



FILLING PRODUCTS

Chemotechnische Fabrik e.K.



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APPLICATION GUIDELINES FOR SEALING TURBINES AND TURBOSETS USING FILLING PRODUCTS

Turbine construction

The application guidelines apply to the following types of turbine:

- **Steam turbines**
- **Gas turbines**
- **Turbosets**

Steam and gas high-pressure turbines (HPT)

- The split joints on high-pressure turbines (HPT) consist of two sealing strips with a continuous sealing surface.
- There is one inner and one outer sealing strip.
- Only the inner strip is load-bearing (internal strip).

Steam and gas medium-pressure turbines (MPT), low-pressure turbines (LPT)

- The split joints on medium-pressure turbines (MPT) and low-pressure turbines (LPT) consist of a continuous sealing surface with centred cylindrical holes.
- The inner sealing area of the split joints is load-bearing as standard up to the start of the cylindrical holes.

If all the requirements of the general application guidelines are satisfied, we guarantee **100% sealing** of the turbine surfaces (split joints), with the temperature and pressure values stated in our product documentation, on:

- **Steam turbines**
- **Gas turbines**
- **Turbosets**

General information

for the implementation of the application guidelines for sealing split joints on steam turbines, gas turbines and turbosets using FILLING PRODUCTS

1. Properties of all FILLING PRODUCTS

By selecting **FILLING basic®**, **FILLING 1000®** and **FILLING 2000®**, you have chosen to purchase high-quality, single-component sealing materials in paste form. Only the **combined use** of **FILLING basic®** and **FILLING 1000®/2000®** guarantees the desired quality of the seals on split joints and cut surfaces. The products are temperature resistant **up to 950 °C** against: hot steam and hot air, hot and cold water, cold air, fuel oils and lubricants, as well as crude oil and natural gas.



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Even in the absence of temperature and pressure the products remain resistant to erosion and corrosion. **FILLING basic®**, **FILLING 1000®** and **FILLING 2000®** offer such a high level of adhesion on sealing surfaces and split joints that we can guarantee a one hundred per cent seal up to a pressure of **275 bar**. In addition, we guarantee a pressure resistance for flanges without sealing rings of up to **570 bar** and for screw joints of up to even **670 bar**. We guarantee a product service life of **10 years** for machined sealing surfaces (split joints). The prerequisite for this guarantee is that the products are used in accordance with the instructions and that the service intervals are observed in the product segment **steam and gas turbines** and all other application areas.

FILLING basic®, **FILLING 1000®** and **FILLING 2000®** are in water hazard category **WK1 (low water hazard)** and are therefore classed as **non-hazardous substances**.

1.1 Product properties **FILLING basic®**

High temperatures combined with pressure on smooth sealing surfaces (split joints) make extreme demands on the quality of the sealing compound. This is particularly important when sealing metallic joints in **steam and gas turbines**, compressors, generators, expanders, pumps, housings and flange joints etc. You are optimally equipped for these jobs with **FILLING basic®**.

FILLING basic® is suitable for sealing all surface sizes. The surface quality of the sealing surfaces corresponds to machined/abraded surfaces with a finishing accuracy of $R_a = 0.8 \mu\text{m}$ to $1.2 \mu\text{m}$. Sealing surface damage of $\leq 0.2 \text{ mm}$ is compensated with **FILLING basic®**.

1.2 Product properties **FILLING 1000®**

High temperatures combined with pressure on localised pitting, flat corrosion or erosion damage (cavities) on housing split joints make extremely high demands on the quality of the sealing compound. **The use of this product means that costly, mechanical pretreatments are no longer required.** This is particularly important when sealing metallic joints in **steam and gas turbines**, compressors, generators, expanders, pumps, housings and flange joints etc. You are optimally equipped for these jobs with **FILLING 1000®**.

FILLING 1000® is suitable for sealing all surface sizes. The surface quality of the sealing surfaces corresponds to machined/abraded surfaces with a finishing accuracy of $R_a = 0.8 \mu\text{m}$ to $1.2 \mu\text{m}$. Localised pitting, flat corrosion or erosion damage on these surfaces of $\leq 0.5 \text{ mm}$ can be compensated with **FILLING 1000®**.

1.3 Product properties **FILLING 2000®**

High temperatures combined with pressure on localised pitting, flat corrosion or erosion damage (cavities) on housing split joints make extremely high demands on the quality of the sealing compound. **The use of this product means that costly, mechanical pretreatments are no longer required.** This is particularly important when sealing metallic joints in **steam and gas turbines (particularly cross joints)**, compressors, generators, expanders, pumps, housings and flange joints etc. You are optimally equipped for these jobs with **FILLING 2000®**.

