



Original title: Montageanleitung für MTU-Bürstendichtungen in ungeteilter oder segmentierter Bauart

Assembly instruction of MTU brush seals
Single-piece and split versions

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1 Scope

This specification details the procedure for installation and removal of single-piece and split MTU brush seals with the bristle pack directed inwards.

If there is an assembly operation sheet covering installation and removal of MTU brush seals, the procedure described on such operation sheets shall be strictly adhered to. The assembly operation sheet shall be prepared by the operator of the facility or machine in consultation with MTU Aero Engines.

Continued on pages 2 to 6

Translation remark:

This specification is a translated (equivalent) version of the German company standard; any perceived discrepancy or dispute as to the intent within the English version shall be resolved by reference to the original German version.

MTU Aero Engines GmbH will not accept any liability for damage resulting from any errors in the translation.

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2 General

2.1 Handling

MTU brush seals are supplied in packaged condition. At any time during storage, unpacking, installation, removal as well as in the installed condition care shall be taken to make sure that the bristle pack is not touched as this might result in personal injuries or damage to the bristle pack (see figure 1).



Figure 1. Handling of the MTU brush seal

Minor radial and axial runout of uninstalled MTU brush seals is permissible as these deviations are eliminated after their installation in the locating slots.

MTU brush seals installed in the casing shall be protected from damage by suitable maskings (plastic cap, cover, etc.) when the rotor is removed. Furthermore, care shall be taken to ensure that no rags, cleaning wool etc. come into contact with the bristle pack, as the bristles may be damaged or even rendered unserviceable.

2.2 Structure and function

MTU brush seals may be single-piece or split seals. As can be seen from figure 2 (single-piece version) the MTU brush seal essentially consists of three elements. The core element (1) is held in place by the support plate (2) and protected by the cover plate (3). The wire bristles are bent 45° in the direction of rotation of the rotor.

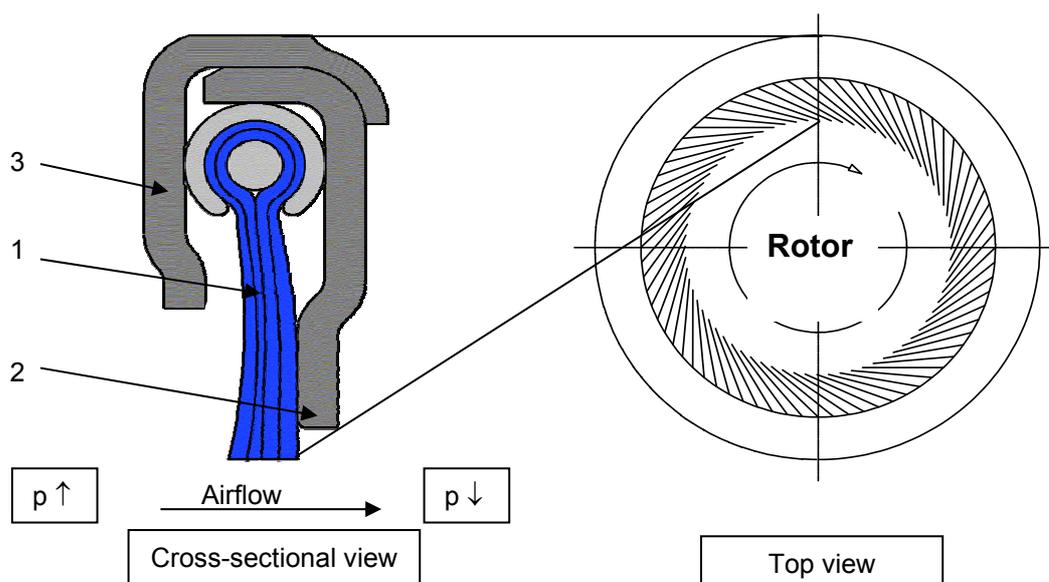


Figure 2: MTU brush seal

2.3 Wax embedding

At the end of the production process, the MTU brush seals may be embedded in wax upon the customer's request to facilitate installation and to protect the bristle pack.

Wax-embedded brush seals, whether as an individual part or in the installed condition, must not be heated to a temperature above 40 °C prior to operation, since otherwise the wax liquefies and its protective action gets lost.

