Somaloy® 7P

Frequently asked questions

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Somaloy® FAQ

This document provides answers to frequently asked questions about Somaloy materials. As a living document, it is continuously updated with new questions and answers to reflect the latest knowledge and customer needs.

If you cannot find the answer you need, please contact *SMCsupport@hoganas.com*.

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Material characteristics

What are the main benefits of Somaloy 7P compared to Somaloy 5P?

Compared with earlier Somaloy 5P grades, Somaloy 7P offers lower magnetic losses, improved thermal durability, and a water-based coating system.

How should Somaloy data be compared with laminated steel?

Laminated steels are typically preferred for conventional low-frequency designs. Somaloy materials provide advantages in applications that benefit from 3D magnetic flux and higher operating frequencies. Refer to application notes for detailed comparisons.

Is Somaloy 7P available without lubricant?

No. Somaloy is supplied only as a press-ready mix. The lubricant is an essential part of the material design and has a significant effect on both processing and final properties.

Does Höganäs offer training on Somaloy materials and processes?

Yes. Training can be provided upon request. Please contact your local Höganäs representative or *smcsupport@hoganas.com* for more information.

How can I determine whether my Somaloy part design is feasible?

If this is your first Somaloy part design, we recommend scheduling a feasibility meeting with Höganäs at no cost. During this meeting, we can help optimize the design for manufacturability, including mass-production considerations and pressing tool requirements.

We can also support material selection by recommending the most suitable Somaloy grade for your design and application.

If you are unable to share your design or sign an NDA, our support will be more limited. However, you are still welcome to contact us for general design guidance.

Compaction

Can Somaloy 7P be compacted at room temperature?

Yes, compaction at room temperature is possible. However, it will generally result in lower part density, which will negatively affect material properties. We recommend comparing datasheet values at different densities to understand the impact.

Is my press capacity sufficient?

It depends on the required part density and the projected pressing area.
The achievable compaction pressure is determined by the press force and the projected pressing area, according to:

Where:

p = compaction pressure

F = pressing force

A = projected pressing area

For practical use, this relationship can be expressed as:

$$p\ (\text{MPa}) = \frac{F\ (\text{kN})}{A\ (\text{mm}^2)} \times 1000$$

You can calculate the maximum achievable pressure for your part and compare it with the compressibility curves in the Somaloy processing guidelines to determine whether the target density can be reached. Part geometry must also be considered. Features such as steps in the die, variations in section thickness, and complex shapes can increase friction and reduce the effective pressure, which may limit the achievable density.

Why is density important?

Density is a key parameter that strongly influences the properties of Somaloy. Lower density generally leads to reduced magnetic and mechanical performance. We recommend comparing datasheet values at different densities to understand the effect.

In addition, density variation within a part should be minimized. Local density differences can lead to variations in material properties and may increase the risk of crack formation.

To evaluate density variation, the part can be sectioned and measured using the Archimedes principle. For very small sections where this method is not applicable, microstructural analysis of cross-sections can be used as an alternative.

What causes surface scratches on my components?

Surface scratches are typically caused by insufficient lubrication, tooling condition, or other process-related issues.

Increase lubrication, while noting that this alone may not always solve the issue. Check the condition of the die and punches, as well as the tool clearances. Monitor temperature and ejection force as early indicators of potential problems. Reduce abrasive fines and keep the tooling clean. If die wall lubrication is used, it should be carefully controlled.

Can hardened steel be used instead of carbide tooling?

We recommend using carbide inserts, as the pressures required to achieve the desired part density are typically around 800 MPa. Carbide is therefore also recommended for prototype tooling. However, if a lower density is acceptable during prototyping, hardened steel may be used. Tool wear should also be considered, as hardened steel generally has lower wear resistance than carbide.

Are there limitations on component height?

The maximum achievable component height depends strongly on the part geometry and on whether compaction is single-sided or double-sided.

- **The following general guidelines can be used:**
- **Components higher than approximately 10 mm**
  These often require a higher lubricant content than the standard 0.3%.
  If increased lubricant levels are used, the effect on density should be evaluated using the compressibility curve.
- **Components higher than approximately 40 mm**
  Consider incorporating draft angles in the die to facilitate ejection and reduce the risk of cracking.
- **Thin walls**
  - A minimum wall thickness of 2 mm is recommended.
  - The aspect ratio (height-to-wall-thickness) should not exceed 5:1.
    (See handbook-3_design_and_mechanical_properties_1039hog.pdf)
- **Lubricant content limits**
  Increasing the lubricant content beyond approximately 0.5% is generally not recommended, as it does not significantly improve ejection performance and may negatively affect density.

