LATILUB
SELF LUBRICANT COMPOUNDS
LOW WEAR & LOW FRICTION
WHO IS LATI?

LATI was created in Italy in 1945.

From the year of foundation until today, Lati has gained an absolutely prestigious position in the production of technical thermoplastic compounds.

Nowadays Lati is:
• the compounder with the largest range of technical thermoplastics in Europe;
• one of the most qualified self-extinguishing compounds suppliers in the world;
• the most important independent European producer of fit-for-use thermoplastic compounds for special applications.

The company has two plants in the North of Italy with a potential capacity of 38,000 tonnes per year.

LATI’s products are suitable for use in several industrial segments, from the automotive to fine mechanics, from domestic appliances to electronics.

The distribution of materials is guaranteed by its own export network.

The mission of LATI is to guarantee complete satisfaction to the customer thanks to the high technical contents of its own products and services, keeping maximum flexibility towards market requirements with a constant quality level.

SUPPORT & SERVICE

LATI’s goal has always been to support customers in the implementation of innovative projects, providing both high performance compounds, and specialized technical services.

LATI provides assistance to its clients from the earliest stages of design through advice and, if necessary, customized formulations as well as assistance on site to ensure correct conversion.

• Co-design
Simulations are performed by technicians operating in this sector for almost twenty years, by directly working on the geometries provided by customers and using mechanical and rheological characterizations complying with conditions of use.

• Support in injection molding
At the beginning, the conversion of special compounds may not be a simple task. Getting the maximum thermal, mechanical, and dimensional performance from selected materials may require a number of attempts to best tune the process. For this reason, LATI provides injection molding technicians on site, with thirty years experience in the field of injection molding, injection molding machines, and molds.

• Research and development
The offer of customized products meeting specific customer requirements is a key issue for LATI. Each formulation is optimized to meet application requirements even when it differs from those included in the product range.

• Regulations in place
LATI’s custom is to combine the supply of compounds with support in regulations. Its team of experts is at customers’ disposal for the certification procedures with accredited laboratories worldwide.

LATI issues internal certificates of conformity to rules governing all market segments involving thermoplastics marketed.

The values shown are based on tests performed on injection-moulded laboratory specimens, conditioned according to standard protocols, and, unless otherwise indicated, they are data that fall within the typical ranges of the properties of non-coloured materials. Because they are susceptible to variations, these values do not represent a sufficient basis for designing any type of moulded part and must not be used to establish any specific value. The properties of moulded parts can be influenced by a large number of factors such as, but not limited to, the presence of colors, the type of project, the processing, post-processing and environmental conditions, and use of regrind during the moulding process. Wherever it is specifically indicated that the data are provisional, the actual ranges of the properties must be understood to be larger. The present information as well as technical advice are provided purely for information purposes, and may change without notice. Customers must always make sure that they have the most up-to-date version of the technical indications. Lati S.p.A. offers no guarantees regarding the accuracy, suitability, reliability, completeness and adequacy of the information given and assumes no responsibility for the consequences of its use or for printing errors. Lati S.p.A. does not accept any responsibility and will not be liable for any damage resulting from use of or reliance on the information provided. No one is authorised to issue any guarantee or indemnity or assume any responsibility on behalf of Lati S.p.A., except by means of a written document signed in full by a specially authorised legal representative. Unless otherwise agreed in writing, the maximum compensation for any claim is replacement of the quantity of non-conforming product or reimbursement of the purchase price, at the discretion of Lati S.p.A., but in no case may Lati S.p.A. be held liable for damages or penalties that might for any reason be requested. No information contained herein can be considered as a suggestion to use any product in a way that breaches intellectual property rights. Lati S.p.A. disclaims any liability arising from actual or alleged patent infringements. Unless otherwise specifically stated in writing, the products mentioned in this document are not suitable for contact with food or for the transport of drinking water, nor are they suitable for applications in the pharmaceutical, medical or dental sectors. For any other aspect, the Lati S.p.A. Terms and Conditions of Sale apply (copyright © LATI S.p.A. 2018). LATI does not guarantee that the data contained in this list are current, complete and free of errors. To check the values, users are strongly advised to contact the LATI Customer Technical Assistance department or sales network. LATI Industrie Termoplasti S.p.A. disclaims any liability arising from use of the information contained in this document.
INTRODUCTION

The use of thermoplastic materials in the mechanical field is now widespread, especially after the introduction and consolidation, over the years, of reinforcing agents within the thermoplastic matrix.