3 Installation of MTU brush seals

3.1 Preparation

Prior to installation the slot in the casing into which the MTU brush seal is to be installed must be inspected. It shall not exhibit any burrs and shall be free from corrosion, foreign objects, lubricants and oil. Any installation or holding tools specified on the assembly operation sheet shall invariably be used.

3.2 Installation position and direction of rotation

Each individual MTU brush seal is manufactured to suit its particular operating parameters. Therefore, care shall be taken to prevent confusion of brush seals even if they appear to be identical.

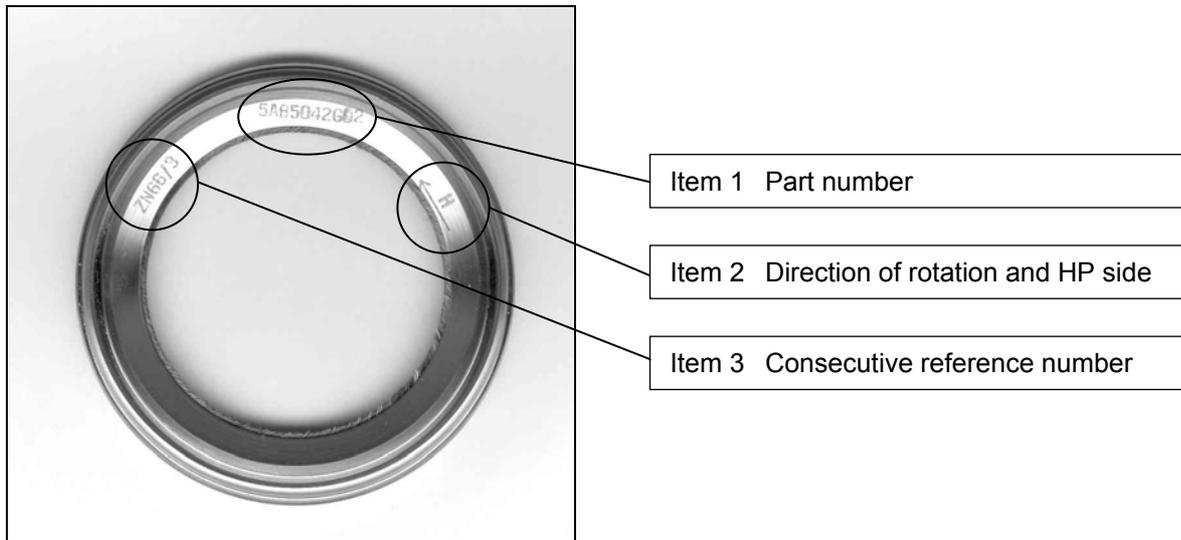


Figure 3. Markings on MTU brush seal (single-piece version)

Since the direction of rotation is specified, the MTU brush seals must not be installed the wrong way round. To ensure correct installation the cover plate is marked – in addition to part number and consecutive reference number – with the letter "H" to indicate the high-pressure side and an arrow "→" to indicate the direction of rotation (see figure 3).

In the event of split MTU brush seals all segments shall be marked accordingly.

3.3 Installation

3.3.1 Single-piece version

Generally, single-piece MTU brush seals are secured in place by press-fitting to prevent their rotation in the casing. These seals must therefore be chilled prior to installation. Depending on the method of press-fitting MTU brush seals may be chilled in a deep freezer or by means of dry ice or liquid nitrogen. The method to use in a particular case may be indicated on the assembly operation sheet.

ATTENTION – DANGER OF ACCIDENTS

To prevent accidents the work safety and health protection instructions for handling chilled components and cooling media shall be observed.

Single-piece MTU brush seals shall be installed as follows:

1. The installation position shall be determined taking the direction of rotation and of pressure into account.
2. Immediately after removal from the cooling medium, the MTU brush seal shall be installed in the casing making sure it is correctly seated.
3. While the MTU brush seal is allowed to reach room temperature in the casing it shall be fixed in place so that displacement is prevented and contact of the abutment face over the entire circumference is ensured.
4. After the MTU brush seal has reached room temperature, its axial and radial location in the casing as well as its installation position in terms of direction of rotation and pressure shall be finally verified and the results of this check shall be documented on the acceptance record sheet.
5. Where the use of tab washers, retaining rings and the like is specified, such items shall be installed at this stage.