FILLING 2000® is suitable for sealing all surface sizes. The surface quality of the sealing surfaces corresponds to machined/abraded surfaces with a finishing accuracy of $R_a = 0.8 \mu\text{m}$ to $1.2 \mu\text{m}$. Localised pitting, flat corrosion or erosion damage on these surfaces of $\leq 1.0 \text{ mm}$ can be compensated with **FILLING 2000®**.



2. Requirements

for conducting an operational test to seal the split joints on steam turbines, gas turbines and turbosets using the products FILLING basic®, FILLING 1000® and FILLING 2000®

In order to test the sealing properties of **FILLING basic®**, the operational test is to be carried out with the **elements of steam, temperature and pressure** (min. 80 °C and 15 bar pressure). If an operational test is carried out with cold water and pressure only, the sealing compound is unable to bond with the irregularities on the sealing surfaces of the split joints and seal them permanently. The material would be **washed out of the split joints**. The element of temperature is absolutely essential. It combines with the element of pressure to cause the material to become **adhesive**. An operational test can also be carried out with **FILLING 1000®** and **FILLING 2000®** with **cold water, cold or hot air and pressure** (min. 15 °C and 3 bar pressure) in addition to **steam, temperature and pressure**.

The **FILLING 1000®** and **FILLING 2000®** products are therefore also suitable for hydrotests.

The **FILLING products** remain elastic and permanently seal the relevant areas on the surfaces of the split joints. Other options for conducting an operational test on **FILLING PRODUCTS** are on steam pipes or flange joints exposed to steam, cold and hot air or pressure. Generally speaking, the operational tests can be done on any kind of metallic connection that is subject to a combination of temperature and pressure.

3. Definitions and implementation

of the application guidelines for sealing split joints on steam turbines, gas turbines and turbosets using FILLING PRODUCTS

Constructional design of the sealing surfaces at the split joints of high-pressure turbines (HPT), medium-pressure turbines (MPT), low-pressure turbines (LPT), steam and gas turbines:

- The split joints on high-pressure turbines (HPT) consist of two sealing strips with a continuous sealing surface. There is one inner and one outer sealing strip. The inner strip is load-bearing (internal strip).
- The split joints on medium-pressure turbines (MPT) and low-pressure turbines (LPT) consist of a continuous sealing surface with centred cylindrical holes. The inner sealing area of the split joints is load-bearing up to the start of the cylindrical holes.

Required surface condition for the sealing surfaces on the split joints of HPT steam and gas turbine models

The sealing areas of the split joints on high-pressure turbines (HPT) comprise one inner sealing strip and one outer sealing strip.

The inner strip (interior strip) is **the load-bearing sealing strip**.

The load-bearing sealing surface at the split joints on high-pressure turbines (HPT) is the inner strip (interior strip). This must be **load-bearing throughout**. The surface quality of the sealing areas of the inner strip corresponds to machined/abraded surfaces with a finishing accuracy of Ra = 0.8 µm to 1.2 µm.

The limit values for the Ra value are Ra = 30 µm to 50 µm, in order to seal off the split joints.

In the event of damage to the split joint sealing surface of **≥ 0.3 mm to 0.5 mm**, both turbine halves are usually exchanged with one another in order to identify **erosion/corrosion damage** and these are compensated by mechanical machining. This means that the inner strips of the upper and lower turbine halves are machined against one another, thus compensating for damage and irregularities on the sealing surfaces.



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The use of our FILLING 1000® and FILLING 2000® products means that cost-intensive premachining is no longer necessary!

The outer strip (exterior strip) is **the non-load-bearing sealing strip**.

The surface quality of the sealing areas on the outer strip corresponds to milled surfaces with a finishing accuracy of **approx. 0.1 mm**. The outer strip **can and must** have greater clearance. When fastening the upper turbine half to the lower one, a greater tightening torque can thus be transmitted by means of the heating bolts to the inner strips via which the turbine halves are sealed.

Required surface condition for the sealing surfaces on the split joints of MPT and LPT steam and gas turbine models

The sealing surfaces of the split joints on medium-pressure turbines (MPT) and low-pressure turbines (LPT) consist of a continuous surface with centred cylindrical holes.

The load-bearing sealing area at the split joints on medium-pressure turbines (MPT) and low-pressure turbines (LPT) is the inner sealing surface up to the start of the cylindrical holes as standard. This must be **load-bearing throughout**.