The need to use polymers in geometrically complex kinematics has increased significantly over the last decade. Such polymer application is quite challenging from a chemical and mechanical point of view.

The use of polymers in this field allows the manufacture of items within the specified dimensional tolerances without the need for further expensive mechanical machining, as occurs, for example, in the metal gear manufacturing process. In fact, the conversion of this material is not only simple and respectful of environment and health, but also cost-efficient.

For the manufacture of self-lubricating products requiring no oil, grease and sound-proofing systems, the first step is to determine correctly the physical phenomena to be dealt with, and second a good knowledge of base additives and resins is required.

With this brochure LATI want to share with its customers some of his experience in this area by offering as a guide and reference point in the field of lubricating products, thanks to its special compound and the technical expertise of its staff.

The tribological properties of a material permit a description of its behavior during sliding against another body made of the same or different material.

However, it must be stressed that phenomena generated during motion are also correlated with factors unrelated to the nature of material, such factors being, rather, dependent on the surface properties (shape and roughness), environmental conditions (temperature) as well as operating conditions (loads, speed, contact area, etc.).

It is therefore advisable not to consider tribological properties of the material as reliable specifications that can be used at the design stage. The described parameters should therefore be used for comparison between the different self-lubricants products only and not considered as absolute values.

Moreover, preliminary, dedicated tests should always precede the development of any project.

The properties studied in tribological field are the following:

- static and dynamic friction coefficient;
- PV limit;
- wear factor.
THE FRICTION COEFFICIENT

Friction force is defined as the force required to induce a relative motion between two bodies in contact with each other, thereby overcoming the resistance to motion generated by the chemical and physical interactions that occur on surfaces in contact.

The resistance in relative motion is called friction.

A coefficient quantifying the extent can be derived by appropriately operating on the normal force acting on the surfaces, the relative sliding speed, the geometry of the part and, of course, the materials involved and the surface roughness. (fig. 1).

\[
\frac{F_a}{W} = \mu
\]

The friction coefficient is defined as the relationship between the force required to move the body \(F_a\) and the normal force acting on the surfaces \(W\).

If the bodies to be moved are at rest relative to each other, it is called static friction; if they are already in relative motion, it is called dynamic friction.

As already mentioned, the friction coefficient depends on the nature of materials, the roughness of surfaces and the temperature, while it is not connected with the extent of surfaces.

The friction force is due to several components:

- the adhesive component, linked to the interaction between the surfaces in contact, such as the adhesion of the micro-roughness;
- the deformation component, determined by the mechanical properties of materials involved.

The physical phenomenon that gives rise to the two components is different, so it is important to consider both in the design of components for applications involving relative motion (fig. 2).

The friction coefficient is defined as the relationship between the force required to move the body \(F_a\) and the normal force acting on the surfaces \(W\).

The friction generates a series of local events that cause negative effects on products in relative motion.

The metal/polymer, polymer/polymer and polymer/elastomer composites are heavily penalized because of adhesion and deformations also due to heat generated by friction.

With the introduction of LATILUB, the family of intrinsically selflubricating products, this phenomenon is largely reduced and the tribological properties of materials are improved, thereby opening a wide range of possible applications for plastics in the mechanical field.

For the evaluation of tribological performance of its products, LATI also makes use of a test set based on the thrust washer method.

The measurement of friction coefficient and wear factor is carried out by rotating a washer made of selflubricating compound on a metal, polymer or elastomer counterpart, by imposing a known push and relative speed.