In the event of MTU brush seals not embedded in wax, the casing may be heated as an alternative to cooling of the seal, or a combination of heating and cooling may be used. The methods to use shall be specified on the assembly operation sheet.

3.3.2 Split version

Split MTU brush seals are positively or non-positively locked to prevent their rotation in the casing. Clamping claws (see figure 4), locking wires and the like may be used for the purpose

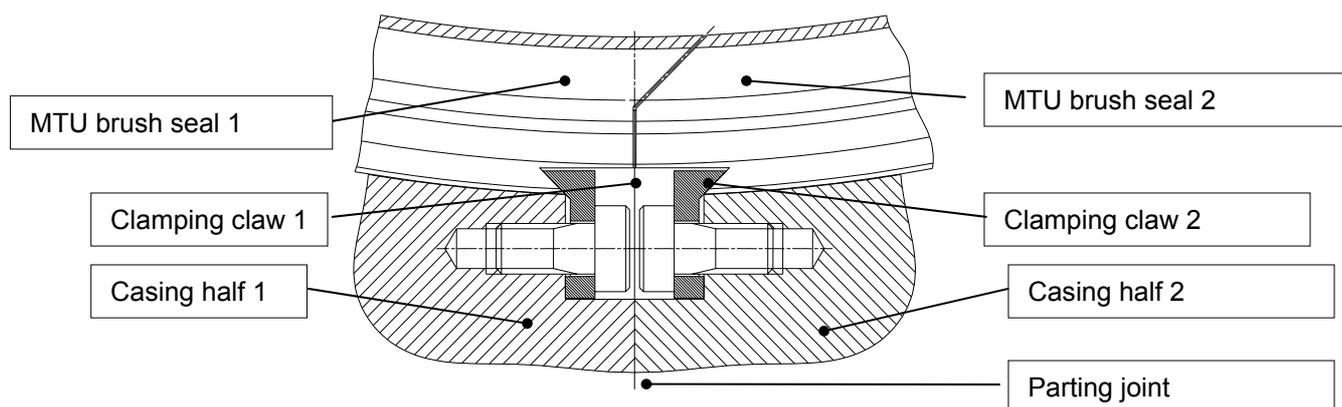


Figure 4. Split MTU brush seal (installed with clamping claws)

Split MTU brush seals shall be installed (with the aid of clamping claws) as follows:

ATTENTION

Make sure only segments with identical part number and consecutive reference number are installed together.

1. Segments with identical part number and consecutive reference shall be selected for each locating slot.
2. The seal segments shall be located in the clean locating slot, making sure the direction of pressure and of rotation is correct.
3. Assemble the clamping claw on one side and slightly pre-stress it.

4. Use a straight-edge or equivalent device to check that the parting joint of the seal is flush with the parting joint of the casing (see figure 5). Otherwise, the MTU brush seal segments might overlap or there might be a gap between them (see figure 4).
5. Mount the clamping claw on the opposite side.
6. Tighten the bolts uniformly on both sides (using a torque of approx. 7 Nm).
7. Make sure that the brush seal is in contact with the slot wall to the low-pressure side to prevent air from by-passing the seal in operation.
8. Following assembly of both clamping claws, check both sides (e.g. with a straight-edge) to make sure that the parting joint of the seal is flush with the parting joint of the casing.
9. Following installation of the MTU brush seal the direction of pressure and of rotation of all seals both in the upper and the lower part shall be checked again.

