called "out-of-round",
- Irregular deformation due to uneven wear,
- Flats caused by depressed segments due to electrical erosion,
- Segments projecting (high bars), segments recessed (low bars),
- Loosening of segments, occurring after overloading of the machine,
- Bad condition of bearings.

When a commutator has loosened, the manufacturer or a specialised repairer, should be consulted, since re-tightening, which is generally carried out hot, is a delicate operation calling for suitable tools and experienced work-force.

Measuring "out-of-round"

One procedure is to attach a profilometer firmly to the motor frame with the sensor of the instrument resting on the top of a brush. The contact area of the brush should be reduced to the thickness of one connection segment. When the commutator is rotated extremely slowly the profilometer detects the segments which are recessed or projecting.

Another option is to measure the dynamic deformation by means of remote measuring instruments (capacitive pick-ups and oscillographs). – See *Technical Note STA BE 16-26 GB*.

If the deformation exceeds a few hundredths of a millimetre (depending upon the peripheral speed) then truing must be carried out.

c) Truing with an abrasive stone:

This is the only method for truing a commutator or a slip-ring at their normal operating speed, when that peripheral speed is very high. This method removes the minimum amount of material.

It must be remembered that it is always desirable to true a commutator or a slip-ring at its normal rotation speed, due to the dynamic deformations occurring at this speed.

We recommend to use medium abrasive stone (symbol "M") for the phases of finition.

For LARGE MACHINES

If no driving motor is available, and provided some precautions are adopted, one may consider truing a collector "under voltage":

- Withdraw all brushes except 1 or 2 per arm, and supply the machine at reduced voltage,
- On the arm level with the lathe slide, remove all the brushes and brush holders and insulate the arm,
- Similarly, the slide must be insulated from the frame of the machine, so must the operator carrying out the truing operation,
- Ensure that safety recommendations (UTE C 18-515 publication) are observed,
- Lastly, the machine being supplied at minimum voltage, will have been uncoupled from its load; it will therefore rotate under no-load, at minimum current.

USING FRAMES

These robust and precise appliances, of small dimensions, require only a perfectly stable support.

The main conditions to be fulfilled in order to carry out satisfactory truing are:

- Bring the frame level with the commutator axis,
- Ensure that the stone-holder slide is parallel with the axis of the commutator to be trued,
- Rotate the commutator in order to have the stone in trailing position (see Fig. 1),
- Ensure that no substantial play exists in the slides,
- Fix the frame rigidly to the motor carcass or to the brush-holder arm with an adaptor.

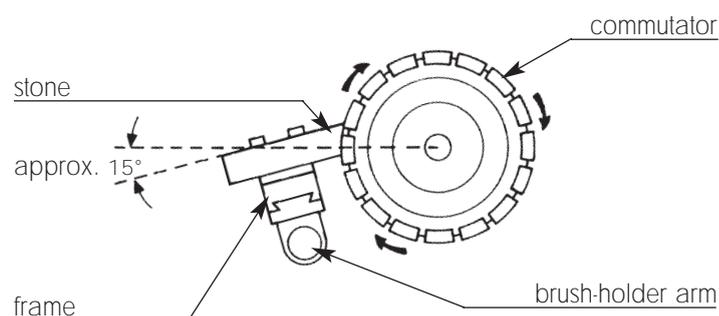


Fig. 1

TRUING

There is a choice between two methods, depending upon whether or not it is possible to remove the rotor from the machine.

In all cases, prevent copper swarf or dust from entering the armature winding for it could cause some short-circuits between coils. To reduce this risk, it is sufficient to fix thick paper bands on the risers, forming a protective screen for the armature winding.

1) On the lathe

This method is applicable to low and medium power rotors, the rotation speed of which is less than or equal to 1 500 rpm.

Recommended conditions for truing commutators and slip-rings				
	Tool	Cutting speed (m/mn)	Feed speed (mm/rev)	Depth of cut (mm)
commutator	High speed steel	45 - 60	0.1 - 0.2	0.05 - 0.15
	Tungsten carbide	100 - 300	0.05 - 0.1	0.05 - 0.15
	Diamond	300 - 1500	0.04 - 0.1	0.03 - 0.10
rings bronze & steel	High speed steel	20 - 40	0.05 - 0.15	0.10 - 0.15
	Tungsten carbide	100 - 150	0.05 - 0.10	0.10 - 0.15

2) Rotor in situ

The truing of commutators or slip-rings can be carried out with:

- a) a lathe tool,
- b) a grinding wheel,
- c) an abrasive stone.

a) Truing with a lathe tool:

This is only possible if a lathe slide can be mounted on the frame of the machine.

It is also necessary to be able to drive the rotor by an auxiliary motor or power supply and when possible to approach above operating conditions.

The **inverted** tool is much used, being placed slightly **below** centre.

b) Truing by grinding wheel (not often used):

This procedure involves the use of a grinder mounted on slides; several types of these exist.

This assembly is mounted on the frame of the machine; the grinding wheel must rotate in the same direction as the commutator.

The grain of the grinding wheel should be medium for rough truing, and fine for the finishing operation.

Ensure that the grinding wheel does not clog, for this may cause lapping of the copper.

The cuts must be small (of the order of 2 to 3/100 mm), in order to obviate tearing and crushing of the copper, which might block the inter-segment recesses and create difficulty in the subsequent operations of scraping the micas and chamfering the segments.

Also the passes must always be very small in order to obtain a perfectly regular surface state (particularly at the end of the operation).

On each reversal of the slide, the stationary time of the stone must be kept as short as possible to prevent grooves being formed.

The medium grain grinding stone will be suitable for the majority of cases.

IMPORTANT POINTS

– 1 – After truing, the surface state should correspond with the defined conditions in our Technical Note STA BE 16-1. These are:

Large Commutators Ra = 0.9 to 1.8 μm .

Small Commutators Ra = 0.5 to 1 μm .

Steel or bronze rings Ra = 0.75 to 1.25 μm .

A glazed or over polished surface develops brush difficulties due to vibration and instability.

– 2 – Truing of commutators must always be followed by chamfering the bar edges (See Technical Note STA 3) necessary micras. Micras should be at least 1 to 1.5 mm deep and can be increased by a suitable hand tool of high speed or diamond or by the use of a saw having the appropriate thickness to clear the interbar completely of mica.

– 3 – Safety. There are precise rules governing the safety of operators and protection to be worn when carrying out these operations.

These rules must be observed (See publication UTE C 18-515).

For any further information please contact our Motor Maintenance Service:

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