How should lubricant content be selected?

The lubricant content should be selected based on the component design and compaction requirements.

The lubricant in the powder mix serves two main purposes:

- To reduce friction against the die wall, enabling safe ejection of the component without damaging the tool or the part surface
- To protect the insulation coating on the iron particles during compaction

General recommendations:

- The optimum lubricant level depends on component geometry, particularly part height and complexity
- For guidance related to part height, refer to the previous question on height limitations
- Do not increase the lubricant content unnecessarily, as higher levels may reduce the achievable density

Important:
Do not add your own or any external lubricant to the powder mix. Only the lubricant system included in the powder grade should be used. The lubricant is specifically designed and optimized for each powder grade. For further guidance, please contact Höganäs for application support.

Can Höganäs provide support with compaction?

Yes. Höganäs can provide support with compaction, including press tool design and the production of prototype components. Although Höganäs does not offer mass production of parts, we can recommend experienced PM companies that specialize in series production. In addition, press tools developed and used at Höganäs can later be transferred for use in mass production at your preferred supplier.

Is there any difference between compacting conventional PM materials and Somaloy?

The compaction techniques used for conventional PM materials and Somaloy are largely similar, as both typically rely on uniaxial pressing with high stroke rates suitable for mass production. However, higher compaction pressures are generally required for Somaloy to achieve the target density needed for the application, typically in the range of 600–800 MPa. Another important difference is that Warm Die Compaction is commonly used for Somaloy materials to further improve density and performance.

What are the common causes of cracks in green components?

Crack formation is most commonly associated with the following factors:

- Incorrect lubrication level
- Incorrect compensation for tool deflection during demoulding
- Excessive ejection speed
- Tool misalignment
- Uneven temperature distribution
- Uneven filling
- Maintaining the correct balance of part temperature and lubrication is one of the most effective ways to prevent defects
- Incorrect counterforce during part ejection

Heat-treatment

What type of thermocouple should I use?

A K-type thermocouple is recommended. It should be heat-resistant up to 800°C and suitable for the required temperature range. It should also be calibrated regularly, especially after extended use, to ensure there is no bias between the actual and measured temperature.

What type of furnace is required for heat treatment of Somaloy components?

A suitable heat-treatment furnace should primarily provide a controlled-atmosphere environment with low oxygen content, typically using nitrogen, throughout the critical heating stage. In practice, this means the furnace should have good sealing, reliable gas inlet and exhaust control, uniform temperature distribution, and ideally a way to monitor oxygen levels so that oxidation can be avoided during heating. For production, a continuous belt furnace with controlled atmosphere is often suitable, while for smaller-scale or development work, a sealed chamber or retort furnace can also be used, provided that atmosphere control is sufficient. The key requirement is not a specific furnace brand, but a furnace design that provides stable temperature control and reliable protective atmosphere control.

How critical is the O_2 content during heat treatment?

Oxygen content is very important during the heat treatment of Somaloy 7P. It strongly affects the balance between coercivity and surface resistivity. High oxygen levels, especially before the temperature reaches 300°C, can permanently increase coercivity.

How do I measure the O_2 content?

The O_2 content is preferably measured using an oximeter connected to an oxygen sensor located in the furnace. For additional safety, oximeters can be installed at both the inlet and outlet of the furnace to help detect oxygen entering through leakage. The measurement system should be accurate across a range from ppm levels up to 2% oxygen.

Can I heat-treat in pure N_2?

Yes. Heat treatment in pure nitrogen is possible and typically results in cleaner and shinier components compared with heat treatment in the presence of a few thousand ppm of oxygen. It generally leads to lower coercivity, but at the same time also to lower surface resistivity. (Explanation regarding low resistivity can be found in QC section below)

Should components be placed on trays or directly on the furnace belt?

Using trays, for example ceramic plates, is beneficial for maintaining component geometry during heat treatment. They can help preserve flatness and dimensional stability. In contrast, the belt mesh is often uneven and may influence the final shape of the components.