From the monitoring of the motion resistance and wear of moving parts, information on the behavior of the compound in terms of friction and wear can be obtained.
WEAR

Wear is defined as the removal of material from the contact surface between two bodies in relative motion. Two commonly identified wear mechanisms are:

1. **adhesive wear**, i.e. the removal of material due to the breaking of the interfacial bonds between two bodies in contact on the overall available A zone (for instance, rigid plastic materials against smooth metallic surfaces) (fig. 3);

2. **abrasive wear**, i.e. the removal of material from the surface caused by the contact with hard particles through a tearing (microcutting) or grooving (ploughing) process.

Such phenomena may be caused by two different factors:

a. the presence of small particles or material powder (adhesion) on the surface
b. the presence of molten polymeric material, large debris or grooves (abrasion – exceeding of the PV limit).

The mathematical relationship between the amplitude of motion $d$, the volume removed $V$, the material hardness $H$, and the applied load $W$ defines the **wear factor** $K$ (Fig. 4).

$$V \approx K \cdot \frac{W}{H} d$$

This factor depends strongly on the “environmental” conditions, and its value may change by some quantities as the case may be.

Clearly, the wear is strongly influenced by the surface finish or roughness (fig. 5).

Generally, the wear rate (or WR) is measured in wear phenomena. The result is expressed depending on the distance covered. Therefore, it follows that:

$$WR = \frac{h}{d}$$

where $h$ is the thickness removed and $d$ the distance covered.

Therefore, the behaviors of the main unloaded resins may be analyzed when they are coated with a metal having a known degree of roughness; the values shown in (fig. 6) are expressed in relation to the friction coefficient.

The measurement of wear factor is expressed in cm$^3$/Nm; the tests are carried out at a sliding speed of 3 m/min under a pressure of 20 kg/cm$^2$.

![Fig. 5 - Wear factor and surface roughness](image-url)

![Fig. 6 - Wear resistance of main thermoplastic resins](image-url)
SELFLUBRICATING COMPOUNDS

LATI's know-how in the field of thermoplastic materials has led to the production of a whole family of materials designed to offer better tribological properties than conventional polymers.

The LATILUB range allows, in fact, the manufacture of parts subject to relative motion, without limits with regard to geometric complexity and application environment.

The many benefits linked to the use of LATILUB have a direct impact on the performance and cost of the products:

- exceeding limits of conventional materials such as metals, e.g. weight, corrosion, etc.;
- extremely small masses in motion, so better performance and lower energy consumption;
- simple series production without additional machining (deburring, cleaning etc.);
- possibility of an almost unlimited function sum design;
- noiselessness.

The use of selflubricating compounds allows to eliminate the need for external lubricants, grease and oils, with immediate obvious advantages:

- no dirt catching;
- no need for maintenance;
- steady performance over time

These developments have been made possible by the careful selection of the best thermoplastic resins (e.g. PA, POM, PEEK etc.), and the utilization of different additives that, used as single components or exploiting the synergy between some of them, significantly improve the tribological behavior of base polymers.

The following combinations show, for example, excellent efficiency:

- PTFE and aramid fiber to reduce both friction and wear;
- MoS2 and fiberglass for structural parts with low friction coefficient;
- PTFE and silicone to reduce breakaway force and motion resistance;
- Graphite and PTFE to reduce friction and maintain the maximum dimensional stability.

Properly identifying the grade that best meets the project requirements is, however, a difficult task, especially in the field of self-lubrication.

A number of parameters may, in fact, change the behavior of an even well-engineered product.

Besides, the relative significance of the values of friction coefficient, wear and PV limit is to be added, so the validity of these parameters has to be carefully evaluated during the design phase.

Tribology in the field of polymers is still a developing science, and the empirical approach to real problems, such as the product test, is still the best method to obtain satisfactory results.

The use of selflubricating compounds does not limit the performance available to the most demanding designers. Additives for improving tribological performance are often also compatible with formulations designed to meet different requirements.

SELF-EXTINGUISHING

Improved wear resistance and low friction factor are available even on flame resistant polymer matrix as PA, PBT and PPS.