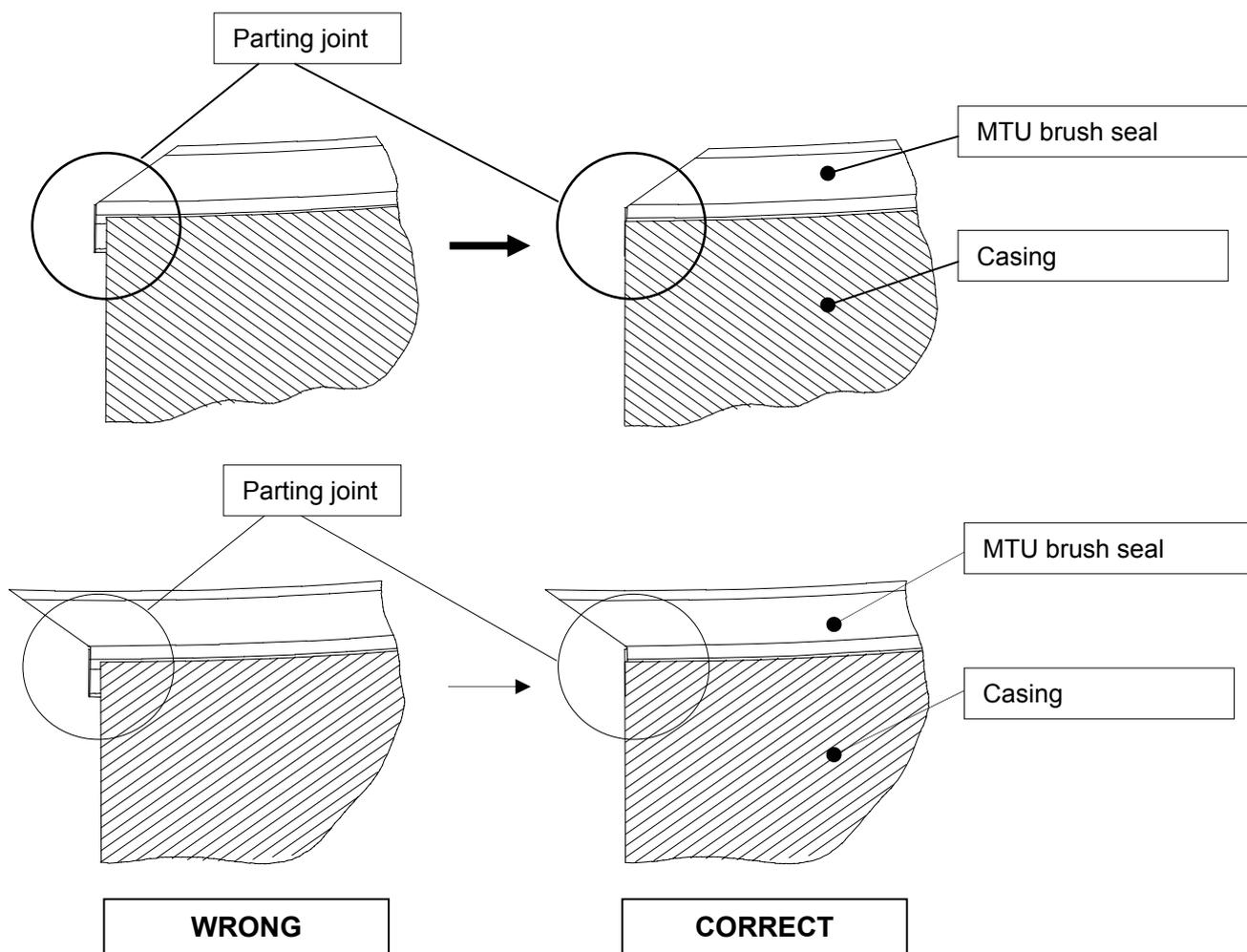


Figure 5. Parting joint configuration

4 Removal of the MTU brush seals

During removal of the MTU brush seals care shall be taken to prevent damage by application of excessive force. If disassembly tools are specified on the assembly operation sheet make sure these tools are invariably used. The use of other tools may cause damage to or even destruction of the brush seal and its locating slot.

4.1 Single-piece version

Where no disassembly tool is available, the MTU brush seal half shall be removed from the casing by pulling or pushing evenly, e.g. with the aid of an extractor. To prevent damage to the seal, the extractor shall be applied at an adequate number of points.

Following removal, the MTU brush seal shall immediately be placed in the package provided for the purpose.

4.2 Split version

The clamping claws shall be removed first.

The seal segments shall then be turned of the slot, applying slight pressure on the seal end. It shall then be grasped at the cover and support plates to remove it completely from the slot. Following removal, the MTU brush seal shall immediately be placed in the package provided for the purpose.

Explanatory notes

Supersedes issue 2001-11.

Specification completely revised in technical and editorial aspects.