Is a cooling zone required in the heat-treatment furnace?

Somaloy parts should ideally be cooled to below approximately 200°C before they leave the controlled furnace atmosphere. If they are exposed to air while still too hot, there is a significant risk of oxidation, which may affect the magnetic properties.

How can I verify that the heat treatment was successful?

A Somaloy heat treatment can be considered successful if the component shows the target coercivity for the grade, high retained resistivity, good TRS or mechanical strength, low losses for the intended application, and no evidence of residual lubricant. Visual inspection is also important to verify that delubrication was not too rapid and did not cause cracking in the components. Low resistivity may indicate over-treatment, where excessive temperature or too long a time at temperature has damaged the coating.

How do I determine whether a delubrication plateau is required during heat treatment?

The two temperature profiles presented in the processing guidelines represent two extreme cases, both of which can be suitable for the heat treatment of Somaloy 700 7P. In general, the process should be adapted to the needs of the specific component. The required time at temperature and the need for an additional delubrication step depend, for example, on the type and amount of lubricant and on the green density of the component, as these factors influence how long it takes to remove the lubricant from the part.

Can Höganäs provide support with heat treatment?

Yes. We can support you with heat-treatment-related questions and, in some cases, also assist with practical heat treatment trials. Please contact Höganäs for support.

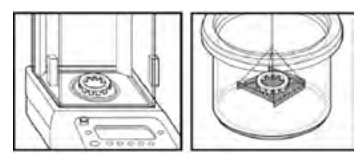
Quality control

What equipment should I have to perform quality control of SMC components?

To perform reliable quality control of Somaloy / SMC components, a combination of electrical, magnetic, mechanical, and geometrical measurement methods is recommended. Each method evaluates a specific aspect of material or component performance:

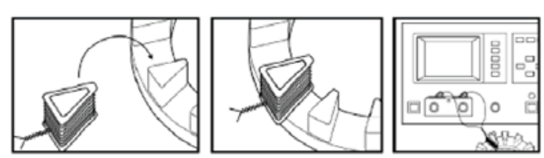
A recommended QC setup typically includes:
Basic / production QC

Density - Precision scale
(e.g Scale, Sartorius Entris 2241 or equivalent to measure weight in air and water as in ISO 2738)



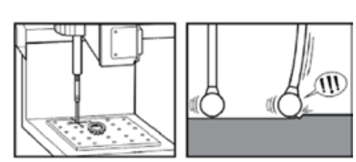
Resistivity
(Electrical DC power supply and voltmeter)

Inductance vs frequency with an LCR meter
(e.g. Agilent/HP 4284A or equivalent)

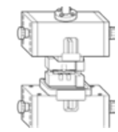


Magnetic properties, coercive force, Hc.
(e.g. Coercimeter CFT200 or equivalent)
Crack investigation (e.g with a microscope)

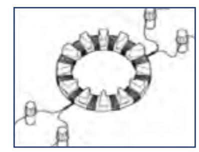
Dimensional QC:
Coordinate Measuring Machine
(e.g Zeiss Duramax or equivalent)



Mechanical QC:
Transverse Rapture Strength, TRS
(e.g Zwick Z010 according to ISO 3325)



Advanced / R&D:
Hysterograph for full magnetic evaluation
(e.g Brockhaus or equivalent)



I have low DC resistivity after pure N_2 heat treatment – is that a problem?

Not necessarily. DC resistivity alone can be misleading when evaluating eddy current losses.

A better indicator is the frequency dependence of permeability (measured with an LCR meter). Materials with higher eddy current losses show a stronger drop in permeability with increasing frequency.

In practice, samples heat treated in pure N_2 may show lower DC resistivity but still have similar eddy current losses compared to standard atmospheres. This is confirmed by comparable frequency-dependent permeability behaviour.

Recommendation: Use frequency-dependent inductance measurements as a complementary quality control method, especially for relative comparisons of similar materials and geometries.

Can Höganäs support with quality control?

Yes. Höganäs has extensive experience in quality control of Somaloy parts and can support with both measurement methods and relevant equipment. We can also assist in verifying your existing QC processes.

Please contact Höganäs for more information and support tailored to your application.

The properties I need are not in the data sheet – where can I find them?