STRUCTURAL

Structural and self-extinguishing parts are obtained using PA, PBT, PPS and PPA matrices containing up to 50% glass fiber.

ANTISTATIC

Graphite and carbon fiber ensure high electrical conductivity as well as excellent self-lubrication.
MOLYBDENUM DISULFIDE

Molybdenum disulfide (MoS₂) provides a nucleant effect on semi-crystalline resins thus favoring the formation of spherulites even in the amorphous areas of the molded piece.

This phenomenon occurs especially in the fast-cooling areas, e.g. the external surfaces in contact with the cold die.

MoS₂ improves the product performances because of its intrinsic self-lubricating properties and through the increasing content of crystalline polymer on the external contact surfaces; thus, a good increase in wear resistance is obtained.

Positive effects may be obtained, in particular, on PA and POM.

This additive may be used especially in plastic parts sliding against metal: MoS₂ can fill the surface microcavities thus reducing the abrasive phenomenon due to roughness.

While it significantly improves the wear factor and PV limit, the friction coefficient shows minor advantages.

The range of Latilub products containing MoS₂ is suitable for applications under conditions of moderate specific pressure and relative velocity.

Thanks to their price/performance ratio, these products may be considered as a first step in the improvement of standard grade self-lubrication for structural applications, such as, e.g., 30% and 50% glass fiber reinforced PA66.

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**PROPERTIES (typical values)**

<table>
<thead>
<tr>
<th>Properites</th>
<th>Testing conditions</th>
<th>Standards</th>
<th>Units (SI)</th>
<th>LATILUB 72/13-01M</th>
<th>LATILUB 62-01M G/30</th>
<th>LATILUB 66-01M G/15</th>
<th>LATILUB 66-01M G/30</th>
<th>LATILUB 66-01M G/50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Density</td>
<td>23°C</td>
<td>ISO 1183</td>
<td>g/cm³</td>
<td>1.44</td>
<td>1.36</td>
<td>1.14</td>
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<td>Linear shrinkage at moulding* (60x60x22mm - 60MPa)</td>
<td>along flow</td>
<td>ISO 294-4</td>
<td>%</td>
<td>2.00 ± 0.30</td>
<td>0.40 ± 0.55</td>
<td>1.20 ± 1.50</td>
<td>0.45 ± 0.75</td>
<td>0.35 ± 0.65</td>
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<td>2.05 ± 2.25</td>
<td>0.75 ± 1.00</td>
<td>1.25 ± 1.55</td>
<td>0.95 ± 1.25</td>
<td>0.75 ± 1.05</td>
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<tr>
<td>Charpy - Impact strength notched (specimen 80 x 10 x 4 mm)</td>
<td>23°C</td>
<td>ISO 179-1eA</td>
<td>kJ/m²</td>
<td>5.8</td>
<td>9</td>
<td>4</td>
<td>4</td>
<td>9</td>
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<tr>
<td>Charpy - Impact strength unnotched (specimen 80 x 10 x 4 mm)</td>
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<td>ISO 179-1eU</td>
<td>kJ/m²</td>
<td>50</td>
<td>70</td>
<td>NR</td>
<td>30</td>
<td>65</td>
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<tr>
<td>Tensile modulus</td>
<td>23°C</td>
<td>ISO 527 (1)</td>
<td>MPa</td>
<td>2600</td>
<td>8800</td>
<td>3700</td>
<td>6000</td>
<td>9400</td>
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<td>ISO 527 (1)</td>
<td>MPa</td>
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<td>160</td>
<td>85</td>
<td>110</td>
<td>165</td>
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<tr>
<td>Elongation at yield</td>
<td>23°C</td>
<td>ISO 527 (1)</td>
<td>%</td>
<td>5</td>
<td>9</td>
<td>11</td>
<td>3.8</td>
<td>3.1</td>
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<tr>
<td>Elongation at break</td>
<td>23°C</td>
<td>ISO 527 (1)</td>
<td>%</td>
<td>20</td>
<td>3</td>
<td>11</td>
<td>3.8</td>
<td>3.1</td>
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<tr>
<td>Thermal</td>
<td>Vicat - Softening point (heating rate 50°C/h)</td>
<td>50 N</td>
<td>ISO 306</td>
<td>°C</td>
<td>130</td>
<td>210</td>
<td>240</td>
<td>250</td>
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<tr>
<td>HDT – Heat Distortion Temperature</td>
<td>0.45 MPa</td>
<td>ISO 75</td>
<td>°C</td>
<td>110</td>
<td>220</td>
<td>235</td>
<td>250</td>
<td>260</td>
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<tr>
<td>Tribological</td>
<td>Static and dynamic coefficient of friction load 6.1Kg speed 15m/min ASTM D 1894</td>
<td>µ static</td>
<td>0.18</td>
<td>0.45</td>
<td>0.29</td>
<td>0.36</td>
<td>0.42</td>
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<tr>
<td></td>
<td>µ dynamic</td>
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<td>0.27</td>
<td>0.32</td>
<td>0.36</td>
<td>0.39</td>
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<tr>
<td>Wear Factor (K)</td>
<td>pressure 20 Kg/cm² speed 3 m/min - 40 h Thrust Washer (10⁻⁶ m³/h) (N m h)</td>
<td>11</td>
<td>31</td>
<td>70</td>
<td>44</td>
<td>30</td>
<td>24</td>
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<tr>
<td>Processing conditions</td>
<td>Pre-drying temperature</td>
<td>(at least 3 hours at…)</td>
<td>°C</td>
<td>80 ± 90</td>
<td>90 ± 100</td>
<td>90 ± 100</td>
<td>90 ± 100</td>
<td>90 ± 100</td>
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<tr>
<td>Melt temperature</td>
<td>°C</td>
<td>175 ± 200</td>
<td>240 ± 280</td>
<td>260 ± 290</td>
<td>270 ± 300</td>
<td>275 ± 300</td>
<td>280 ± 310</td>
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<tr>
<td>Mould temperature</td>
<td>°C</td>
<td>70 ± 90</td>
<td>70 ± 100</td>
<td>70 ± 90</td>
<td>70 ± 100</td>
<td>70 ± 100</td>
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<tr>
<td>Colorability</td>
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</table>