The surface quality of the sealing area of the inner strip corresponds to machined/abraded surfaces with a finishing accuracy of $R_a = 0.8 \mu\text{m}$ to $1.2 \mu\text{m}$. The limit values for the R_a value are $R_a = 30 \mu\text{m}$ to $50 \mu\text{m}$, in order to seal off the split joints.

In the event of damage to the split joint sealing surface of $\geq 0.3 \text{ mm}$ to 0.5 mm , both turbine halves are usually exchanged with one another in order to identify **erosion/corrosion damage** and these are compensated by mechanical machining. This means that the inner sealing areas of the upper and lower turbine halves are machined against one another, thus compensating for damage and irregularities on the sealing surfaces.

The use of our FILLING 1000® and FILLING 2000® products means that cost-intensive premachining is no longer necessary!

The outer sealing area is a **non-load-bearing sealing area**.

The surface quality of the outer sealing area corresponds to milled surfaces with a finishing accuracy of approx. **0.05 mm to 0.1 mm**.

The outer surface **can and must** have greater clearance; when fastening the upper turbine half to the lower one, a greater tightening torque can thus be transmitted by means of the heating bolts to the inner strips via which the turbine halves are sealed.

Illustration of the required surface condition on steam turbines, gas turbines and turbosets





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Illustration of erosion/corrosion damage to split joints on steam turbines, gas turbines and turbosets



4. Implementation

of the application guidelines for sealing finished split joints on steam turbines, gas turbines and turbosets using the products **FILLING basic®**, **FILLING 1000®** and **FILLING 2000®**

High-pressure turbines (HPT), medium-pressure turbines (MPT), low-pressure turbines (LPT)

FILLING PRODUCTS are suitable for sealing all surface sizes:

- Areas of damage of ≤ 0.2 mm on sealing surfaces can be filled with **FILLING basic®**.
- Areas of damage of ≤ 0.5 mm on sealing surfaces can be filled with **FILLING 1000®**.
- For spot repairs on badly damaged areas of ≤ 1.0 mm, we recommend the product **FILLING 2000®**.

1. Step 1:

Grind the load-bearing sealing surfaces of the split joints

This step must be carried out by **highly qualified experts** only.

In order to guarantee an optimally primed surface for the sealing material, use a vibrating sander with a fibre disc (plate disc) to **lightly** grind the sealing surfaces, 60-80 grit, fine (depending on finishing accuracy, this may **not** be necessary). **Alternatively:** Abrade the surfaces.

2. Step 2:

Clean the load-bearing sealing surfaces of the split joints

Degrease the upper and lower split joints of the HPT, MPT and LPT turbines and clean these with a dry cloth.

3. Step 3:

Apply **FILLING basic®, **FILLING 1000®** and **FILLING 2000®** to the load-bearing sealing surfaces of the split joints**

Depending on the degree of damage, seal the **entire sealing surface area** with **FILLING basic®** or **FILLING 1000®**. Selective and shallow, trough-like corrosion or erosion damage on these surfaces of ≥ 0.5 mm bis **1.0 mm** is compensated with the product **FILLING 2000®**. The required quality of the seals on butt joints and cut surfaces can only be guaranteed through the combined use of **the** sealing products.



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FILLING basic®

Apply **FILLING basic®** with a brush or putty knife on both sides to the dry sealing surfaces. The layer thickness to be applied is **0.2 mm to 0.3 mm**. **FILLING basic® can be subjected to workloads immediately!**

FILLING 1000®

Using a putty knife, apply **FILLING 1000®** with force to the clean, grease-free damaged surfaces. The layer thickness to be applied is **0.2 mm to 0.3 mm**. In order to make application easier, you can remove the anticipated amount required and heat it up to 100 °C. This is not absolutely necessary.

FILLING 2000®

Using a putty knife, liberally apply **FILLING 2000®** to the cleaned, grease-free damaged surfaces in the relevant area. Remove the anticipated amount required and heat it up to 100 °C to apply.

FILLING 1000® and FILLING 2000® may not be mixed with anything. They can be subjected to loads immediately! They do not cure, will not change their consistency even after several hours, and remain flexible and elastic. **FILLING basic®, FILLING 1000® and FILLING 2000®** are dark brown.

4. Step 4:

Seal the steam and gas high-pressure turbines (HPT), medium-pressure turbines (MPT), low-pressure turbines (LPT)

Seal the turbine halves in accordance with the manufacturer's specifications.

The turbine may be placed (started) under load immediately **without any waiting time!**