If a specific property is not listed in the data sheet, Höganäs can often provide additional data, guidance, or recommendations based on your application.

Please contact Höganäs for support with tailored material data or further evaluation.

Post processing

Can Somaloy 7P components be bonded, and which adhesive should be used?

Yes, use an epoxy adhesive. 2K epoxies are generally easier to control than 1K during curing.

Can Somaloy 7P components be bonded, and which adhesive should be used?

Yes, Somaloy 7P components can be bonded. Epoxy adhesives are generally recommended, with 2 component (2K) systems preferred due to better control of curing and more consistent performance compared to 1-component (1K) systems.

Surface preparation is critical for achieving a strong bond. Grinding or sanding (e.g. P240), followed by cleaning with a suitable solvent such as acetone, is recommended to ensure proper adhesion.

Which adhesives are recommended for Somaloy 7P?

Based on evaluation results, the following adhesives are suitable candidates:

1. Permabond ET5424

- 2-component epoxy
- High temperature resistance (up to ~230 °C)
- Suitable for demanding thermal conditions
- Cure: ~1 h at 66 °C

2. Permabond ET5401

- 2-component epoxy
- Good all-round performance
- Less sensitive to curing conditions than 1K systems
- Cure: ~1 h at 80 °C

3. ThreeBond 2285P

- 1-component adhesive
- Designed for high mechanical and thermal resistance
- Suitable for motor and magnet applications
- Higher cure temperatures required (120–150 °C), which may require control of thermal expansion effects

Which adhesive should be selected as a default choice?

The selection depends on application requirements:

- **ET5424** → preferred for high-temperature applications
- **ET5401** → suitable as a general-purpose solution
- **ThreeBond 2285P** → suitable if a 1K system is required and higher cure temperatures can be managed

Are there adhesives that should be avoided?

Yes. Silicone based adhesives (e.g. ThreeBond 1234B) are generally not recommended, as they may provide insufficient bonding strength for Somaloy 7P components.

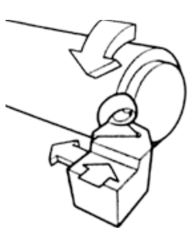
Can Somaloy components be machined?

Machining should be avoided whenever possible, as it may negatively affect the magnetic properties of the material.

If machining is required:

- Grinding is preferred for minor adjustments
- More extensive machining should be carefully controlled
- Sharp tools, low cutting forces, and stable setups are essential
- Process parameters should be optimized to minimize damage to the material and coating

Typical machining recommendations are shown below:

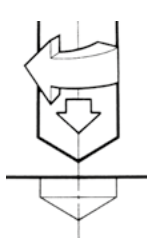


Turning

- Cermet-polished sharp inserts, for machining of aluminium and plastic materials
- **Cutting speed:** Vc in the range 170-200 m/min
- **Feed:** f = 0.1 mm/rev recommended for a good surface finish
- Cutting fluid can be used for better machinability

Tip! Attach the blank gently to the machine.

Tip! Check for tool sharpness.

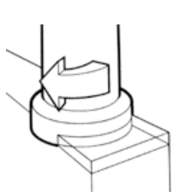


Drilling

- HSS self-centering drill
- **Cutting speed:** Vc = 30 m/min
- **Feed speed:** Vf = 60 mm/min

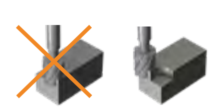
Tip! Drill half way through the blank, then turn the blank and drill the other half.

Tip! Modify the cutter by decrease the height of the cutting surface.



Milling

- Super sharp carbide milling cutter, for machining of aluminium and plastic materials
- **Cutting speed:** Vc in the range 100-200 m/min
- **Feed per tooth:** fz = 0.03 mm/tooth



Tip! Work supportively towards the material - avoid moving towards the edge.

Notes

Notes

Driving positive change through material innovation.

Höganäs' vision is to drive positive change through material innovation and become the preferred partner for sustainable powder materials. Powder technology provides endless opportunities; not only does it empower customers to reduce material and energy consumption, but it also enables the use of new and improved techniques that make final products more efficient and cost-effective. In short, powders are a resource-efficient alternative, ideal for a wide range of industries.

World leader in powders

Höganäs is a company with strong local presence around the world and the market leader in advanced ceramic and metal powders. Contact the nearest Höganäs office today — click or scan the QR code to learn more.