*Values obtained according to ISO norm at the specified pressure. Actual shrinkage values may differ because of the design.
PTFE AND UHMWPE

PTFE is a polymer with a high molecular weight and moderate wear resistance, but its friction coefficient is among the lowest of any known solid material. The stresses developing at the interface between the contacting surfaces during relative motion cause a sort of lamination of the PTFE particles. The polymer fills the surface pores thus reducing the roughness and improving the sliding.

UHMWPE (ultra high molecular weight polyethylene) is a polymer having properties comparable to those of PTFE, and may be used instead of PTFE when halogen (fluorine)-free lubricant formulations are preferred.

In order to optimize the performances of a PTFE reinforced Latilub product, a short “running-in” period may be necessary to allow the formation of a self lubricating surface layer. Since the dynamic friction coefficient of PTFE is higher than the static coefficient, problems of instability during the motion of the contact parts may arise.

In order to avoid this problem, PTFE is often used in combination with a silicone oil. The distribution and content of PTFE are essential elements for the lubricant performance.

The best results are obtained with concentrations of PTFE of approx. 15% in amorphous polymers and 20% in crystal-reinforced polymers.

The use of this additive offers many advantages, among which a low friction coefficient, a low wear factor, and an improved PV limit.

Latilub products with these properties are among the most widely used in mechanical applications.

Suitable for applications:
• high pressure;
• high speed.

### AMORPHOUS SEMI-CRYSTALLINE

<table>
<thead>
<tr>
<th>PROPERTIES (typical values)</th>
<th>Testing conditions</th>
<th>Standards</th>
<th>Units (SI)</th>
<th>AMORPHOUS</th>
<th>SEMI-CRYSTALLINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Density</td>
<td>23°C ISO 1183</td>
<td>g/cm³</td>
<td>1.43 1.32 1.35 1.66</td>
<td>1.25 1.43 1.50 1.64</td>
<td>1.41</td>
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<tr>
<td>Linear shrinkage at moulding* (60x60x2mm - 60MPa)</td>
<td>ISO 294-4 %</td>
<td>0.25 + 0.45 0.55 + 0.75 1.05 + 1.30 0.35 + 0.50</td>
<td>0.40 + 0.65 2.10 + 2.40 2.15 + 2.50 0.40 + 0.65 1.80 + 2.10</td>
<td></td>
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<td>Charpy - Impact strength notched (specimen 60 x 10 x 4 mm)</td>
<td>23°C ISO 179-1eA</td>
<td>kJ/m²</td>
<td>15 12 7 8</td>
<td>7 5.2 4.5 8</td>
<td>1.5</td>
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<tr>
<td>Charpy - Impact strength unnotched (specimen 80 x 10 x 4 mm)</td>
<td>23°C ISO 179-1eU</td>
<td>kJ/m²</td>
<td>60 50 70 35</td>
<td>40 50 45 40</td>
<td>25</td>
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<tr>
<td>Tensile modulus</td>
<td>23°C ISO 527 (1)</td>
<td>MPa</td>
<td>5700 2200 1800 8600</td>
<td>6700 2600 2700</td>
<td>9700 2300</td>
</tr>
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<td>23°C ISO 527 (1)</td>
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<td>85 55 90 60</td>
<td>80 50 50</td>
<td>110 40</td>
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<tr>
<td>Elongation at yield</td>
<td>23°C ISO 527 (1)</td>
<td>%</td>
<td>3 5</td>
<td>12 5</td>
<td>4</td>
</tr>
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<td>Elongation at break</td>
<td>23°C ISO 527 (1)</td>
<td>%</td>
<td>2.5 8 8</td>
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<td>2.8 8</td>
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<td></td>
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<td>Vicat - Softening point (heating rate 50°C/h) 0.45 MPa 1.82MPa</td>
<td>ISO 306 °C</td>
<td>150 145 180 220</td>
<td>130 130 135 135</td>
<td>205 170</td>
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<tr>
<td></td>
<td></td>
<td>µ dynamic</td>
<td>0.20 0.14 0.17 0.20</td>
<td>0.1 0.13 0.09 0.18</td>
<td>0.12</td>
</tr>
<tr>
<td>Wear Factor (K) pressure 20 Kg/cm² speed 3 m/min - 40 h Thrust Washer (10⁻⁸ m/m-h) (N m h)</td>
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<td>12 1.8 2.2 22</td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Processing conditions

| Pre-drying temperature (at least 3 hours at…) | °C | 110 + 130 110 + 130 110 + 130 150 + 180 80 + 90 80 + 90 80 + 90 | 100 + 120 100 + 120 |
| Melt temperature                      | °C | 275 + 320 265 + 300 290 + 320 350 + 390 220 + 250 175 + 200 175 + 200 | 240 + 250 230 + 245 |
| Mould temperature                    | °C | 80 + 110 80 + 100 110 + 130 150 + 190 40 + 60 70 + 90 70 + 90 | 70 + 90 70 + 90 |

### Self-extinguishing

- ✔️
- ✔️
- ✔️
- ✔️
- ✔️
- ✔️
- ✔️
- ✔️

### Colorability

- ✔️
- ✔️
- ✔️
- ✔️

* Values obtained according to ISO norm at the specified pressure. Actual shrinkage values may differ because of the design.
SILICONE OIL

Silicone oil is a lubricant that, if contained in the compound, migrates from the inside to the outside of the material until it reaches the surface.

This phenomenon occurs even during the use of the item, reducing the friction when the piece is in motion.

The use of high-density silicone oils is preferred, as they easily form a persistent layer covering the whole surface of the piece.

The reduction of friction coefficient and wear factor are the main advantages of silicone-based additives.

Also, the PV limit of these compounds is clearly improved.

Bonds between silicone, PTFE and carbon fibers create excellent synergic effects: in this case, silicone reduces the typical stick-slip effect of PTFE during the motion.

The use of silicone oil is recommended for pieces operating at low pressure and high velocity conditions.

### Silicone Oil Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
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<tbody>
<tr>
<td>Density</td>
<td>1.13</td>
</tr>
<tr>
<td>Viscosity</td>
<td>0.95</td>
</tr>
<tr>
<td>Temperature</td>
<td>120°C</td>
</tr>
<tr>
<td>Compatibility</td>
<td>Rubber, plastic</td>
</tr>
<tr>
<td>Solubility</td>
<td>Water</td>
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### SEMI-CRYSTALLINE POLYMERS

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</table>

### Silicone Oil Characteristics

- **Density:** 1.13
- **Viscosity:** 0.95
- **Temperature:** 120°C
- **Compatibility:** Rubber, plastic
- **Solubility:** Water

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**Note:** The table above summarizes the properties of silicone oil, which is used as a lubricant in engineering polymers. The values provided are typical and may vary depending on the specific application and conditions.
CARBON FIBERS

Carbon fibers may be used as lubricant additives as well.

Over the years, these fibers have been used mainly as a mechanical reinforcement in order to increase significantly stiffness, modulus and breaking load.

Remarkable improvements may be achieved even in the thermal and electrical conductivity of the material by exploiting the properties of the graphitic nature of the fiber structure.

Tribological properties, too, are enhanced by carbon fibers: in particular, they increase the PV limit and reduce the friction coefficient.

Since carbon fibers improve the surface hardness of polymeric material, problems due to the combination with the counterbody may arise, e.g. unexpected wear phenomena.

The use of carbon fibers combined with PTFE offers great mechanical and tribological advantages.
**ARAMID FIBERS**

Unlike carbon fibers, aramid fibers do not improve the mechanical properties nor do they increase the surface hardness. However, their morphologic and chemical nature considerably oppose the abrasion action on the contact surfaces due, for instance, to the free particles of material removed.

The most important property of aramid fiber is, therefore, the extremely low wear of the parts in motion and relevant counterbodies both in polymer against metal and polymer against polymer.

The combination with plastic is good even in fibrous reinforced products and in the combination of load and pressure which is normally found in bushings, washers, slide guides, and gears.

The friction coefficient is reduced by the combination of PTFE and aramid fibers. For this reason, products containing both these additives are particularly efficient, especially in those cases requiring wear resistance as well as a very low sliding resistance.

The levels obtained on PA, POM, and PEEK based materials, which are intrinsically selflubricating resins, are particularly interesting.

**GRAPHITE**

Graphite has a hexagonal, layered, crystalline structure which allows the relative sliding of the parallel plates.

This property is significantly enhanced in water, which is an environment where compounds containing this additive offer excellent tribological properties.

The friction coefficient and the wear factor are notably reduced.

Moreover, antistatic properties may be obtained thanks to graphite’s high electrical conductivity.

When using graphite compounds in molding of pieces with aesthetical requirements, the non-colorability of pieces due to the classical black color of this additive should be considered.

As it is similar to a mineral filler, graphite is suitable for the manufacture of items with high dimensional stability that do not require excellent mechanical properties, and for applications at low velocities and high specific pressures.
**Products guide**
Engineering thermoplastics
flame retardant
high performance

**Quick guide to LATI compounds**

**Special materials**
Special materials guide

**Polyamides**
Moisture absorption

**Latilub**
Engineering polymers
featuring low coefficient
of friction and high wear
resistance

**Metal replacement**
Hi-performance compounds,
with high mechanical
properties

**Laticonther**
Thermally conductive
thermoplastic compounds

**Lati Compounds**
For water & food contact

**Latigray**
Radiopaque thermoplastic
compounds

**Latiohm**
Electrically conductive
compounds